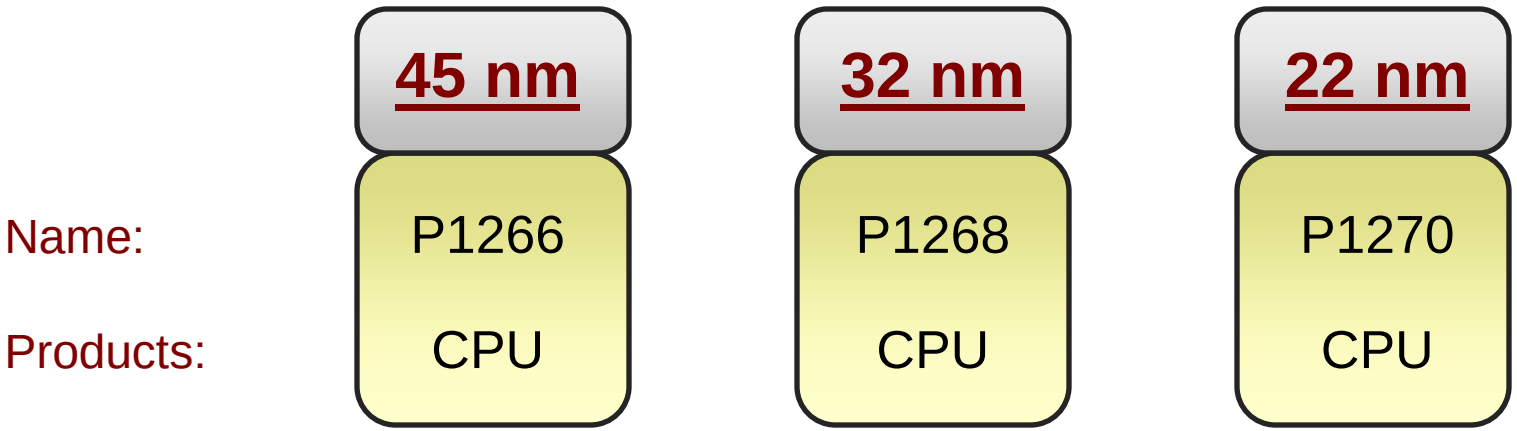
Silicon Technology for 32 nm and Beyond System-on-Chip Products

