

Design
Design
Design

How One Multi-National EDA Vendor Navigates R&D in the Asian IC Design Market

Raul Camposano
Sr. VP, CTO



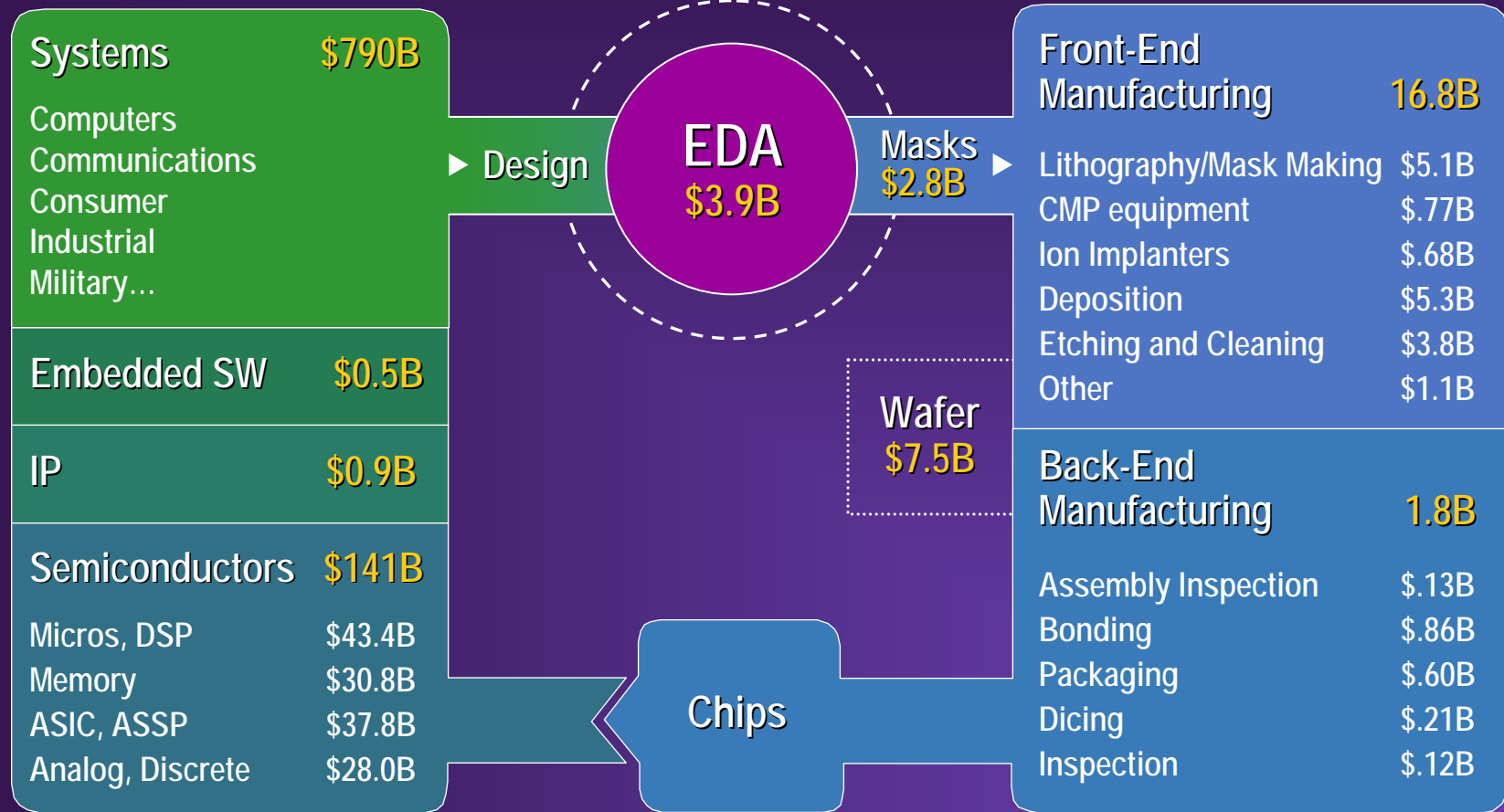
> *Your Design Partner*

SYNOPSYS®

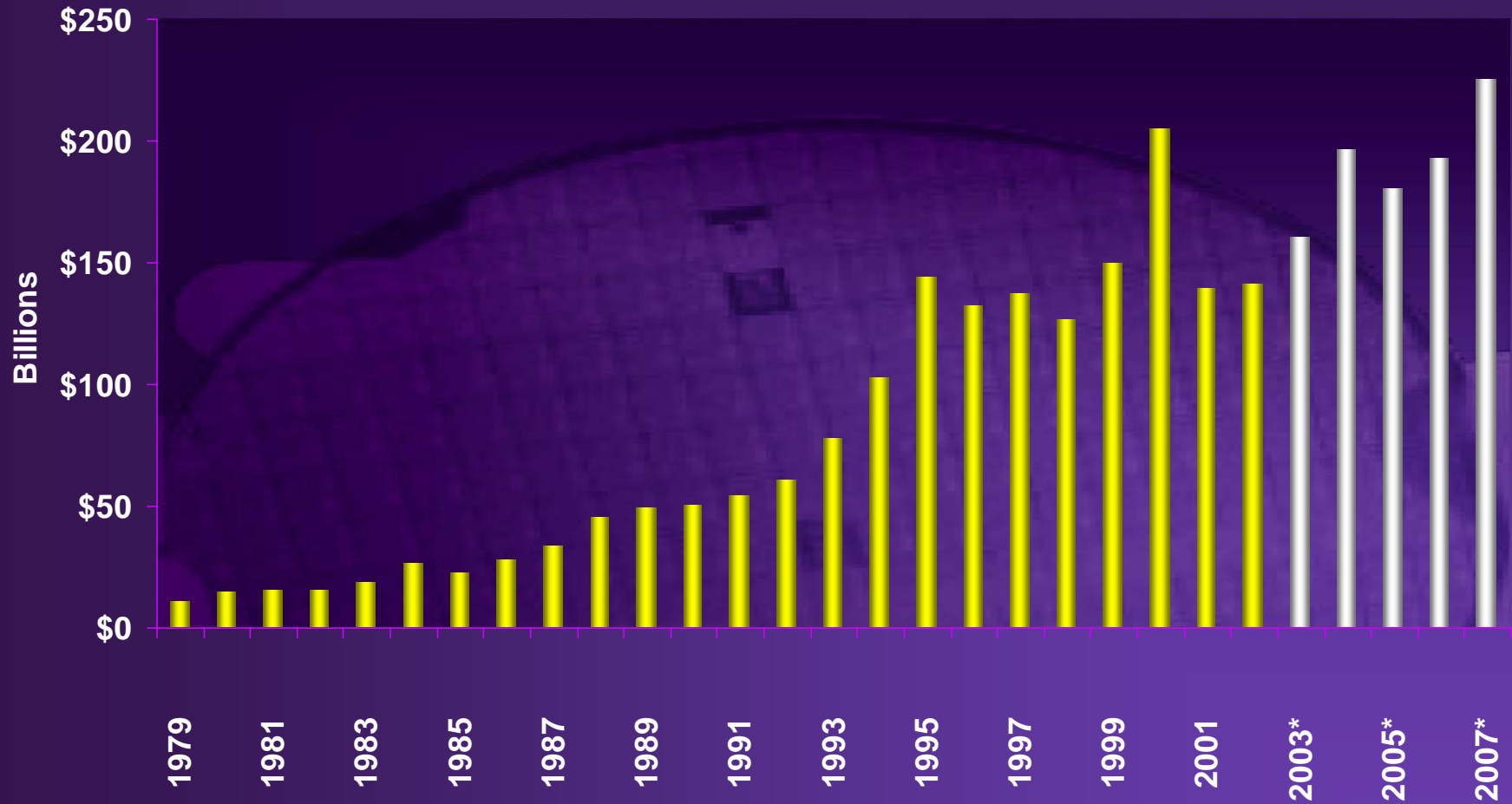
Agenda

- **Industry overview**
- **Why Asia?**
- **Synopsys in Asia**
 - **Selling in Asia**
 - **Service and support in Asia**
 - **Relocating or outsourcing company activities to Asia**
 - **R&D in Asia**

Semiconductor Process Flow



Semiconductor Revenue Growth



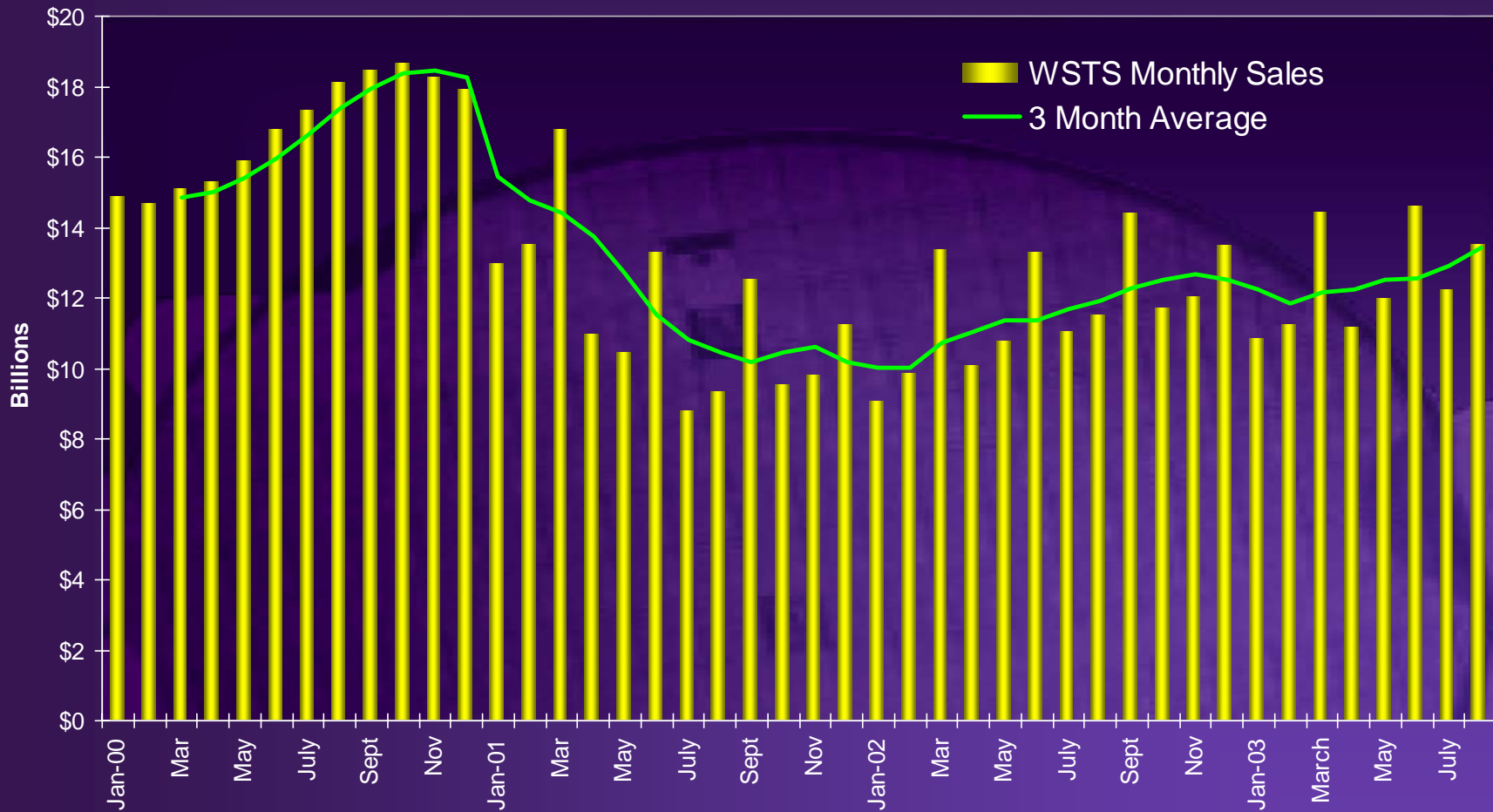
Source: IC Insights, August 2003

Updated: Oct 2003

Filename: SemiRevenueGrowth.ppt

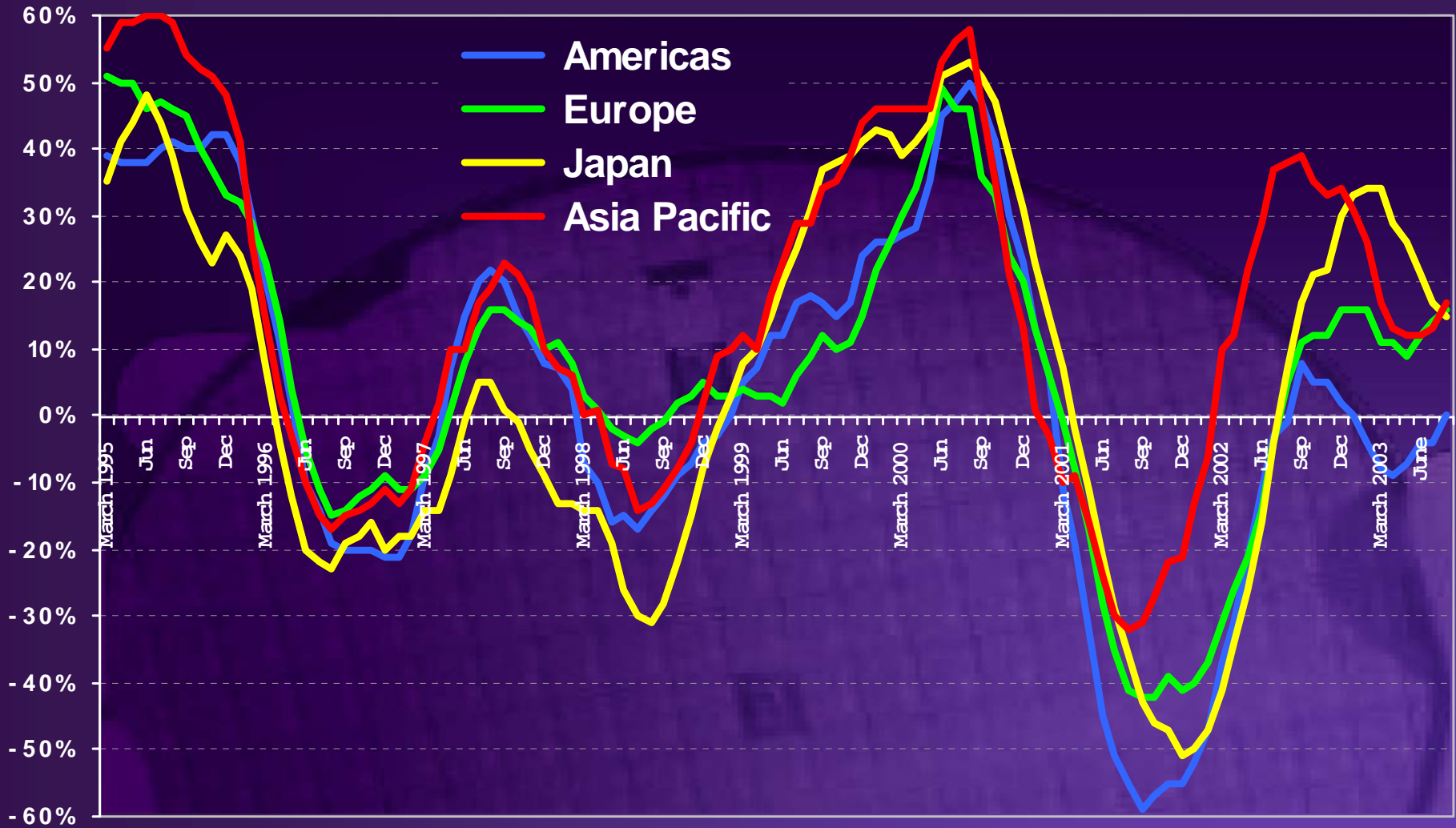
* Estimates

Monthly Semiconductor Sales



Source: SIA WSTS

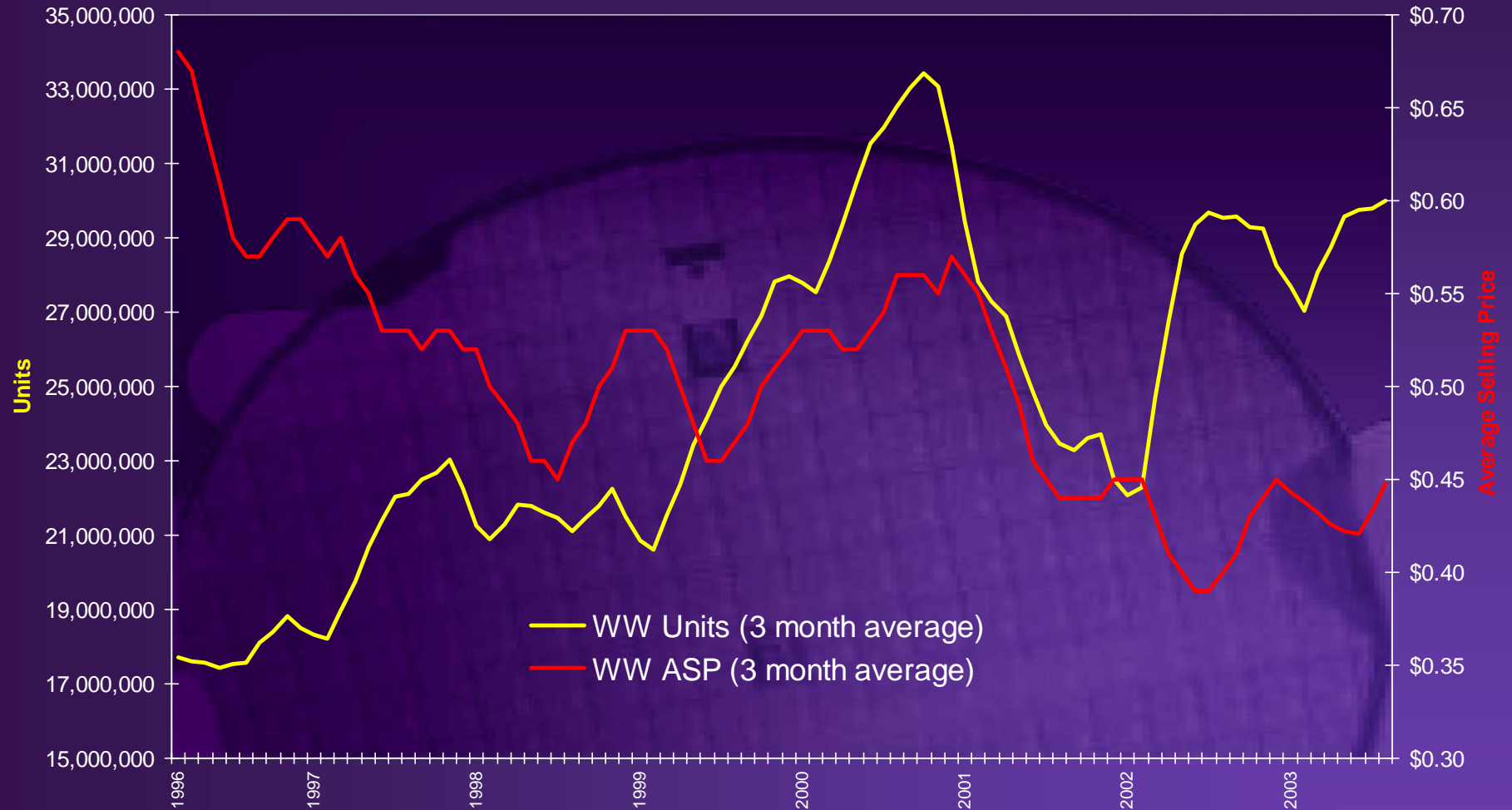
Semiconductor Sales, Annual Growth



Source: WSTS

Note: 3-month average, year/year monthly growth

Monthly Semiconductor Units & ASP



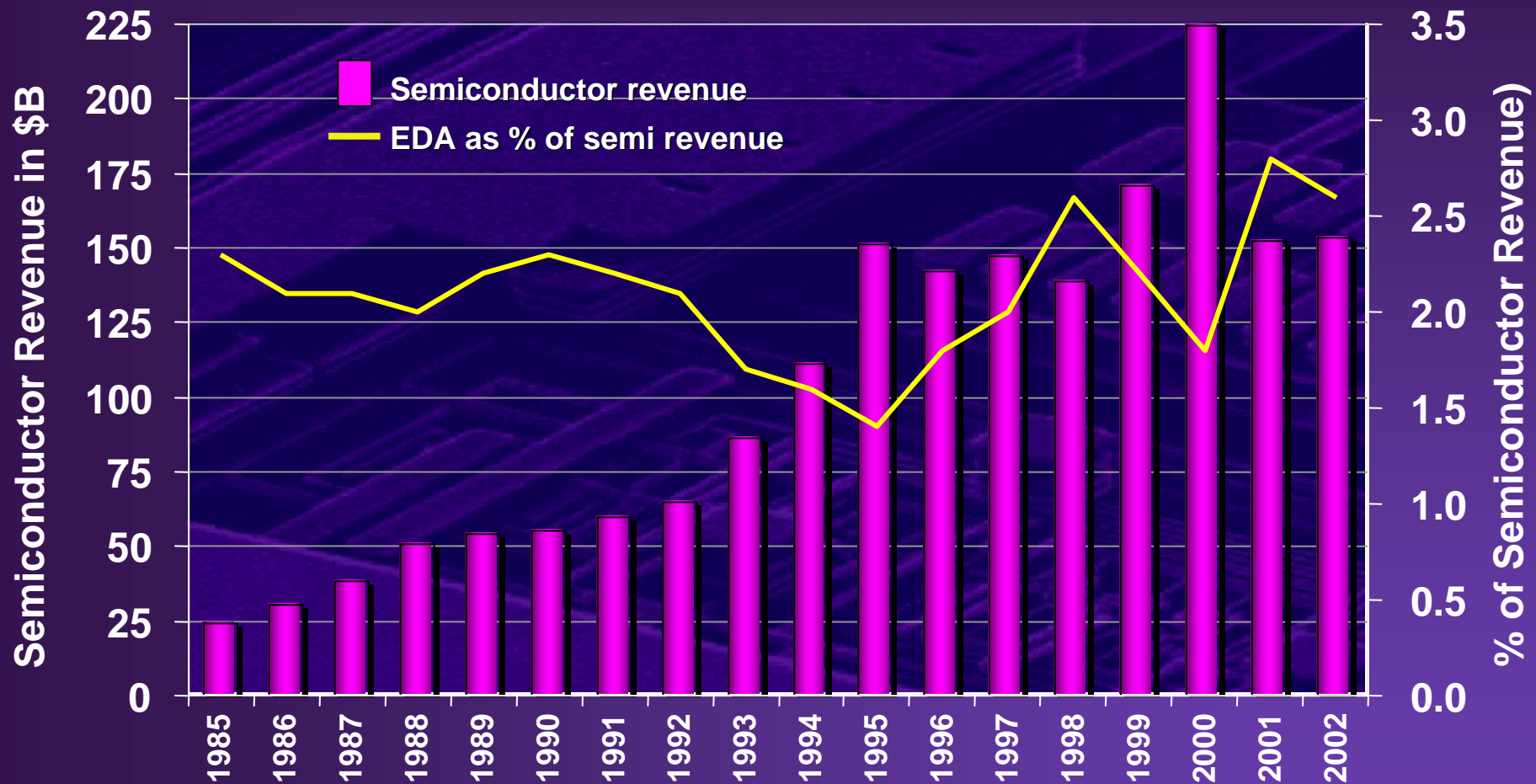
Source: SIA WSTS

Worldwide Top 20 IC* Sales Leaders

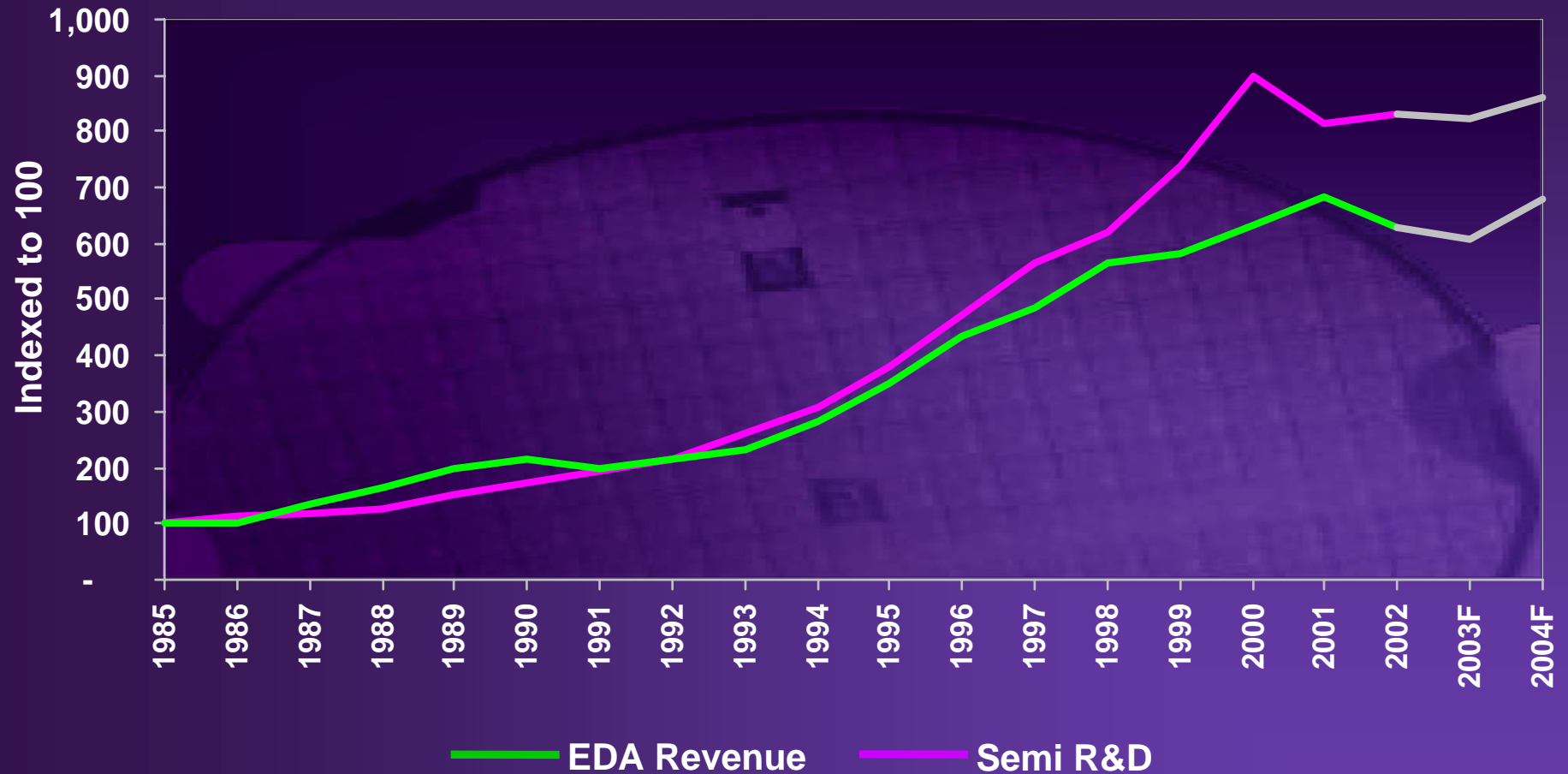
Intel, U.S.	\$24
Samsung, S.Korea	\$8.7
TI, U.S.	\$6.5
ST, Europe	\$5.7
TSMC, Taiwan	\$4.6
Motorola, U.S.	\$4.5
Infineon, Europe	\$4.5
NEC, Japan	\$4.4
Toshiba, Japan	\$4.1
Hitachi, Japan	\$3.8
Fujitsu, Japan	\$3.6
IBM, U.S.	\$3.5
Philips, Europe	\$3.4
Mitsubishi, Japan	\$3.1
Micron, U.S.	\$2.8
AMD, U.S.	\$2.7
Matsushita, Japan	\$2.4
Hynix, S. Korea	\$2.4
Sony, Japan	\$2.2
Sharp, Japan	\$2.0