Mark Bohr
Intel Senior Fellow
Logic Technology Development

SPCS009

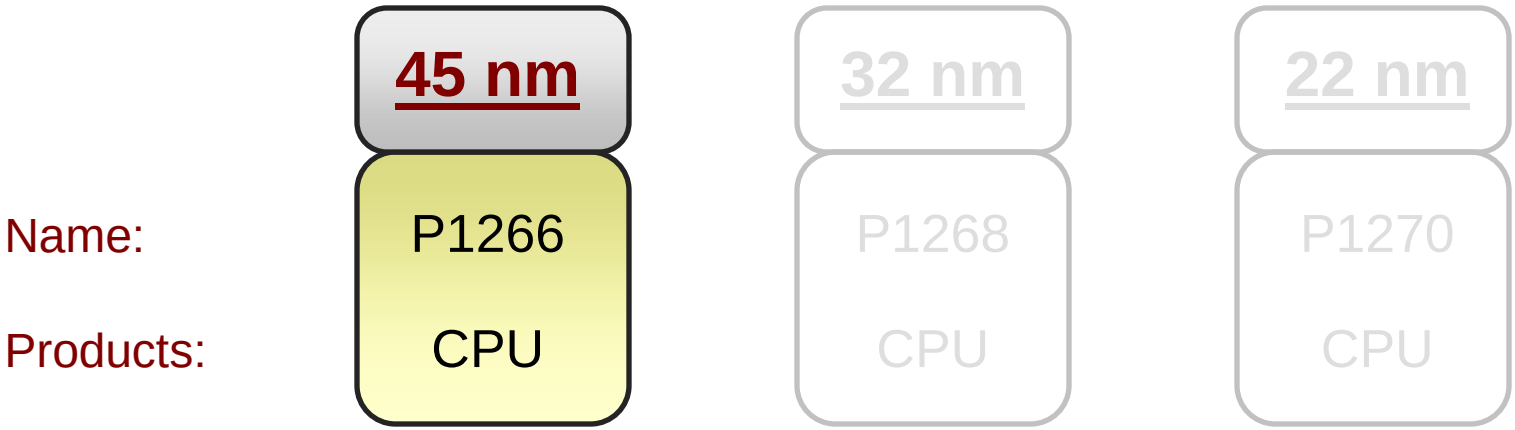
Sponsors of Tomorrow.™ intel

Intel Logic Technology Roadmap

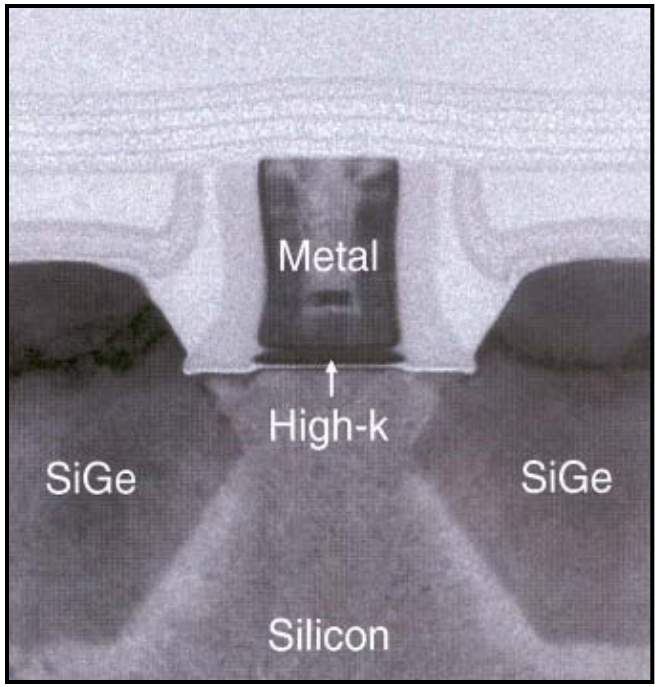


~2 year cycle continues for introducing new technology generations

Intel Logic Technology Roadmap

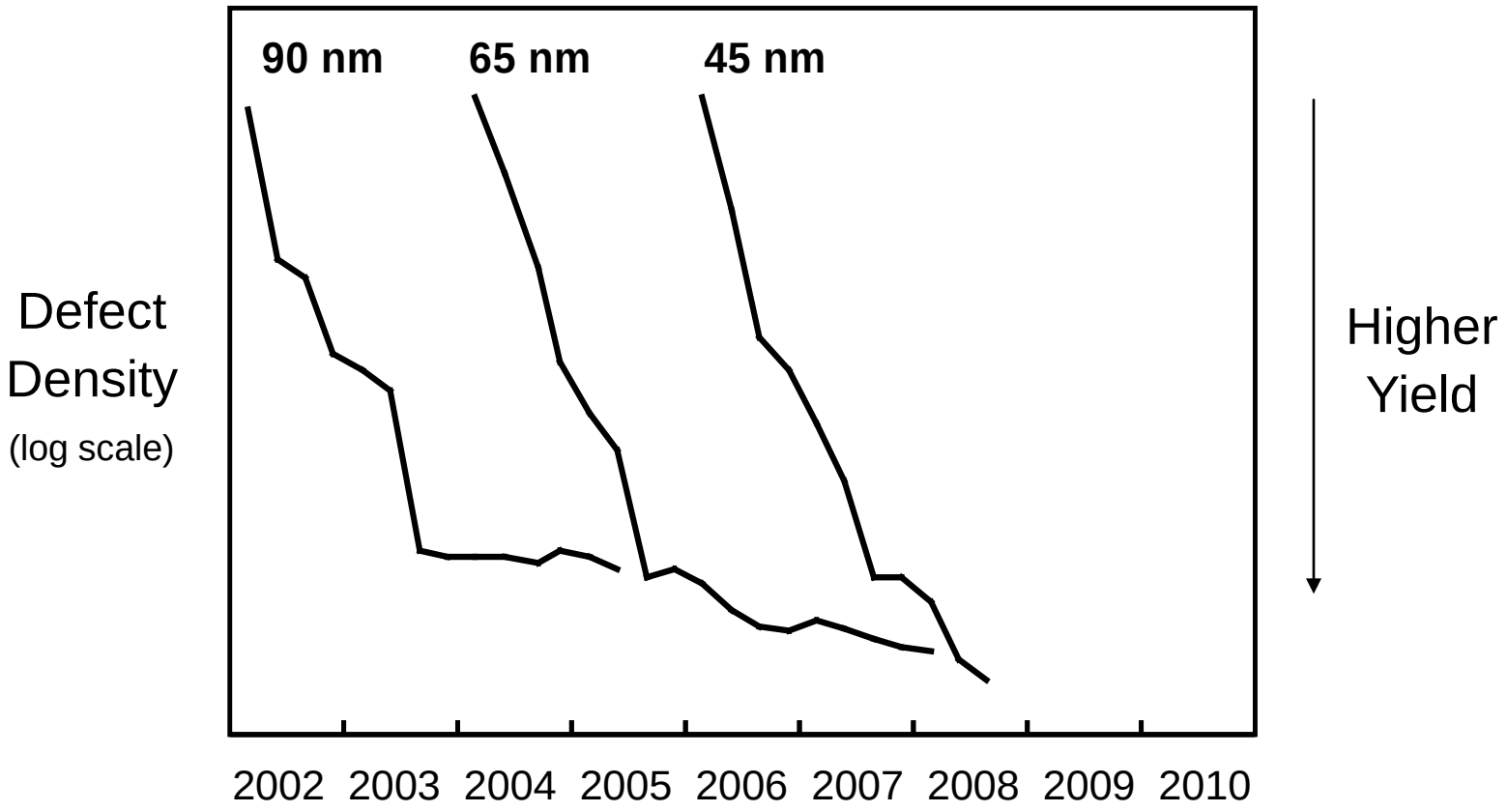


45 nm High-k + Metal Gate Transistors



Intel is only company with high-k + metal gate transistors in production, starting in Nov. '07

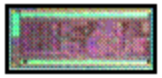
45 nm Defect Density Trend



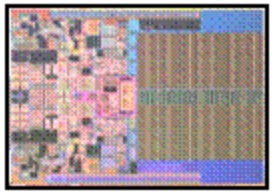
45 nm is Intel's highest yielding process ever