EDA/Semi Revenue Ratio



Semiconductor Revenue, R&D and EDA



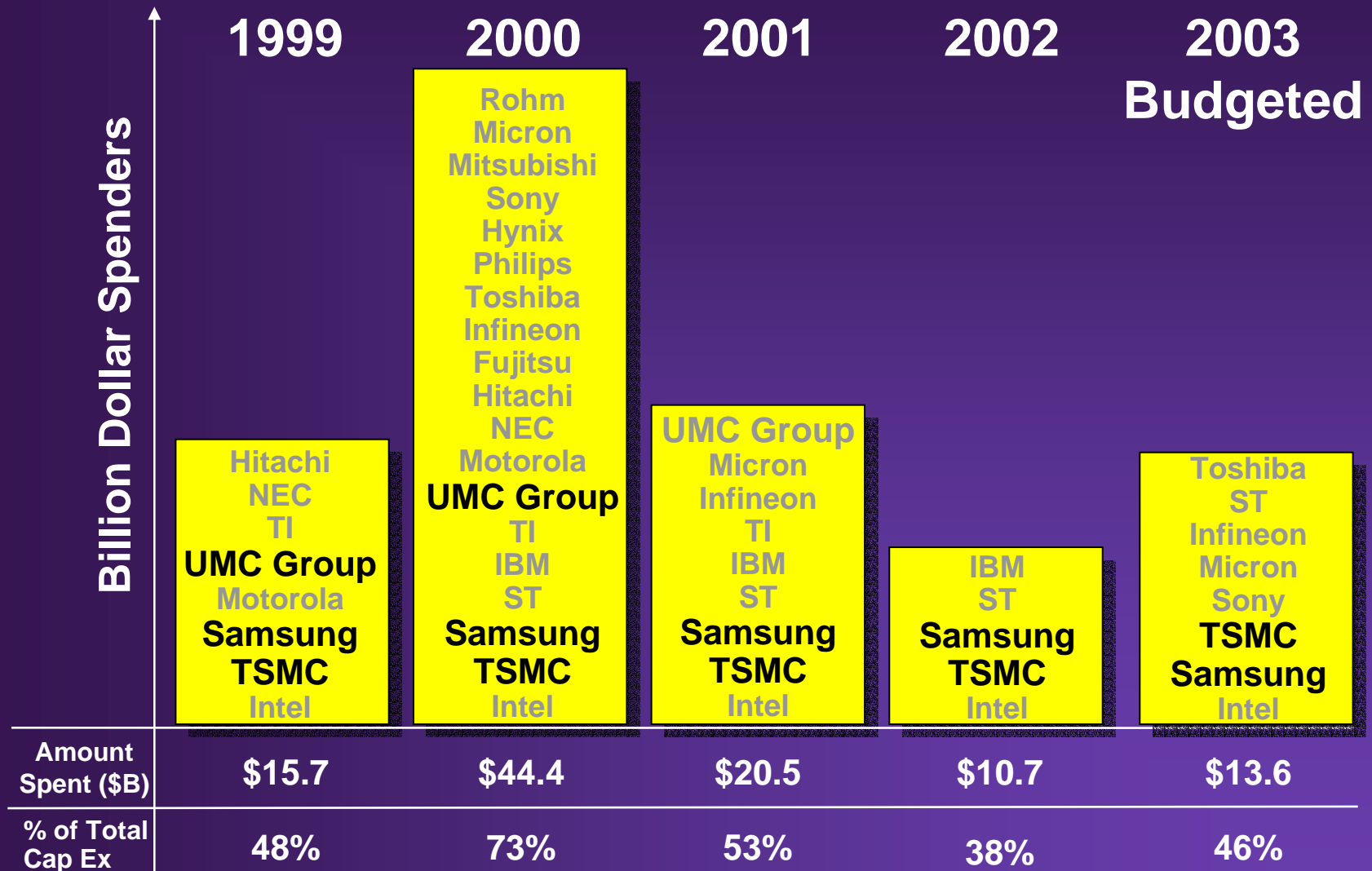
Source: IC Insights April 2003, SIA WSTS Feb 2003, Synopsys Internal Estimates

Wafer Fab Cost Trend



Source: IC Insights, April 2003

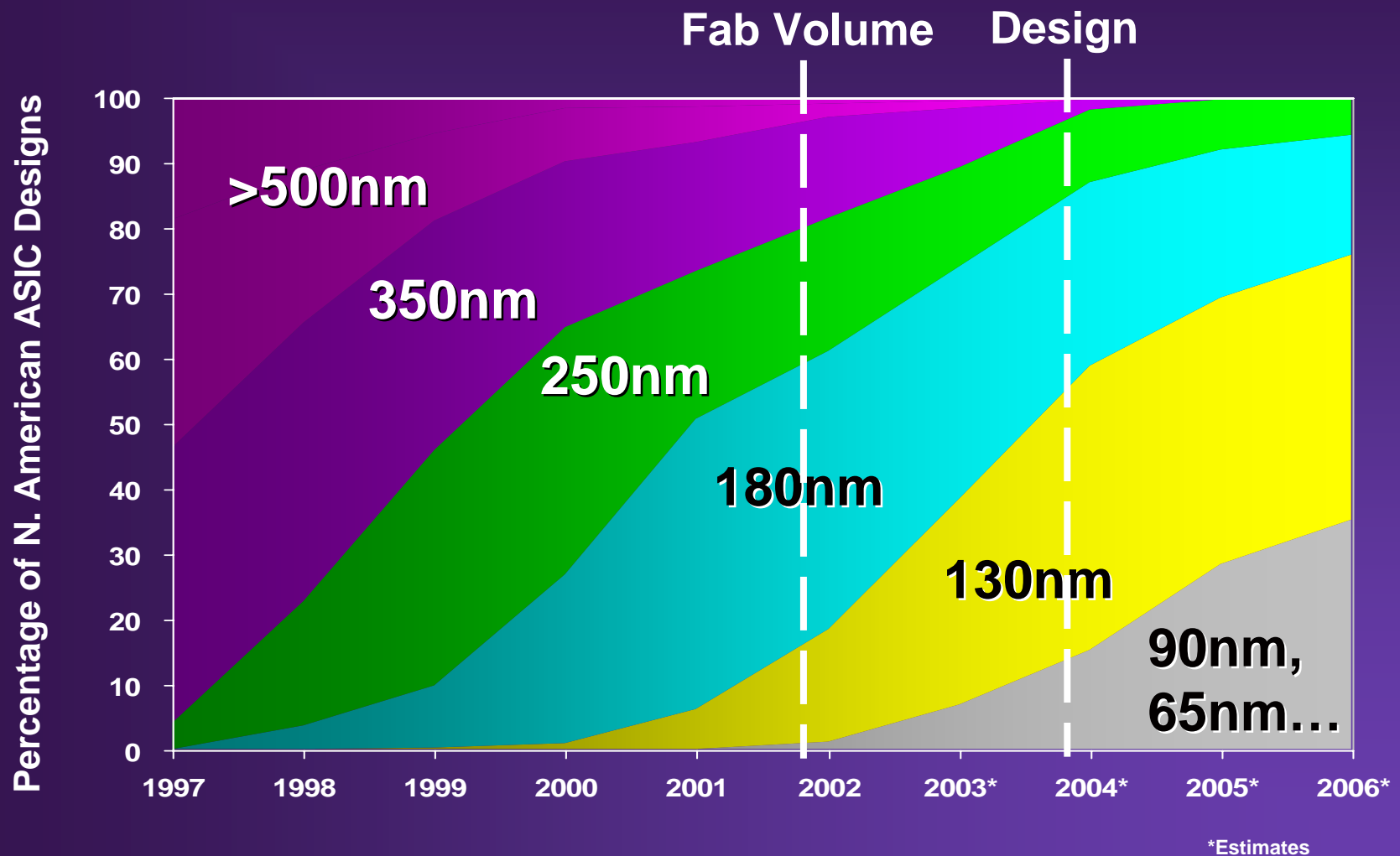
The “Billion-Dollar Club”



The Need for High Volumes (2002 Units in Millions)

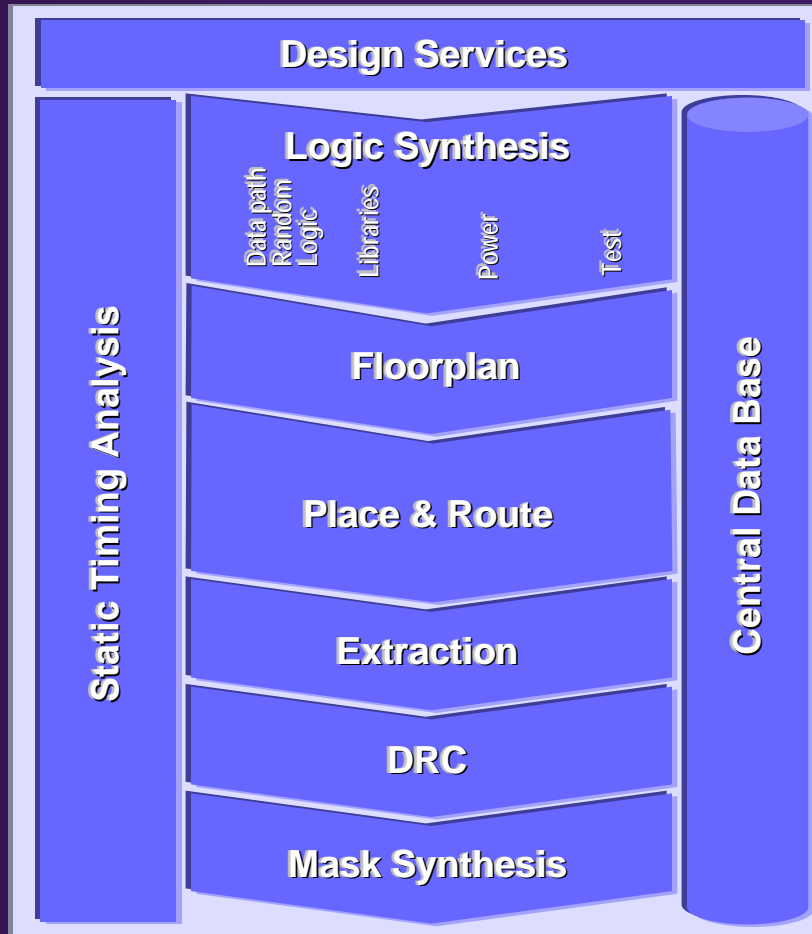
Cable modem	111	DVR / PVR	12.6
Digital Cable Set-Top Boxes	48.0	Digital Still Cameras	10.5
xDSL modems/ Line card	67	Laser Printers	7.6
Cellular Phones (only 2.5G, 3G)	25	Auto display/ dashboard control	5.7
Satellite Set-Top Boxes (STBs)	23.0	Digital Camcorders	5.0
WLAN 802.11b	15	Auto Navigation	3.5
Video surveillance	15.3	Digital TV Sets	3.4
		Digital Copiers	2.3
		WLAN 802.11a	2.2

Adoption of New Process Technologies



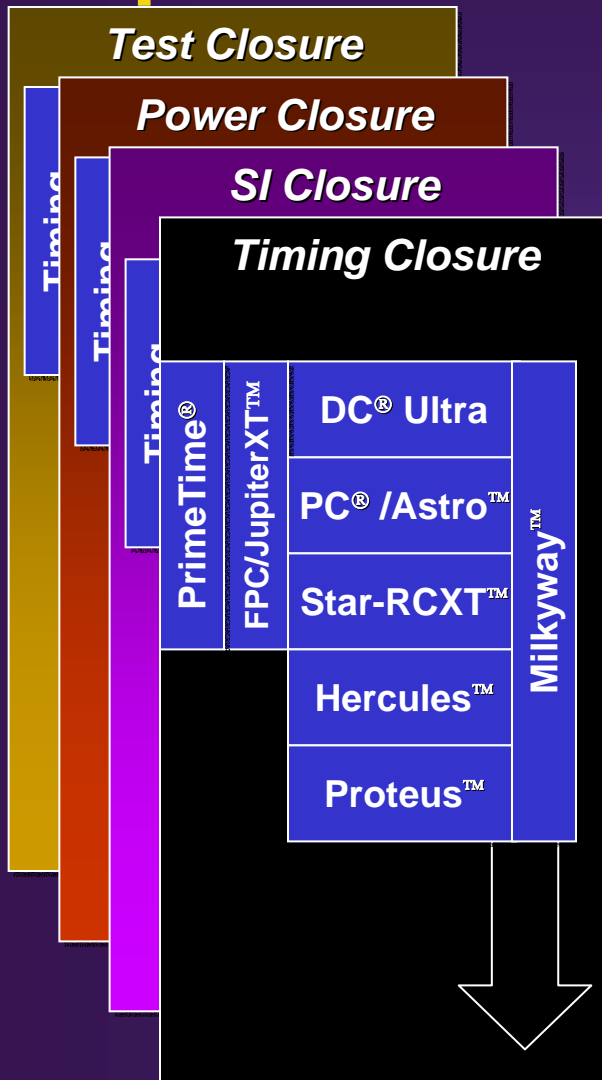
*Estimates

Chip Design



- Essentially compiling a program (Verilog, VHDL) into the patterns for manufacturing (Masks)
- Include IP
- Many complex steps

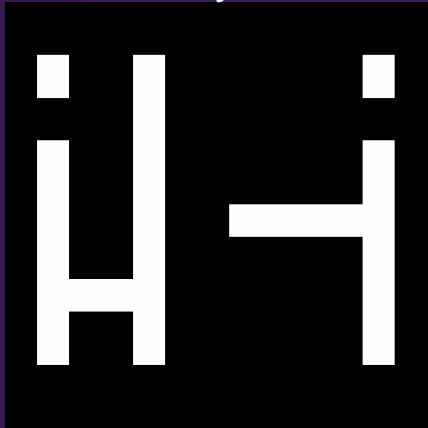
Design Needs To Meet Hard Requirements



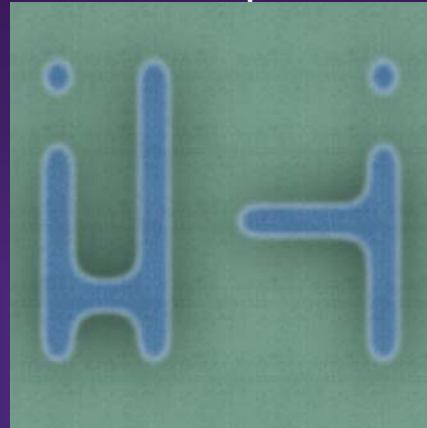
- **Timing Closure** to achieve performance
- **Power Closure** to enable low-power designs
- **Test Closure** to reduce silicon test costs
- **SI Closure** to account for parasitics
- **Size optimization** to minimize cost
- **Mask Synthesis** to account for lithography

Resolving Small Patterns

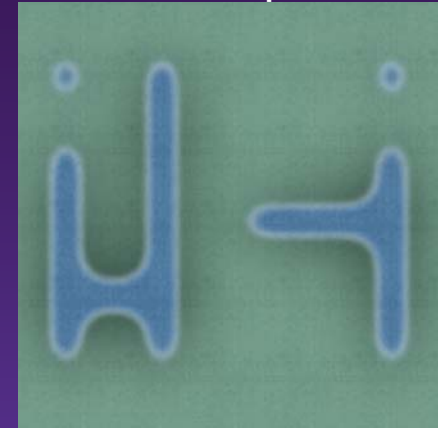
Layout



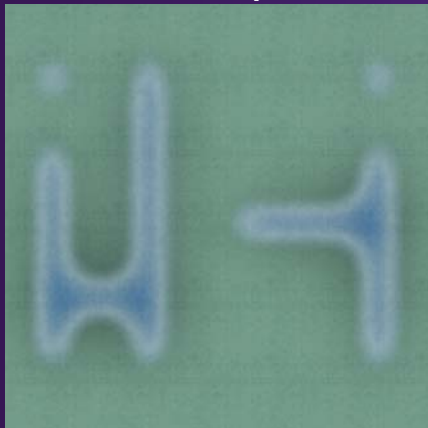
0.25 μ



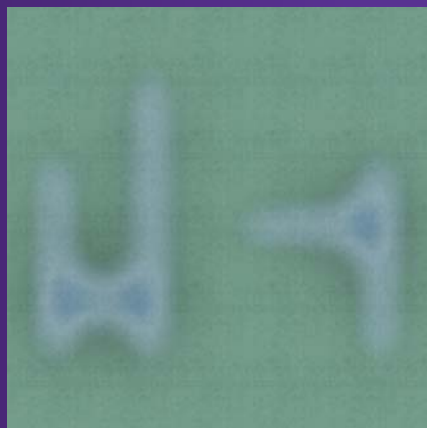
0.18 μ



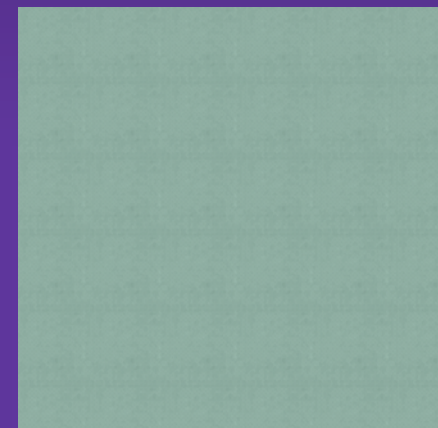
0.15 μ



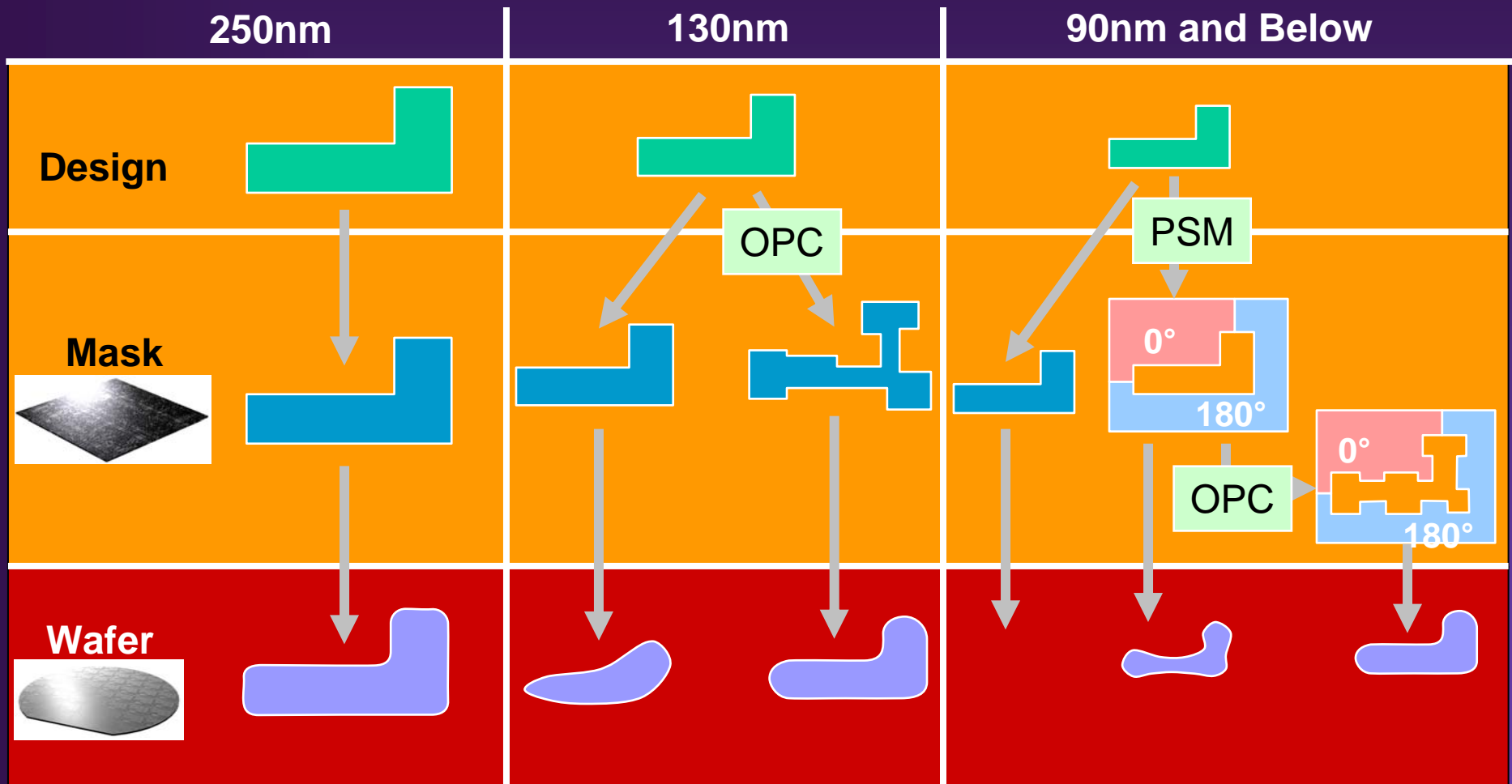
130nm



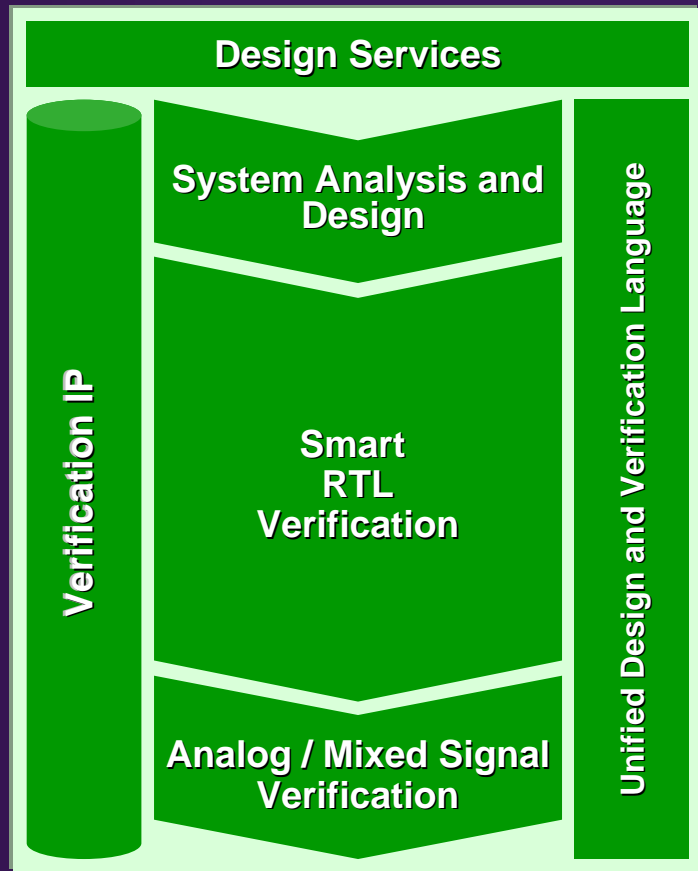
90nm



Mask Synthesis



Design Verification

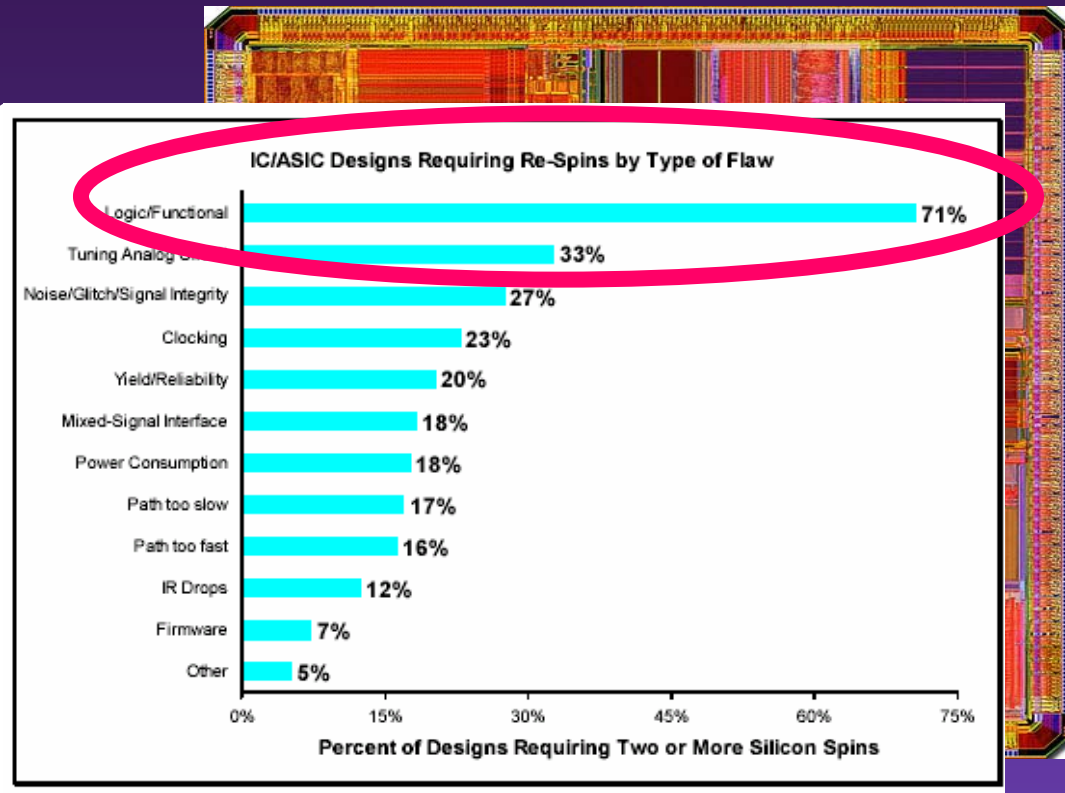


- **Functional verification:**
does the chip do what it is intended to do?
 - Simulation
 - Formal verification
- Digital and analog

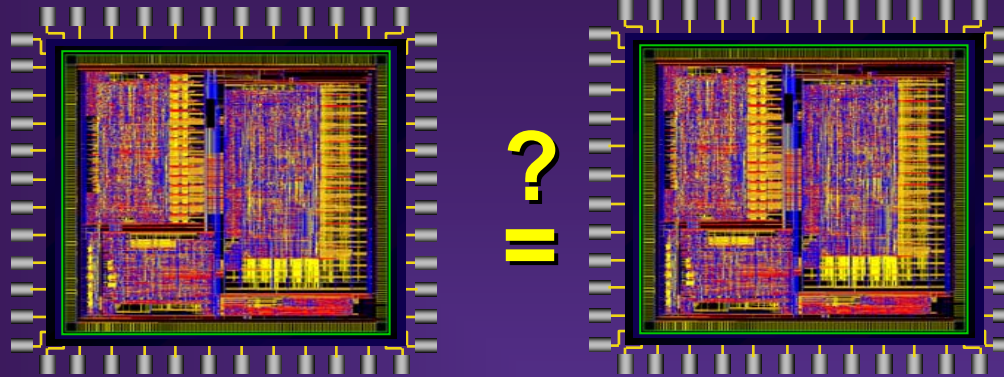
Verification Is a Major Problem

61%
of IC designs
require
one or more
re-spins

Source:
2002 Collett Research International, Inc.