45 nm Microprocessor Products

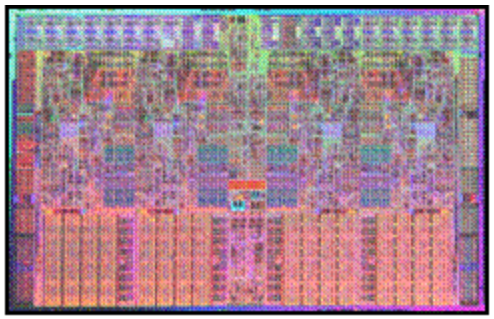
Single Core

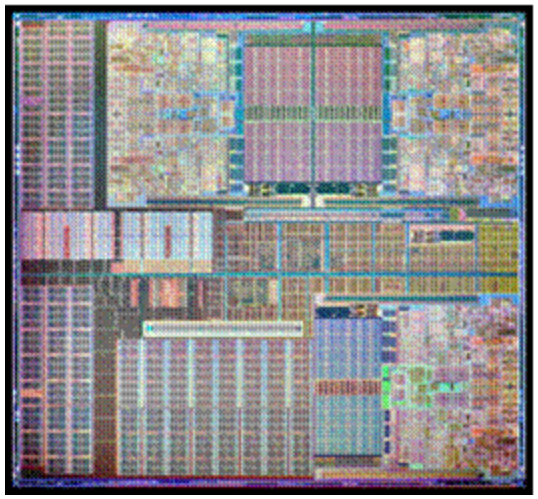


Dual Core

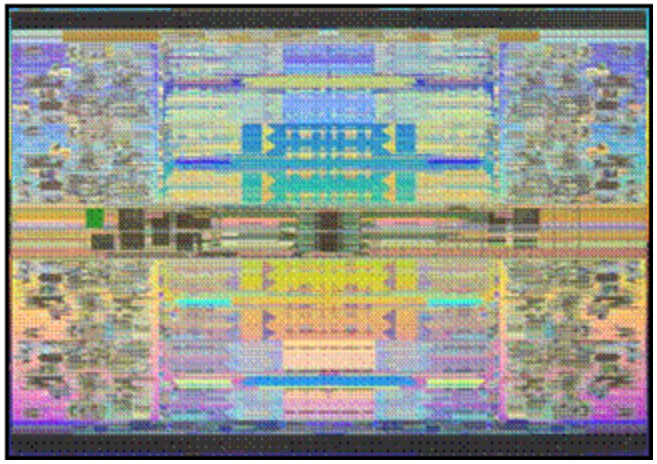


Quad Core





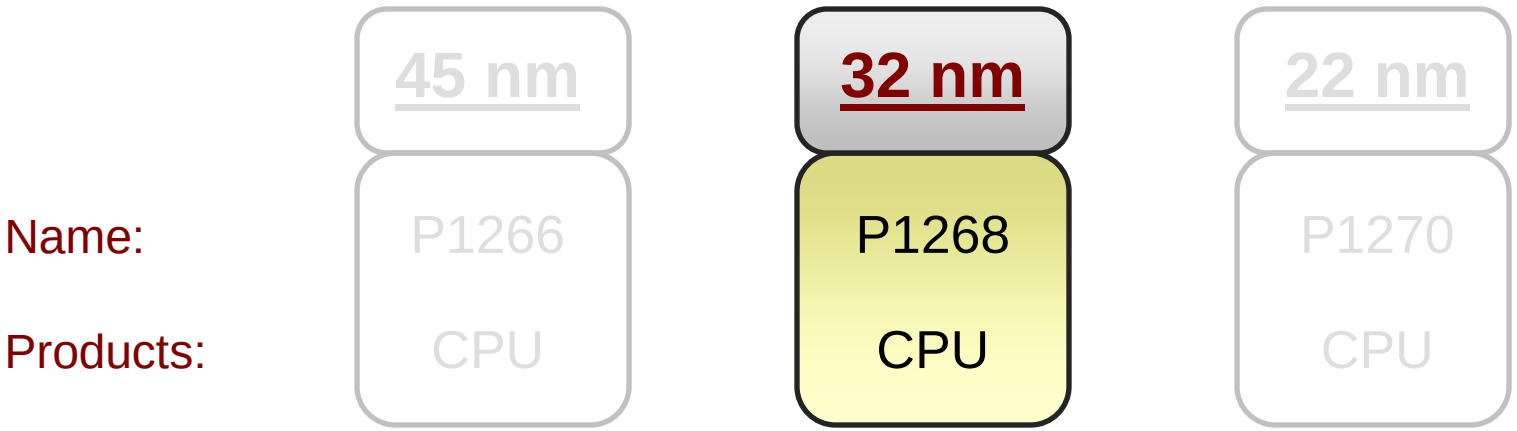
6 Core



8 Core

>200 million 45 nm CPUs shipped to date

Intel Logic Technology Roadmap



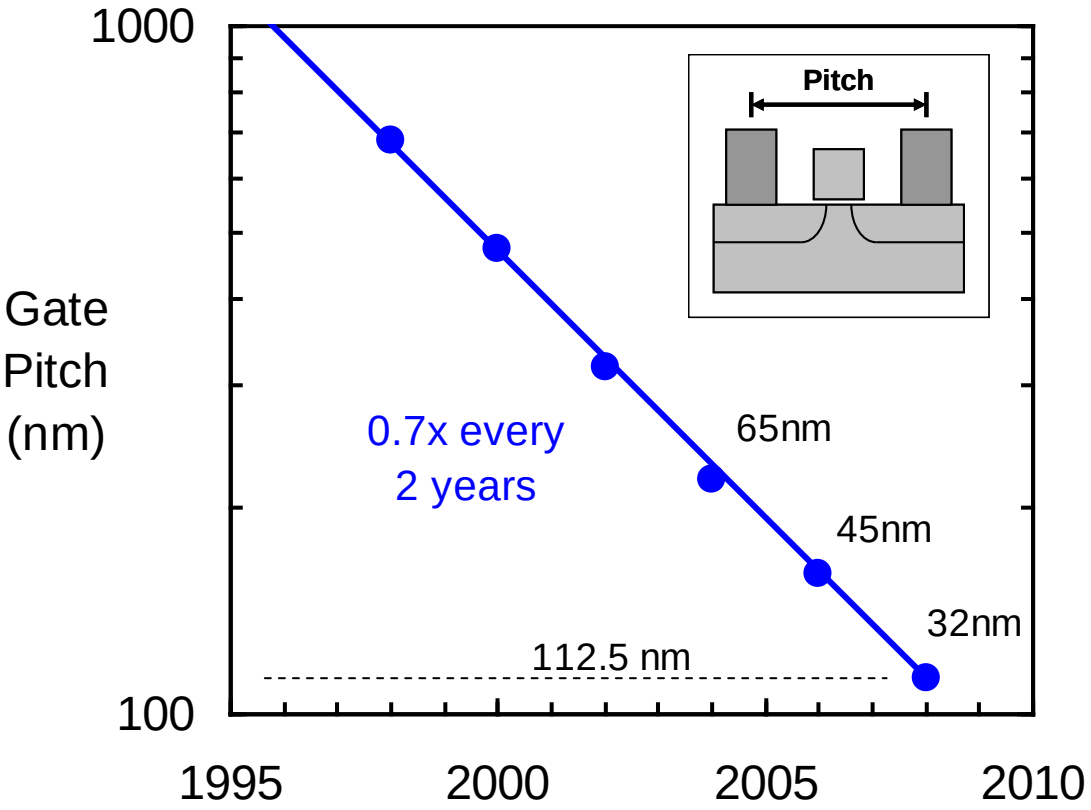
32 nm Technology Features

- 2nd generation high-k + metal gate transistors
- 9 copper + low-k interconnect layers
- Immersion lithography on critical layers