Example: Equivalency Checking



- Checks all stages of a design for functional equivalence
- 100% Exhaustive

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Why Asia?

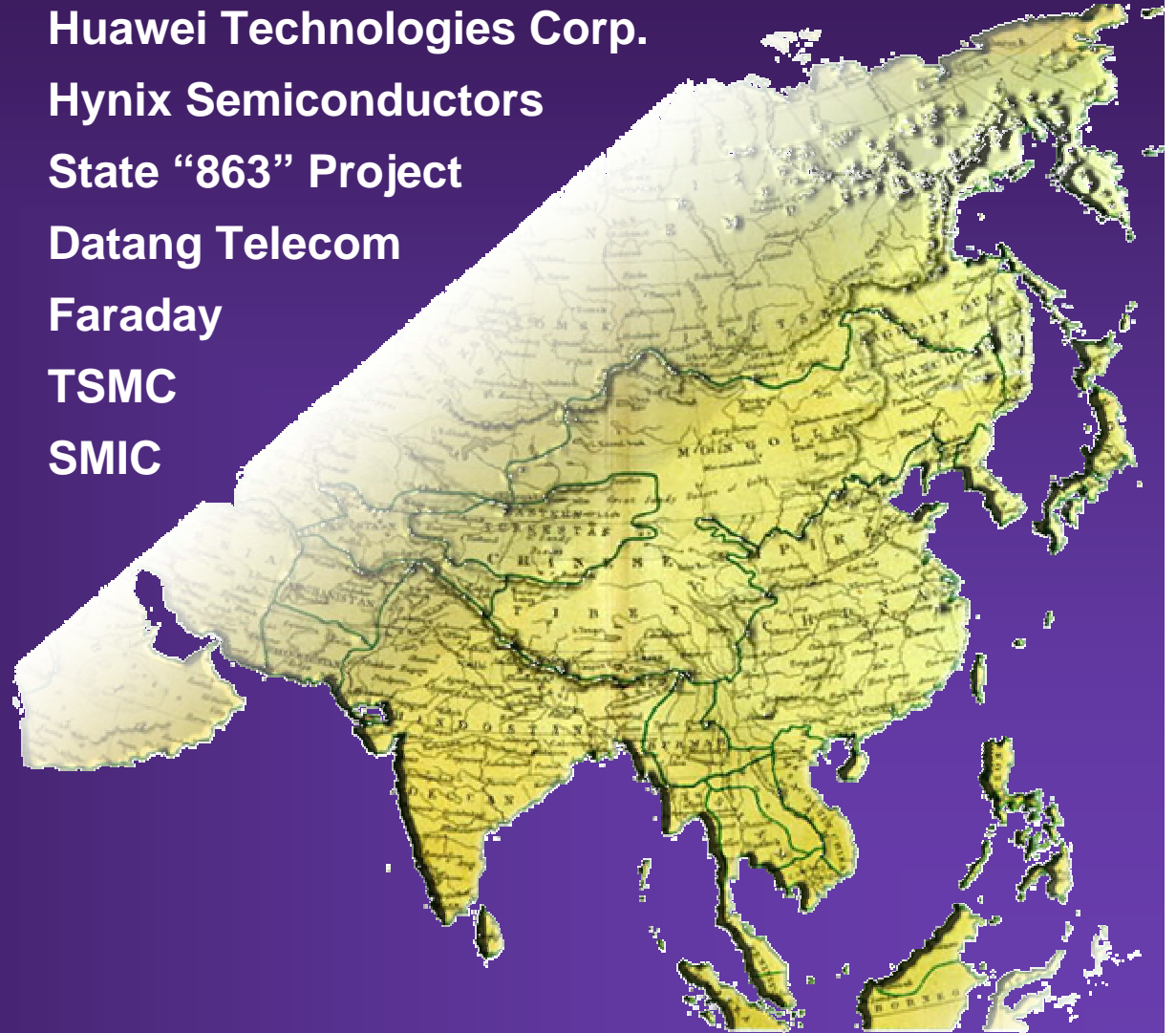


- **Customer proximity**
- **Access to local talent**
- **Cost**
- **Growth**
- **Moving up the value chain**

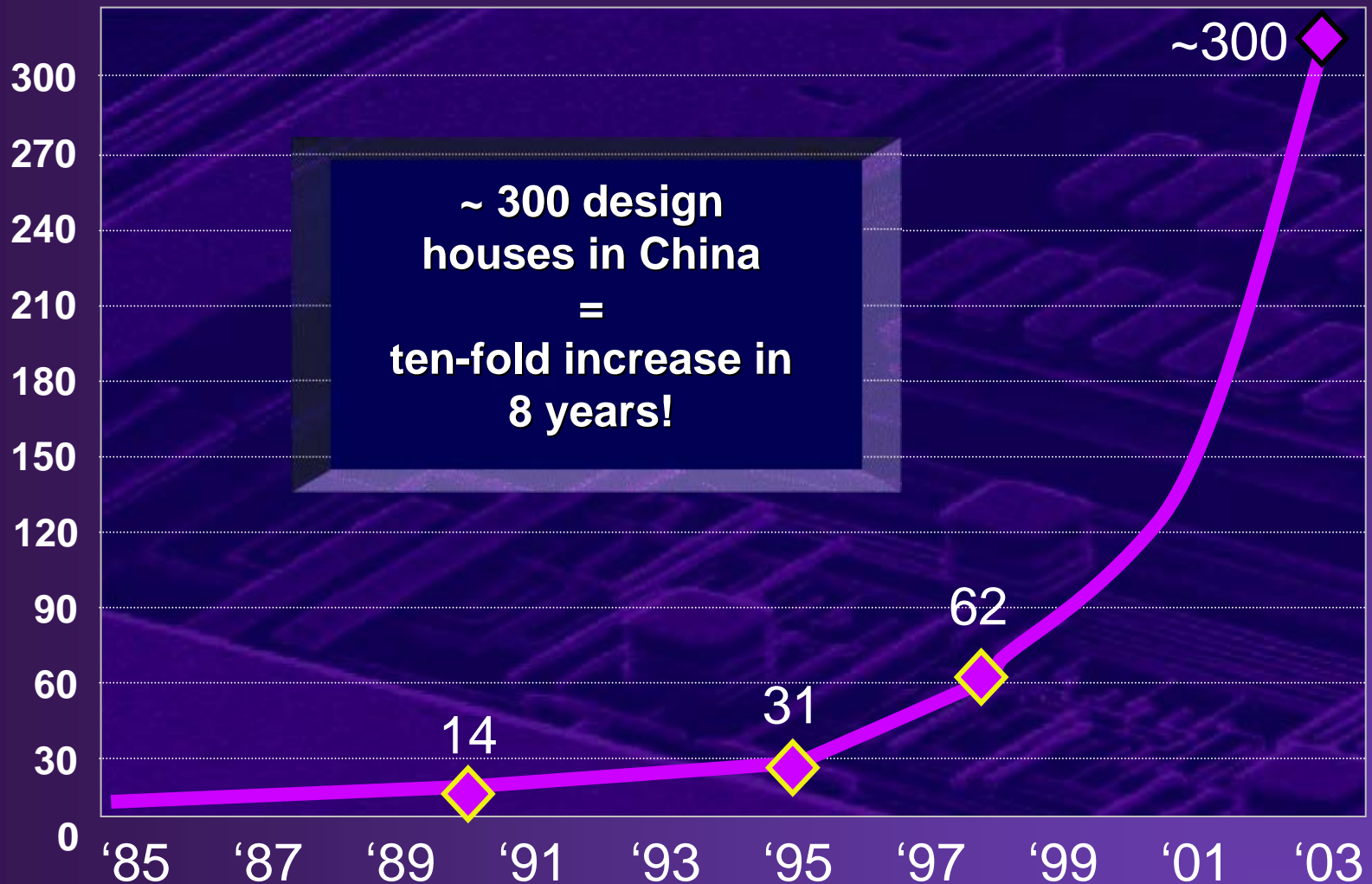
Synopsys' Major Customers in Asia

National Chiao Tung
University MediaTek
Incorporation
Samsung Electronics
LG Electronics
Creative Labs Inc
Ali Corporation
VIA
UMC

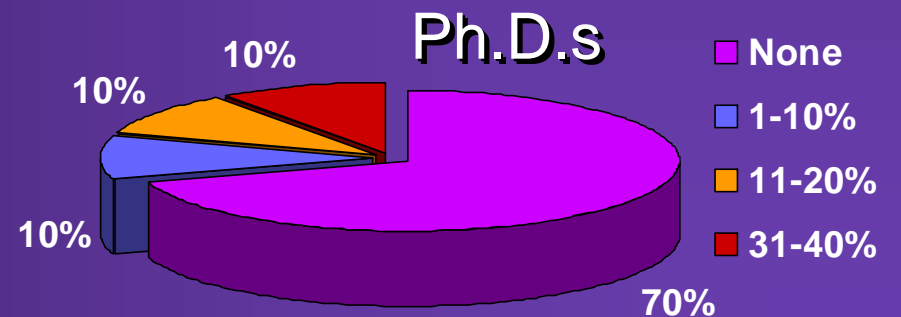
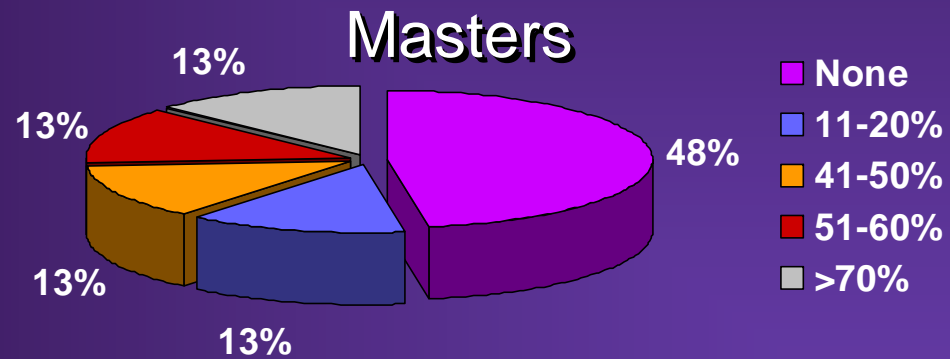
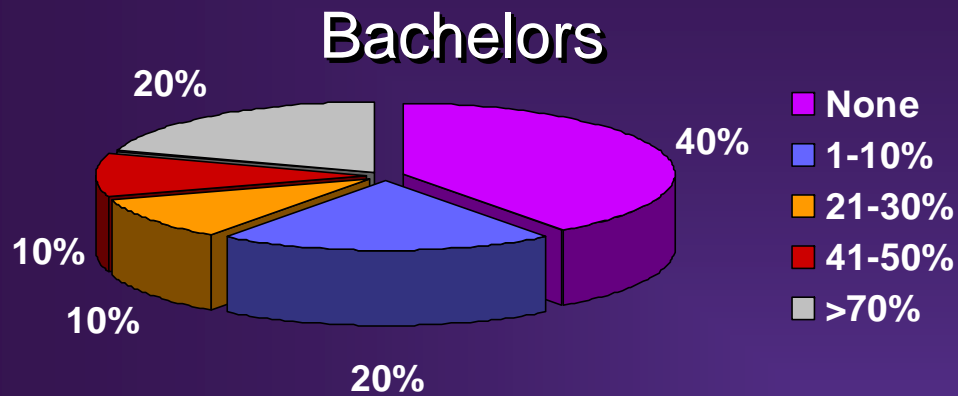
Silicon Integrated Systems Corp.
Huawei Technologies Corp.
Hynix Semiconductors
State "863" Project
Datang Telecom
Faraday
TSMC
SMIC