- ~0.7x minimum pitch scaling
- Pb-free and halogen-free packages

32 nm delivers the promise of Moore's Law:
Higher performing, lower power, and lower cost transistors

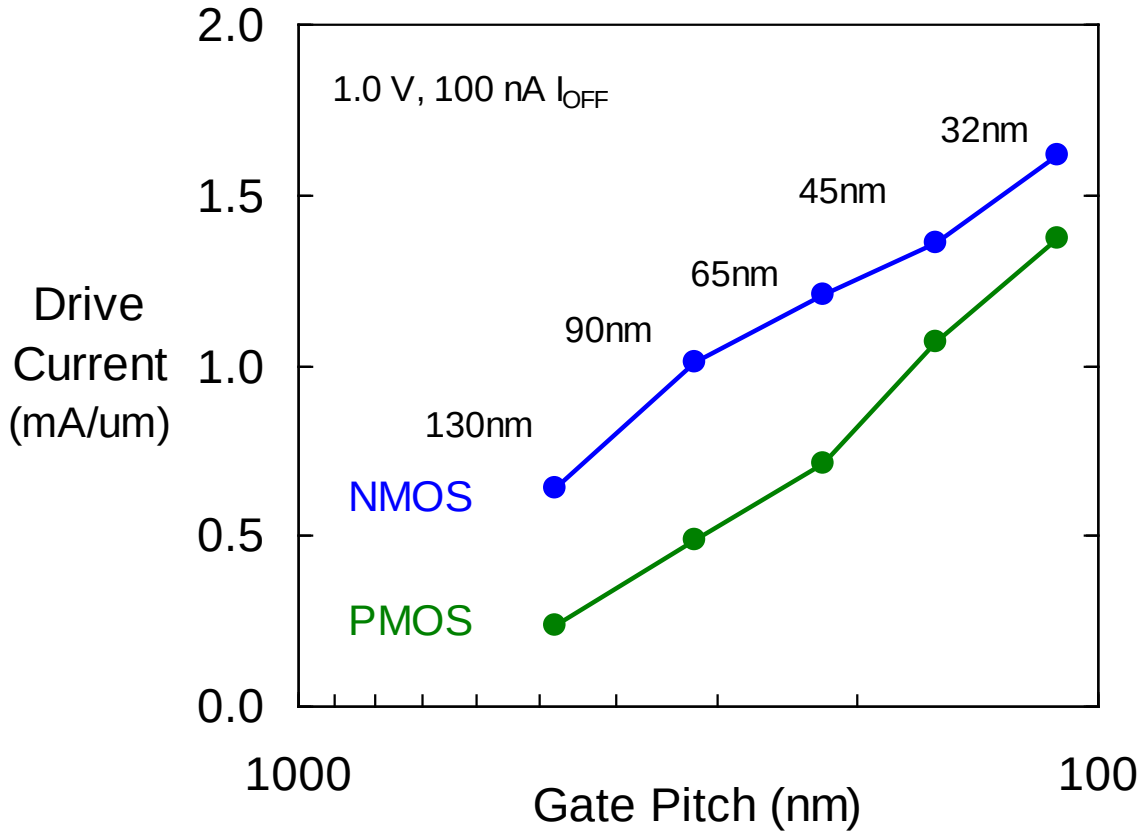
Lead is below 1000 PPM per EU RoHS directive (2002/95/EC, Annex A). Some EU RoHS exemptions for lead may apply to other components used in the product package. Applies only to halogenated flame retardants and PVC in components. Halogens are below 900 PPM bromine and 900 PPM chlorine.

Transistor Density



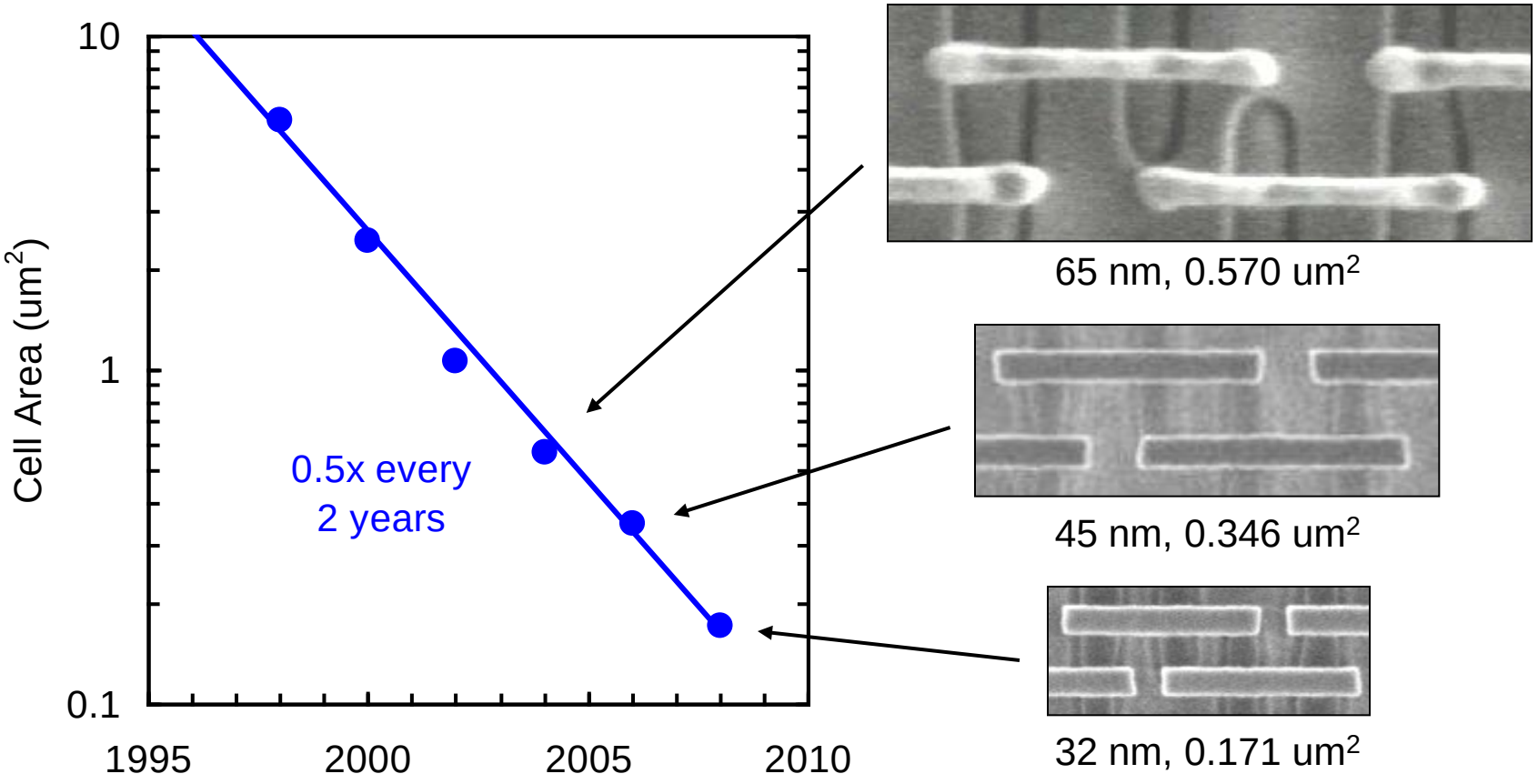
Intel 32 nm transistors provide the tightest gate pitch of any reported 32 nm or 28 nm technology

Transistor Performance



Intel 32 nm transistors provide the highest drive currents of any reported 32 nm or 28 nm technology