Growth Of China's IC Design Houses



% of Degrees By Highest Level Of Education



Source: FSA China Handbook 2003-2004, Survey

Talent Costs

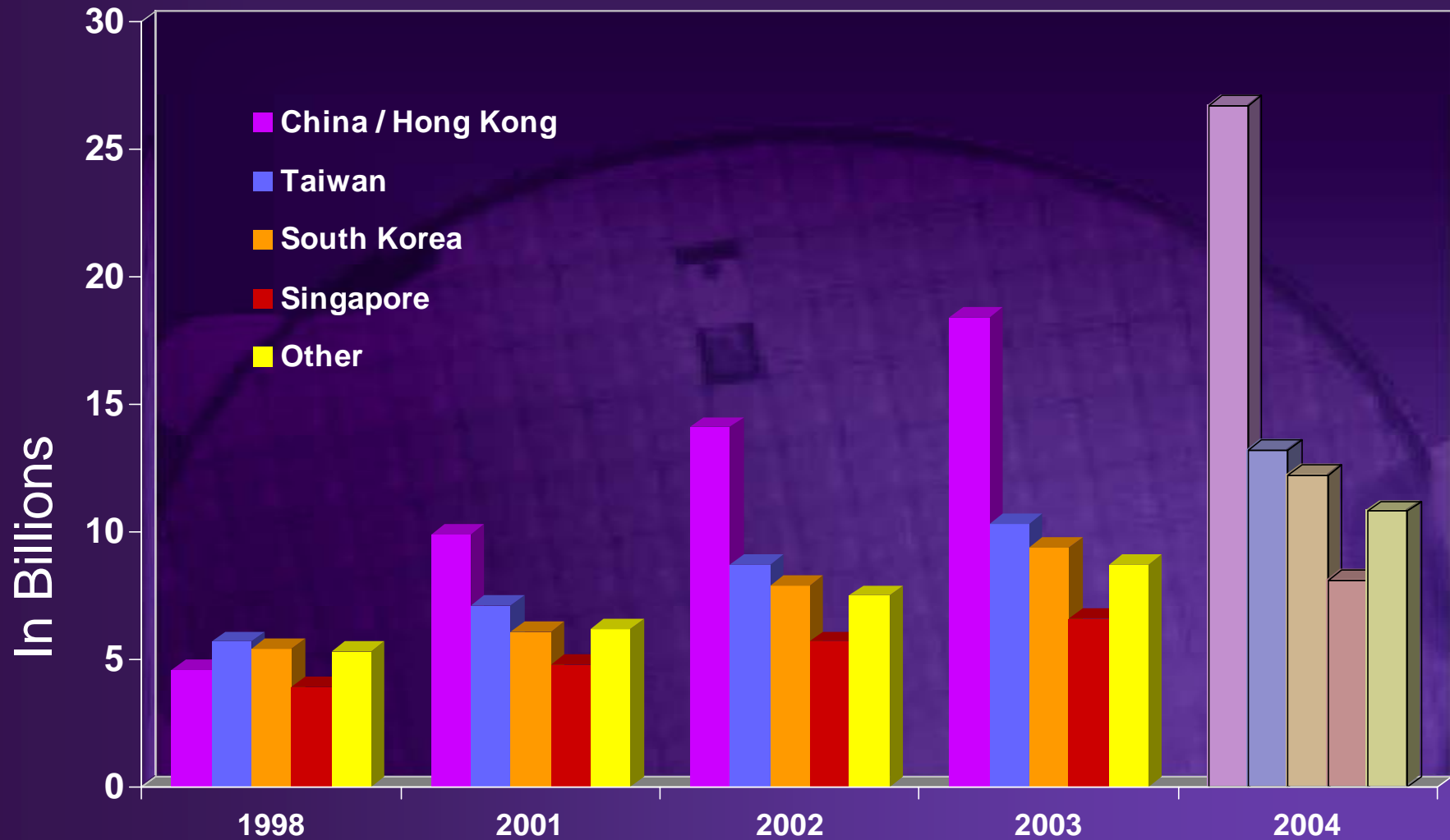
	<\$10,000	\$10K - \$15K	\$15K - \$20K	\$20K - \$30K	\$30K - \$50K	\$50K - \$70K	\$70K - \$90K	\$90K - \$100K	>\$100K
Design Engineer	25%	N/A	50%	25%	N/A	N/A	N/A	N/A	N/A
Process Engineer	N/A	N/A	50%	50%	N/A	N/A	N/A	N/A	N/A
R&D Engineer	N/A	25%	25%	25%	25%	N/A	N/A	N/A	N/A
Field Application Eng.	N/A	60%	20%	20%	N/A	N/A	N/A	N/A	N/A
Customer App. Eng.	N/A	25%	25%	50%	N/A	N/A	N/A	N/A	N/A
Human Resources	67%	N/A	N/A	33%	N/A	N/A	N/A	N/A	N/A
Accounting / Financial	86%	N/A	14%	N/A	N/A	N/A	N/A	N/A	N/A
Customer Service Rep.	25%	25%	50%	N/A	N/A	N/A	N/A	N/A	N/A
Legal	N/A	34%	N/A	33%	N/A	N/A	N/A	N/A	33%
Information Technology	33%	67%	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sales Representative	14%	14%	14%	30%	14%	14%	N/A	N/A	N/A
Marketing Representative	14%	14%	14%	14%	39%	14%	N/A	N/A	N/A