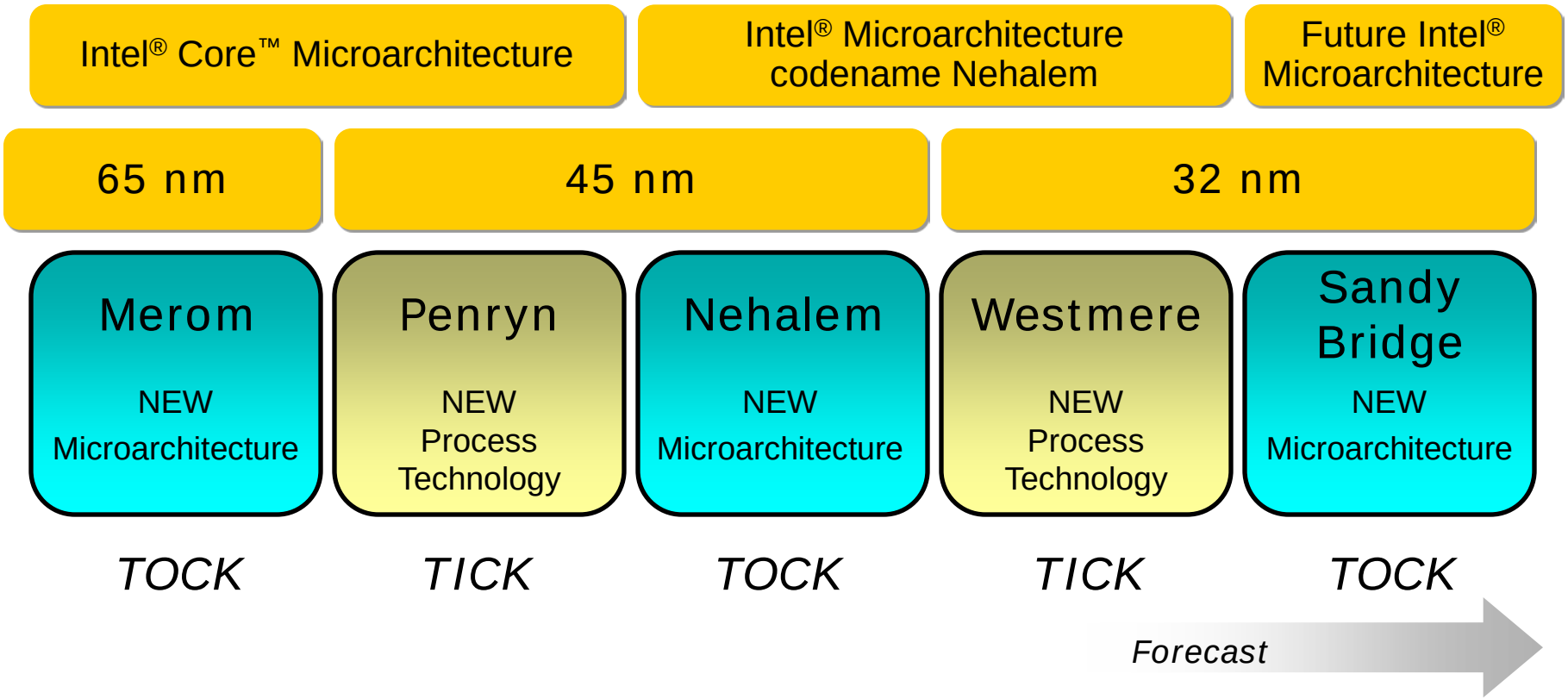
SRAM Cell Size Scaling



Transistor density continues to double every 2 years

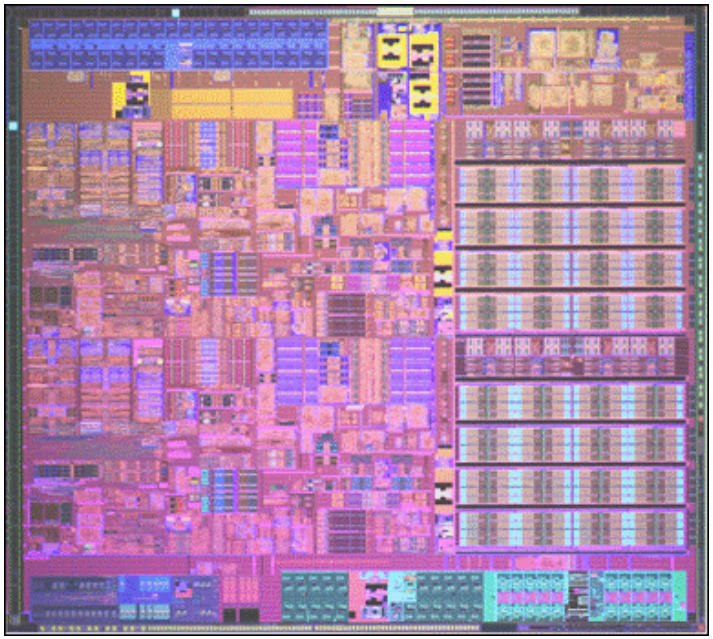
Tick-Tock Development Model

Sustained Microprocessor Leadership



Westmere, industry's first working 32 nm processor, demonstrated in January '09

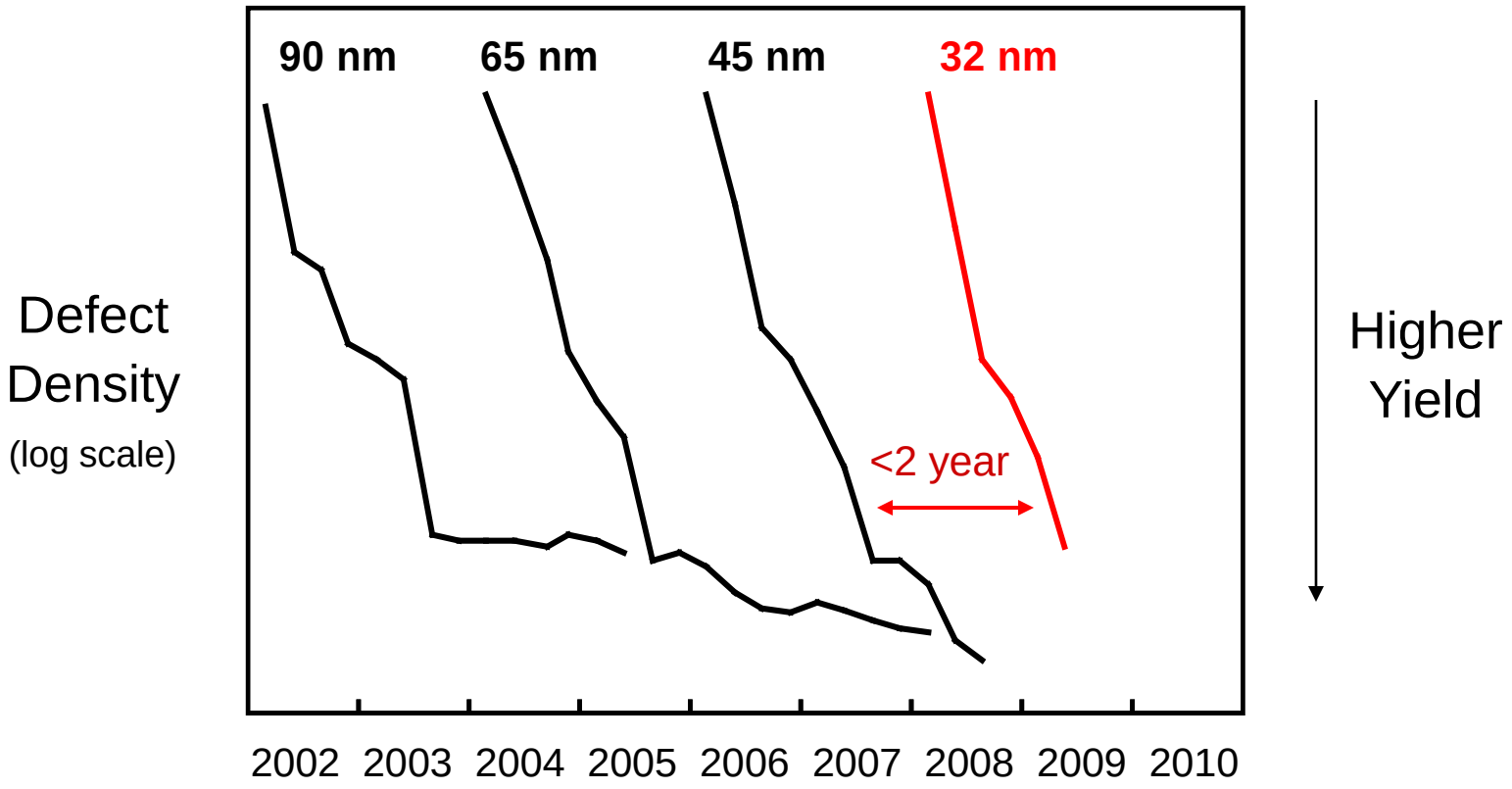
32 nm Westmere Microprocessor



Dual core Westmere

First in a family of 32 nm microprocessors based upon the Intel® microarchitecture codenamed Nehalem

32 nm Defect Density Trend



Intel's 32 nm process is certified and CPU wafers are moving through the factory in support of planned Q4 revenue production

32 nm Manufacturing Fabs

D1D Oregon - Now

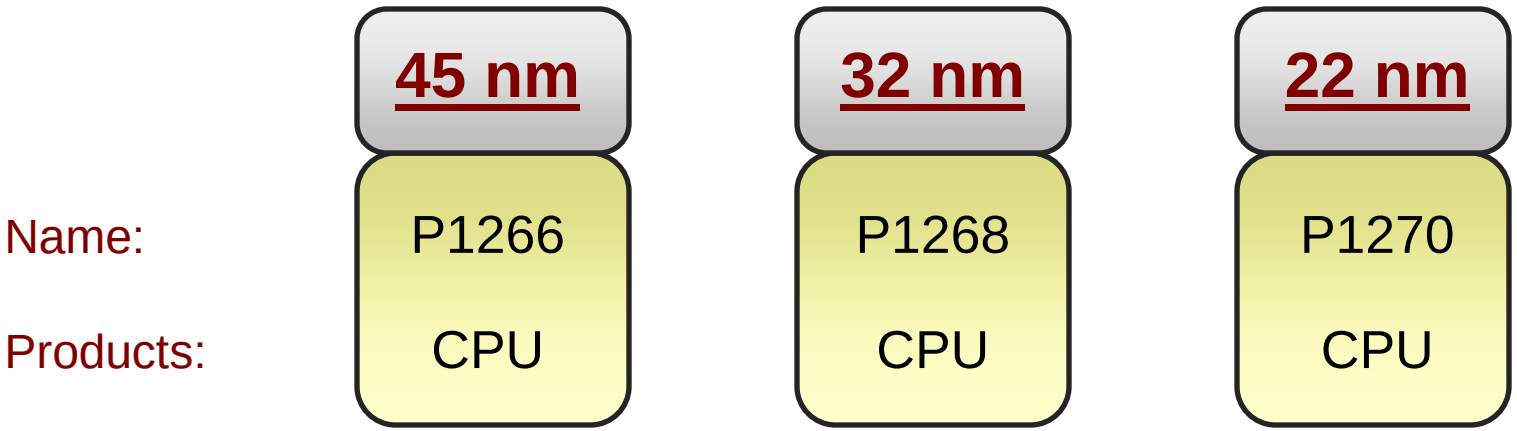
D1C Oregon - 4Q 2009

Fab 32 Arizona - 2010

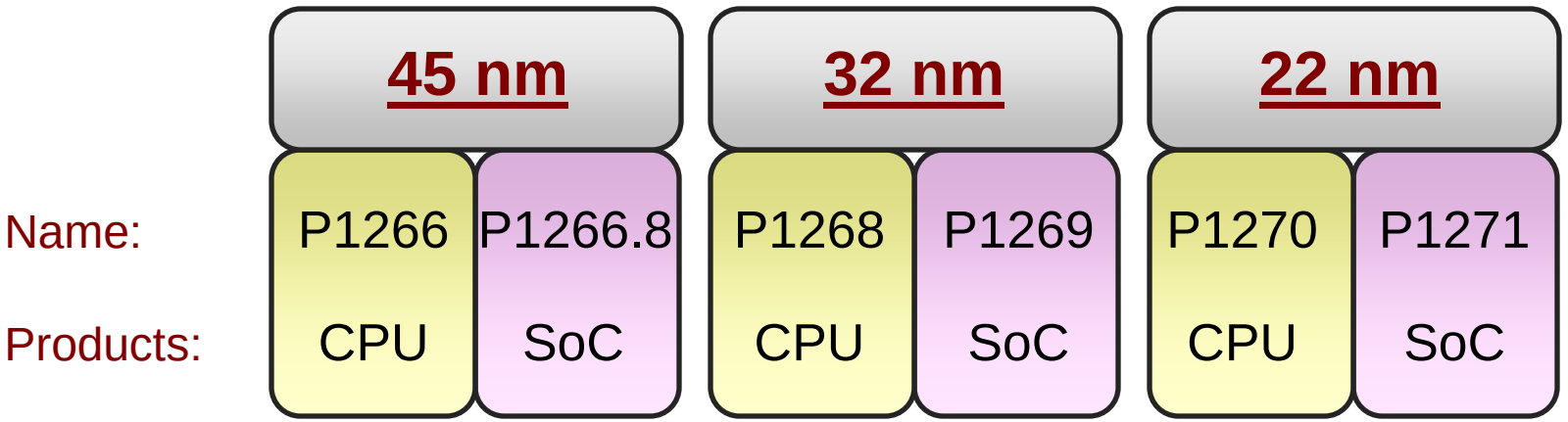
Fab 11X New Mexico - 2010

$7B invested in 32 nm manufacturing fabs