China IC Demand Versus Supply

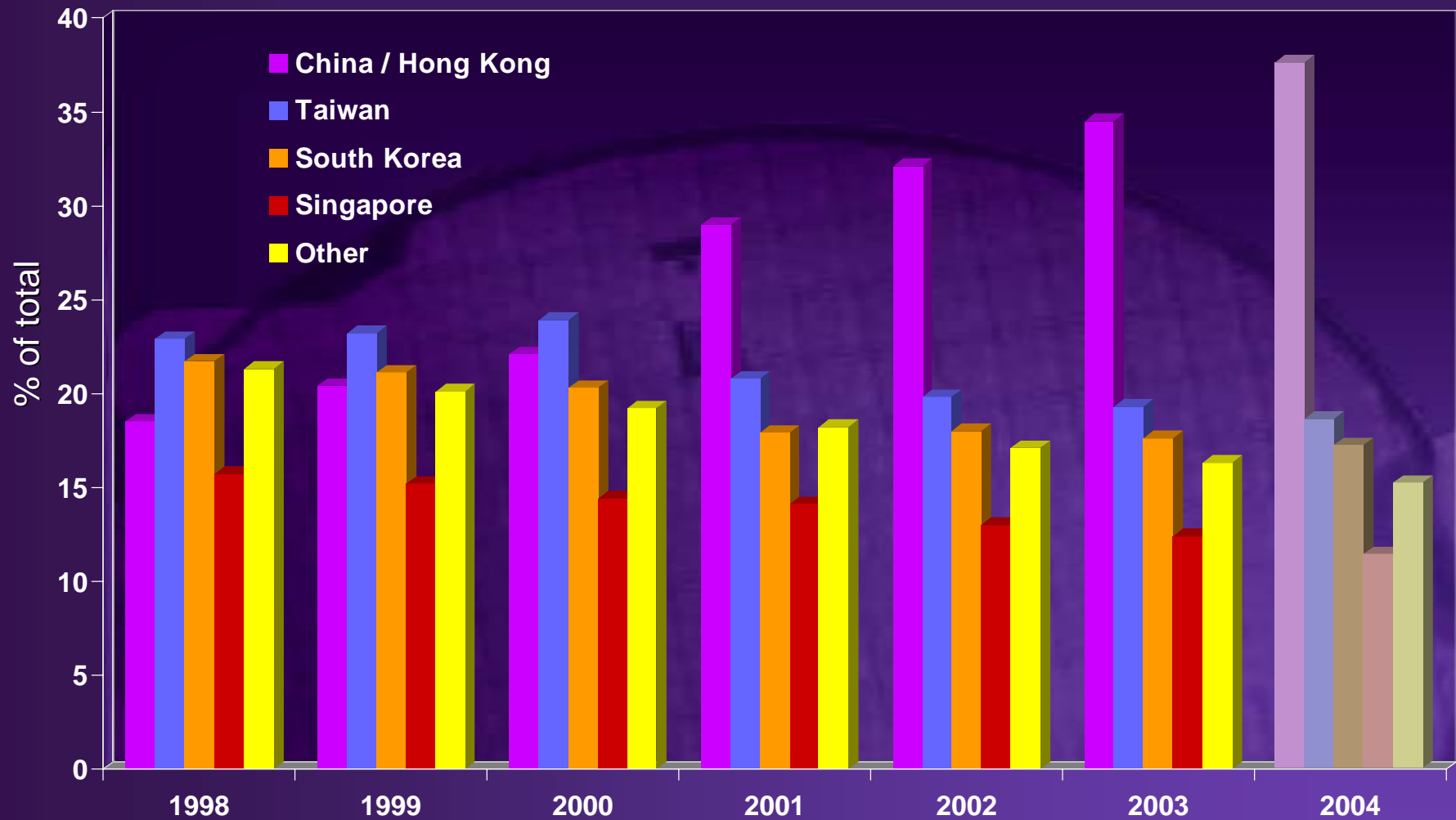
1996-2005



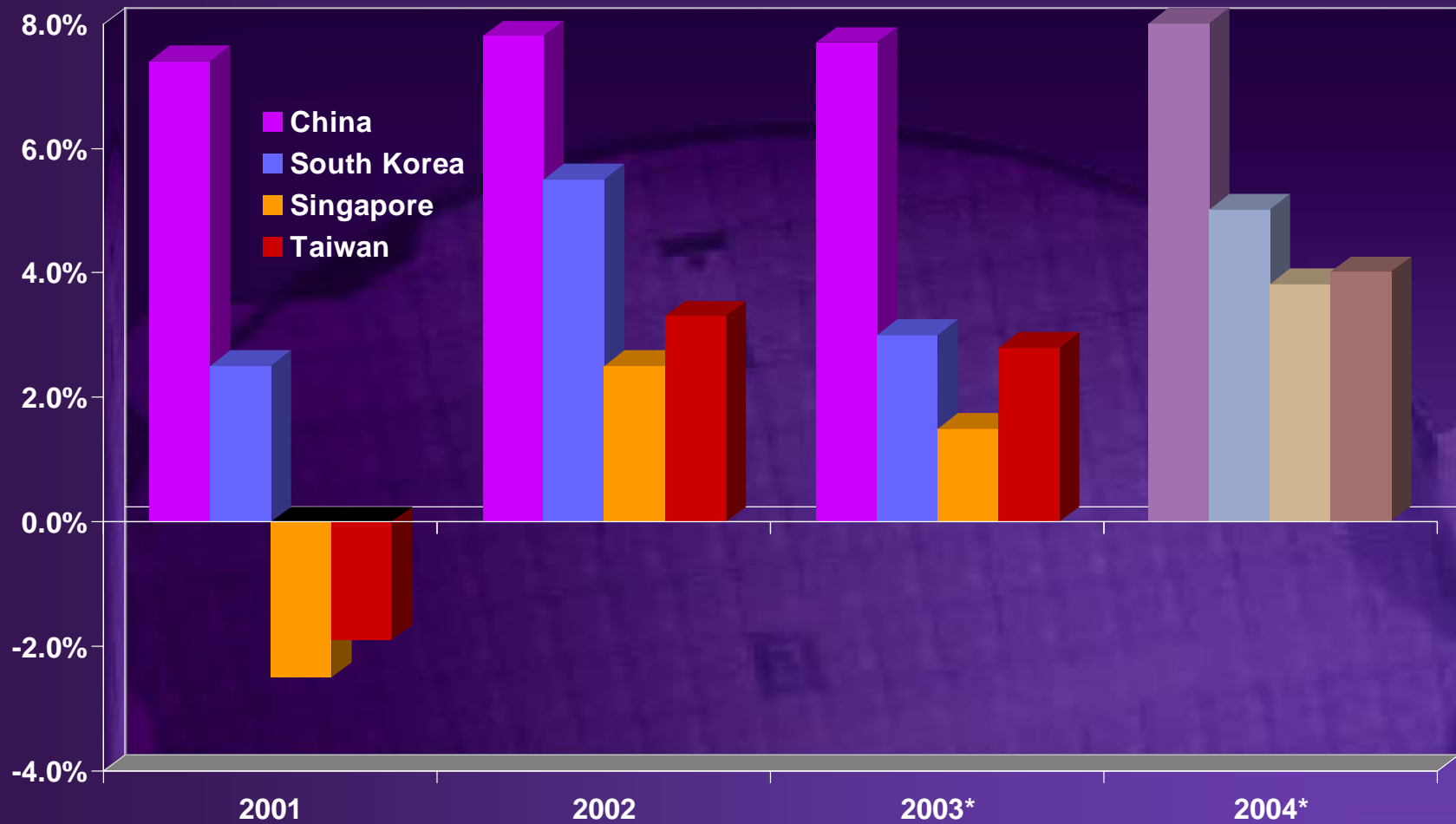
Semiconductor Revenue in Asia



Semiconductor Growth in Asia



Asia GDP Growth



Moving Up The Value Chain

Speed

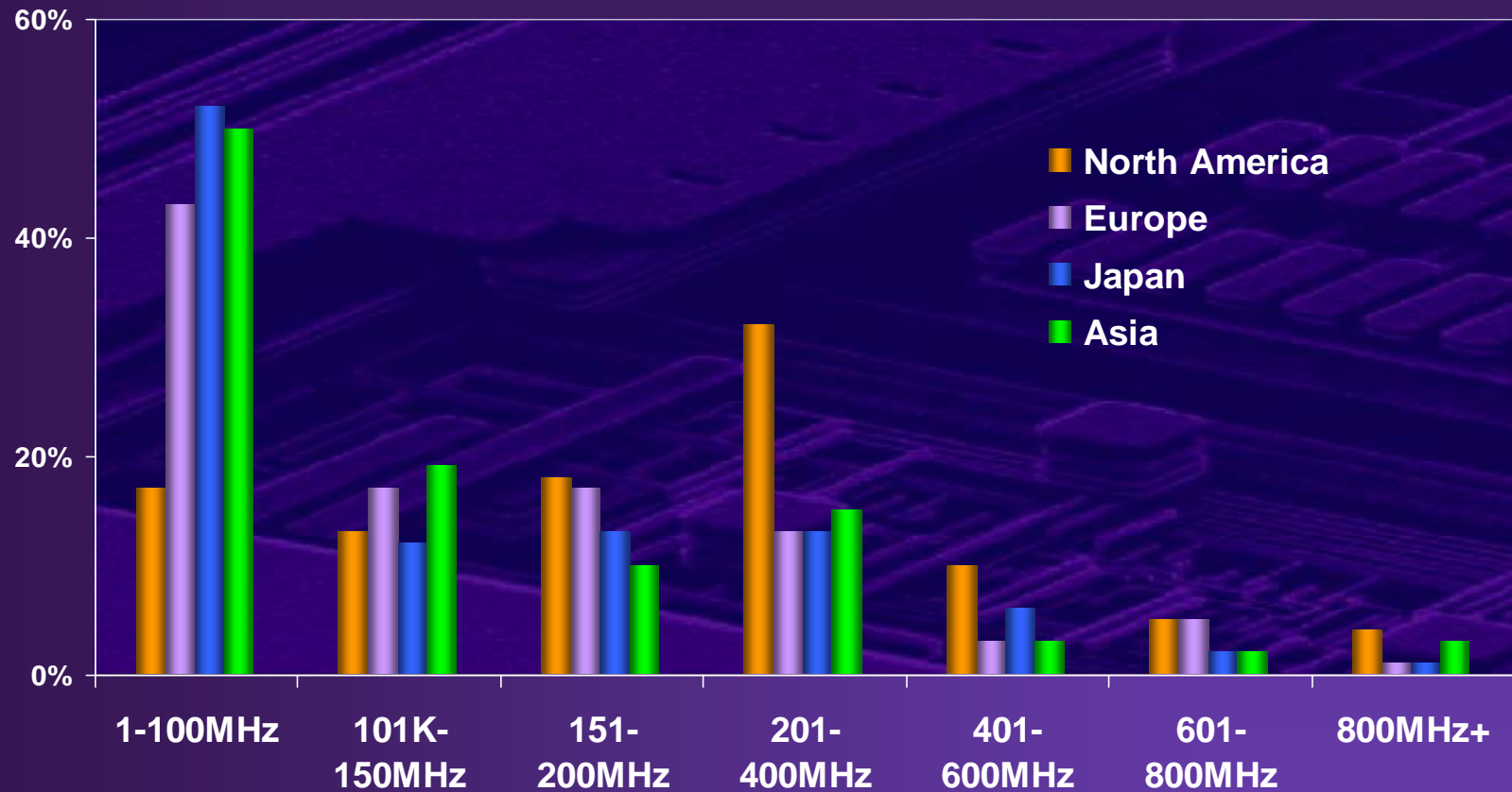


Size



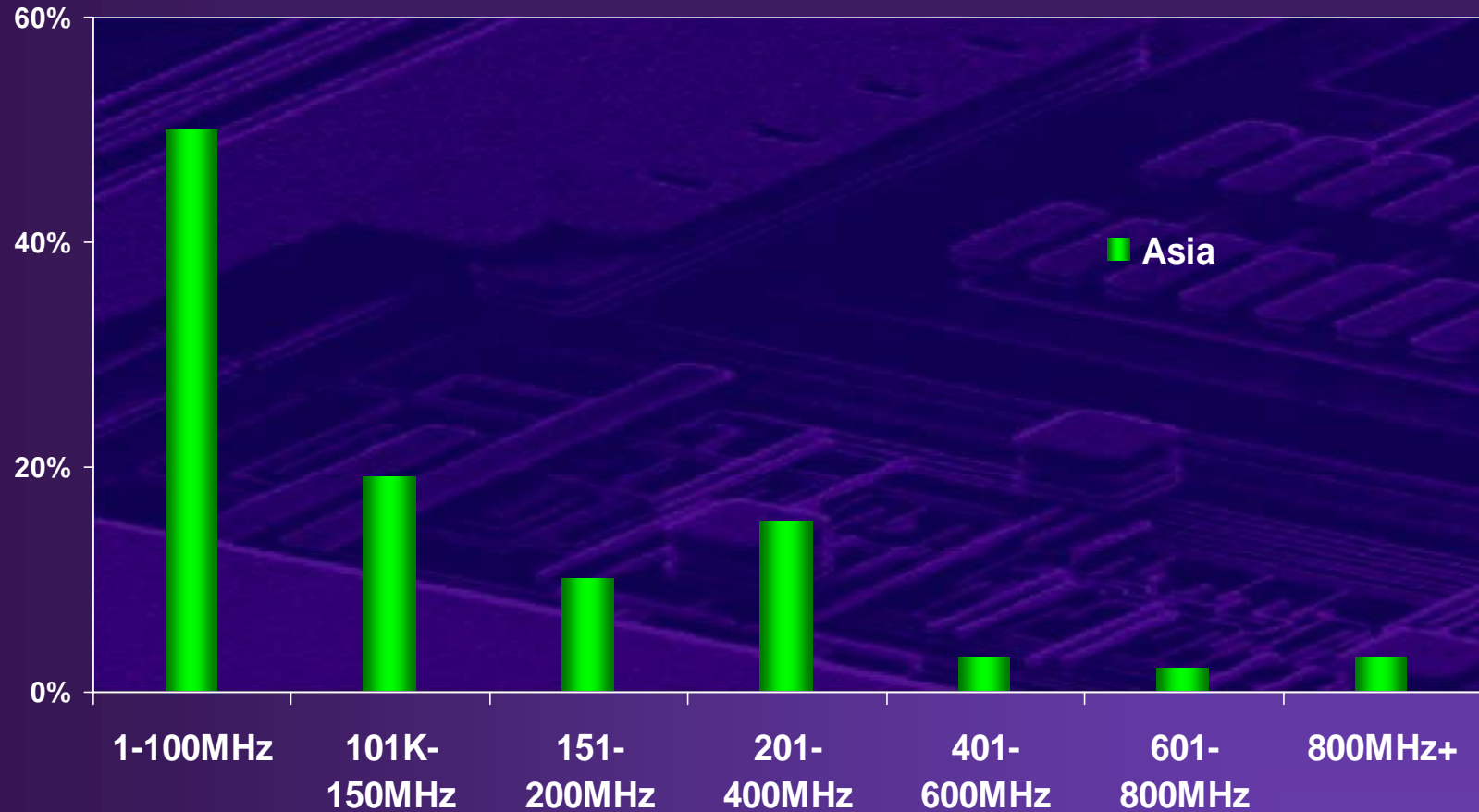
Average Chip Speed by Region

Synopsys SNUG Data 2002



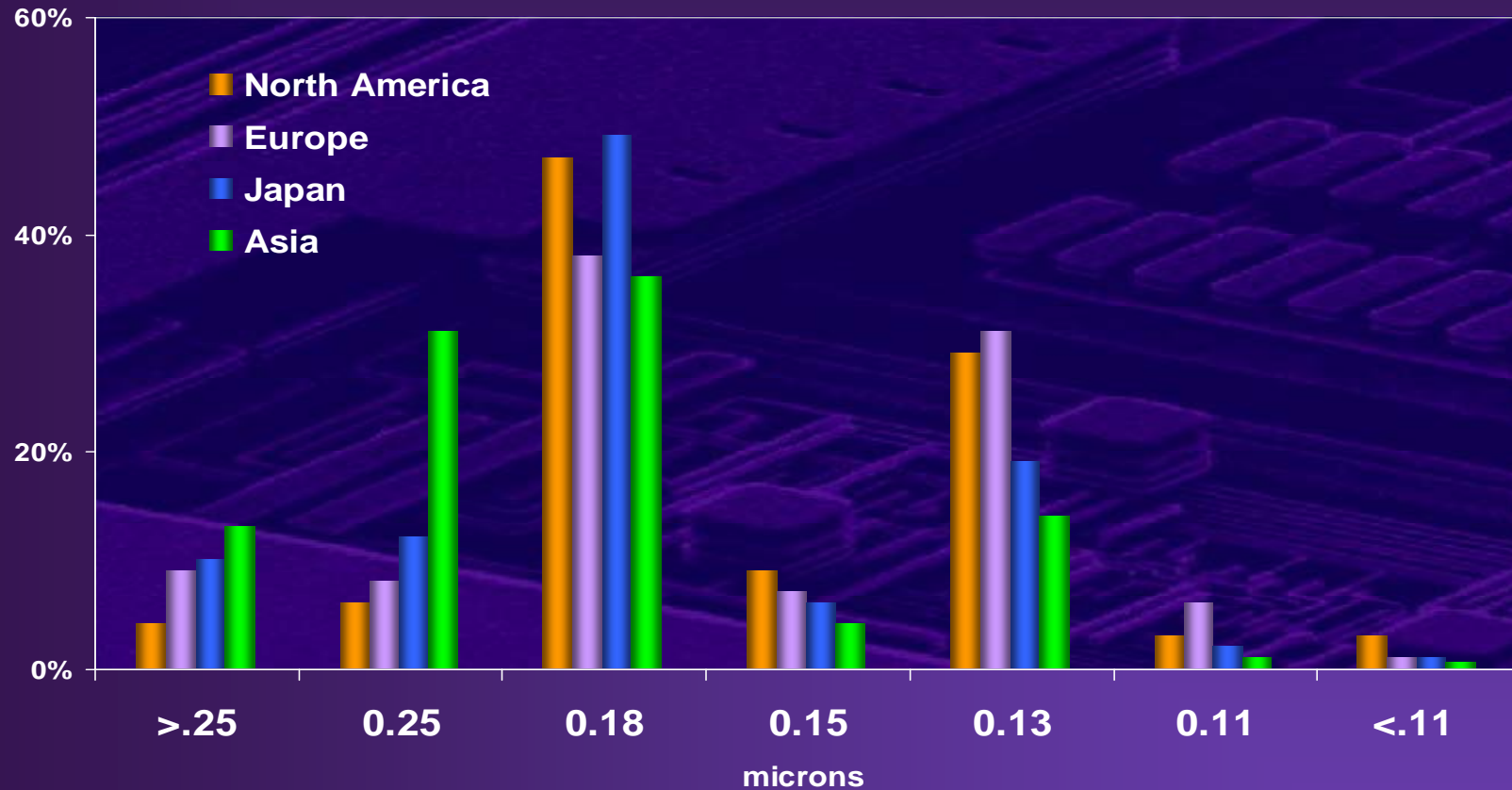
Average Chip Speed Asia

Synopsys SNUG Data 2002



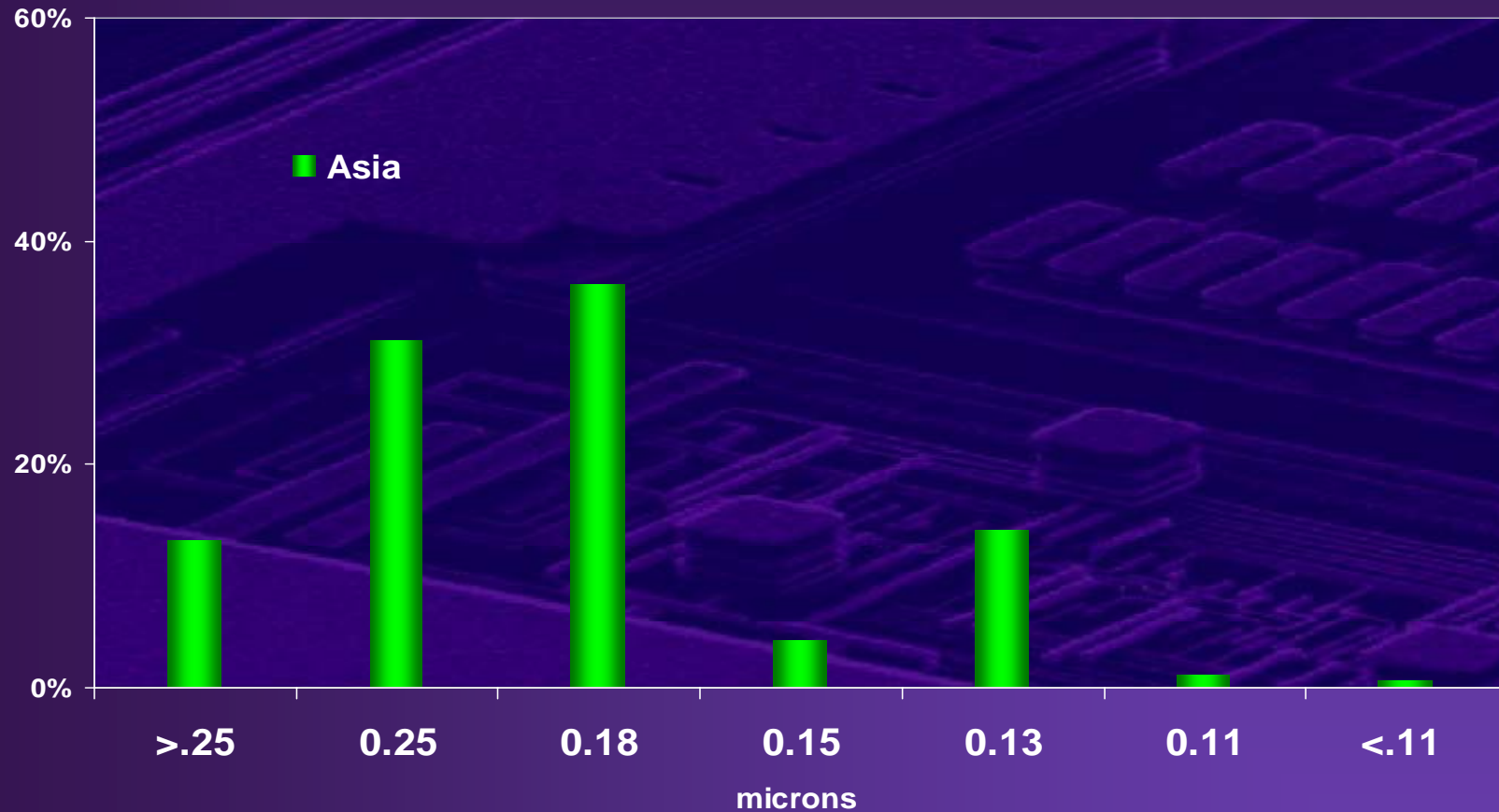
Average Design Geometries by Region

Synopsys SNUG Data 2002



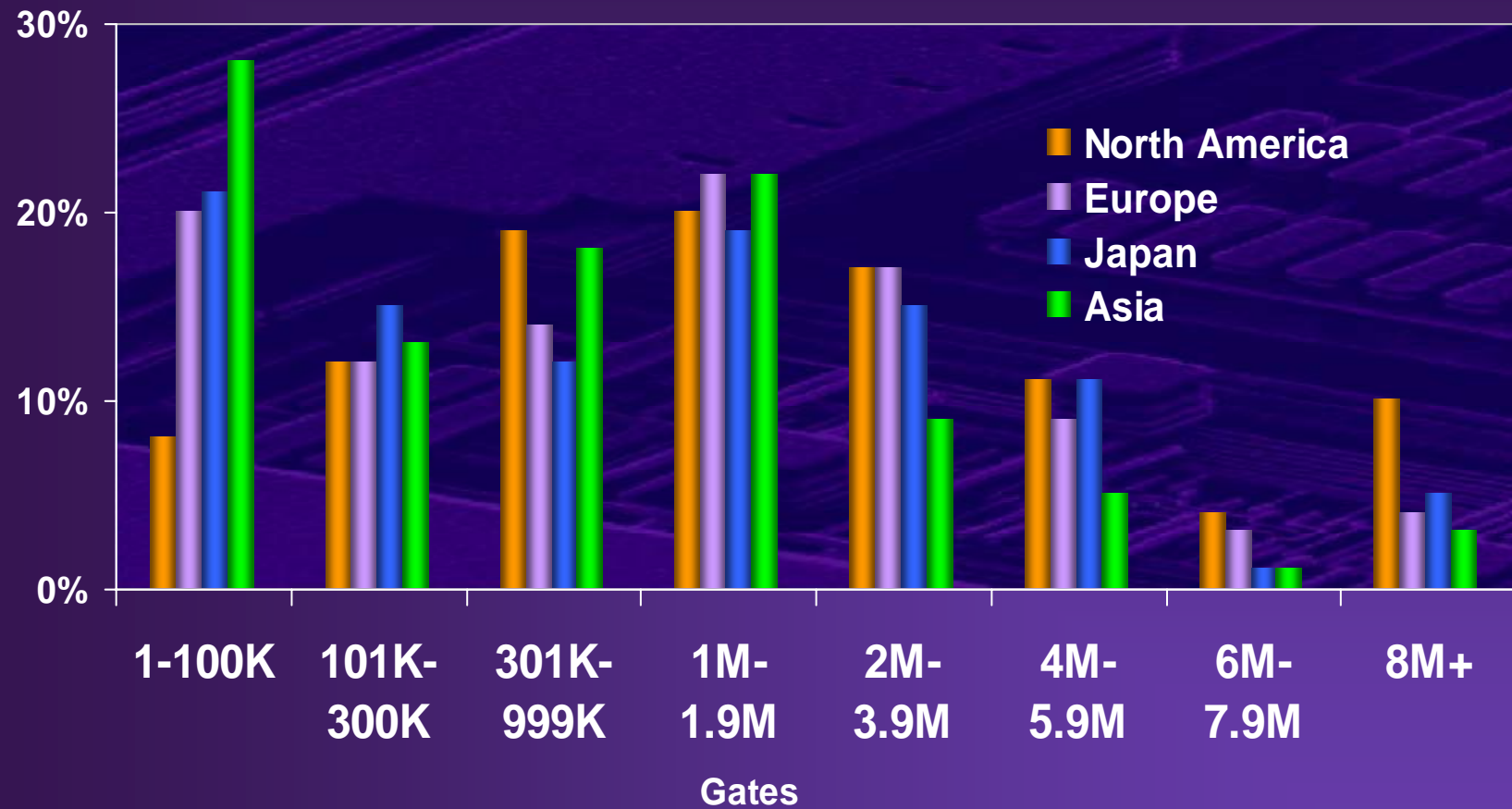
Average Design Geometries Asia

Synopsys SNUG Data 2002



Average Gate Counts By Region

Synopsys SNUG Data 2002



Average Gate Counts Asia

Synopsys SNUG Data 2002



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Synopsys Presence In Asia Goes Through Four Phases

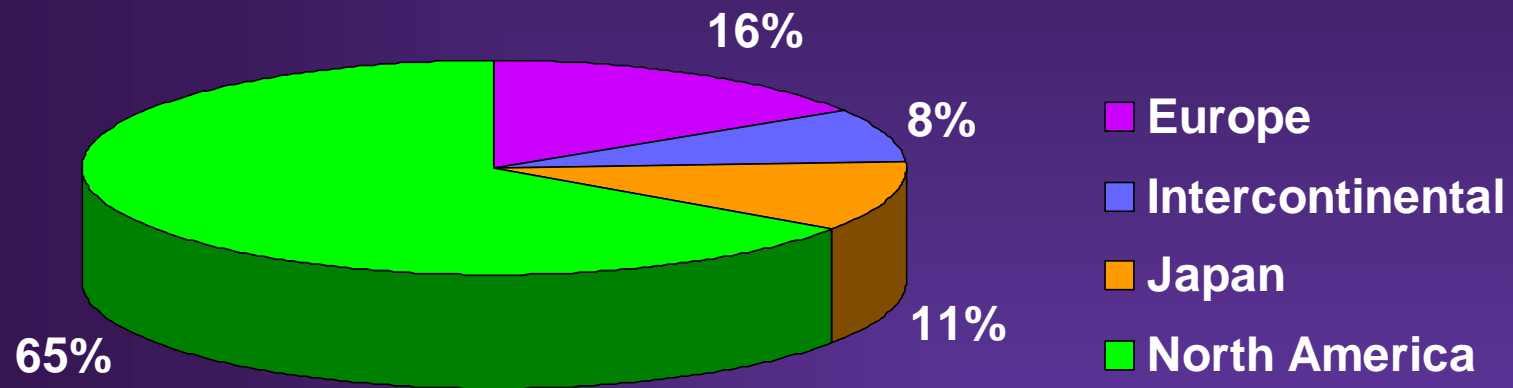
1. Sales
2. Support / Service
3. Outsourcing Infrastructure
 - Distribution
 - Customer Training
 - Finance
 - HR
 - IT
4. R&D



Synopsys: Current Stats

- 
- **Largest EDA supplier**
 - **\$1B+ revenue per year**
 - **Headquartered in Mountain View, CA**
 - **60+ offices globally**
 - **4300+ employees**
 - **25%+ revenue on R&D per year**

Synopsys Revenue By Region



Synopsys in Singapore Since 1994

- ~ 30 employees
 - 41% Sales
 - 40% Support / Services
 - 19% Infrastructure
 - 0% R&D
- Headquarters



Synopsys In Korea Since 1991

- Office in Seoul
- ~ 60 employees
 - 25% Sales
 - 34% Support/ Services
 - 9% Infrastructure
 - 32% R&D
- Support ETRI IT SOC Incubation Center
- University program through IDEC

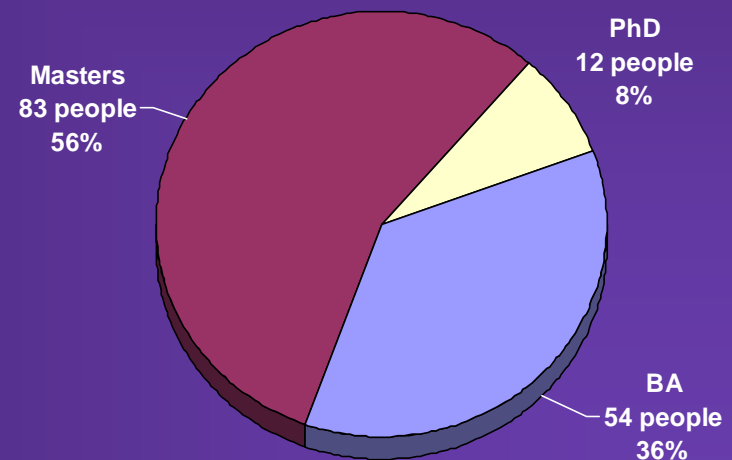


Synopsys in Taiwan

- Synopsys in Taiwan since June 1990
- Offices in
 - Taipei
 - Hsinchu
- ~ 150 employees
 - 23% Sales
 - 32% Support/Services
 - 10% Infrastructure
 - 35% R&D



Employee Educational Level in Taiwan



Six Major Shifts Driving The Industry Growth in China

- School labs to key industry
- Government owned to private owned
- Government funding to policy shifting
- Pure Chinese companies to multinational JVs
- Melody chips to SoC
- IC chip design to industry standard proposal

Synopsys In China Since 1995

- Offices in Shanghai, Beijing, Shenzhen, Hong Kong
- Partnering in IC design initiatives:
 - 7 National IC Design incubation centers
 - University programs at 30 leading universities,
 - Partnerships with Chinese Academy of Science, Datang Telecom, and SMIC
- ~ 250 employees
 - 11% Sales
 - 8% Support/Services
 - 9 Infrastructure
 - 72% R&D



SYNOPSYS Corporate

PRODUCTS & SOLUTIONS PROFESSIONAL SERVICES EDUCATION & TRAINING






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Synopsys and China's Ministry of Science and Technology Sign Agreement for Tool Donation and Joint Promotion of Integrated Circuit Design Industry

Government-Sponsored Program Enables Startups to Develop Ideas in Synopsys Design Environment

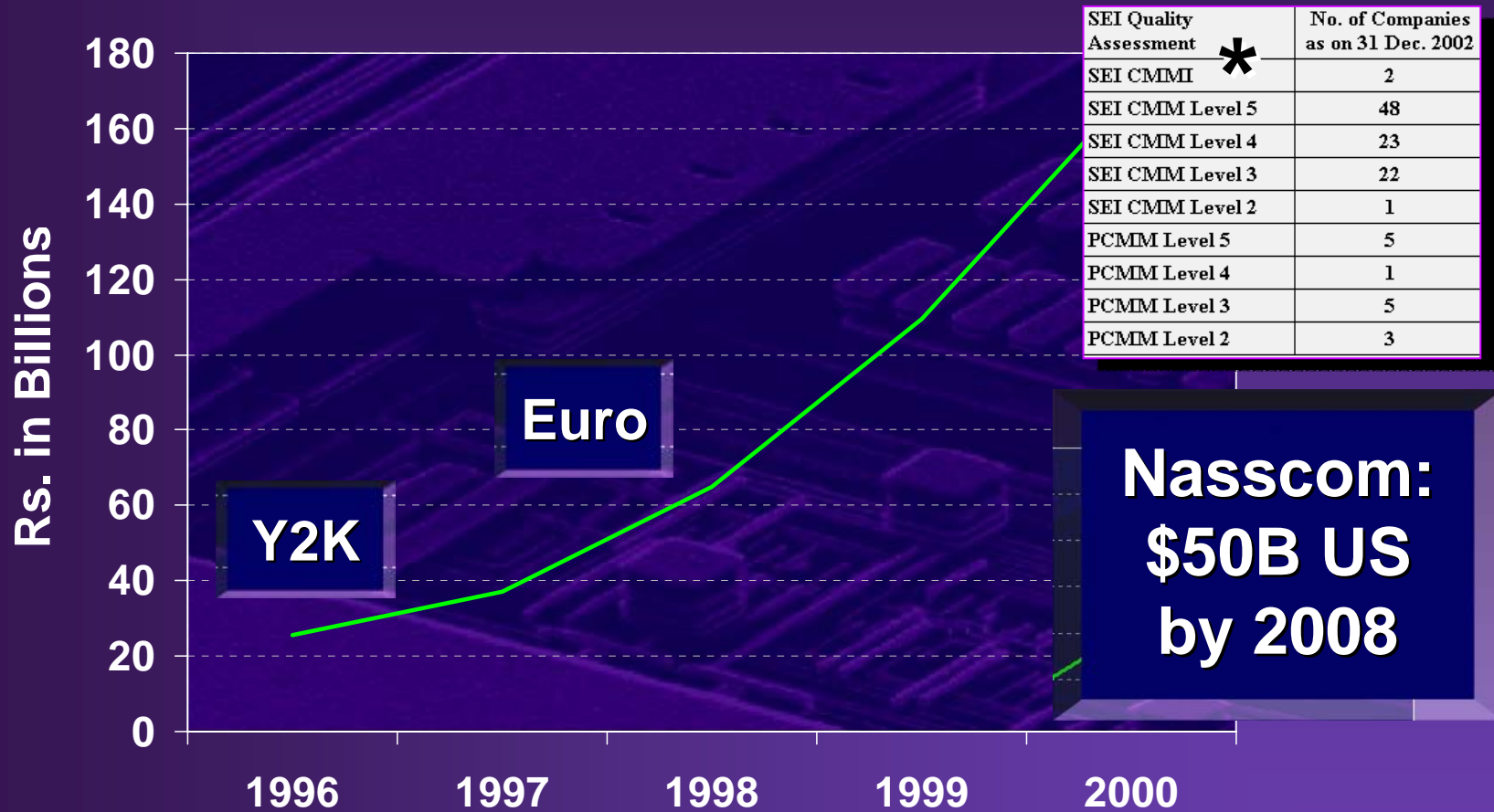
MOUNTAIN VIEW, Calif., March 16, 2003 - Synopsys, Inc. (Nasdaq:SNPS), the world leader in integrated circuit (IC) design software, today announced an agreement with the High Technology Research and Development Center (HTRDC) of the Chinese Ministry of Science and Technology (MOST) to donate IC design tools to the center. The agreement also includes the purchase of additional Synopsys tools by MOST.

Synopsys in China Since 1995

-  Synopsys Offices
-  National IC Design Incubation Centers
-  University Programs
30 locations
-  220 R & D Engineers
-  Partnerships



India's Huge Leap in Software Exports



Synopsys in India Since 1995

- **Bangalore**
 - R&D for tool development
 - IP & design services
 - Corporate applications
 - Advanced technology
- **Hyderabad**
 - Technical support
 - Product validation & infrastructure
 - Foundry & library support
- **Delhi : sales**
- **~ 200 employees**
 - 4% sales
 - 40% support/services
 - 9% infrastructure
 - 47% R&D



Summary

- Semiconductor / EDA business in Asia increasingly same as everywhere else
- Large markets / production
- Talent for
 - Services
 - Support
 - Infrastructure
 - R&D
- Cost advantages will diminish
- Growth will diminish relatively

Thank you!