Intel Logic Technology Roadmap

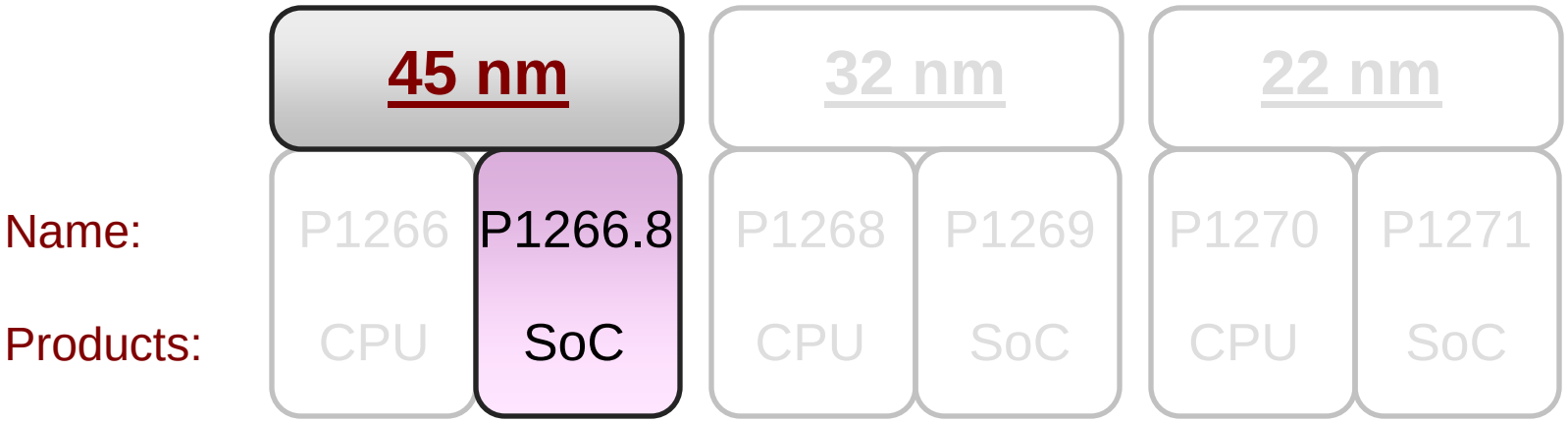


Intel Logic Technology Roadmap



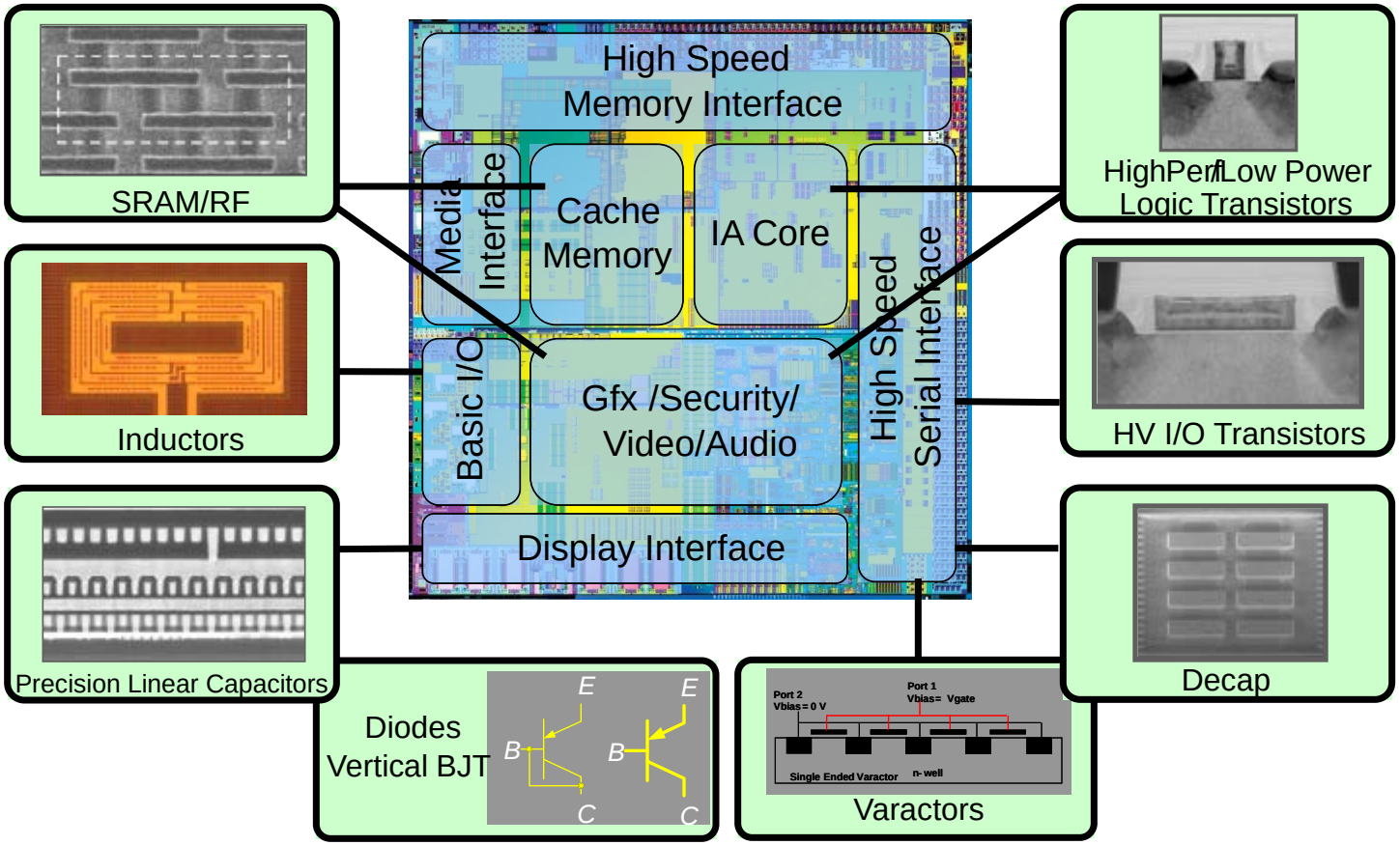
Intel is now developing both CPU and SoC versions of each technology generation

Intel Logic Technology Roadmap



Intel is now developing both CPU and SoC versions of each technology generation

System-on-Chip Building Blocks

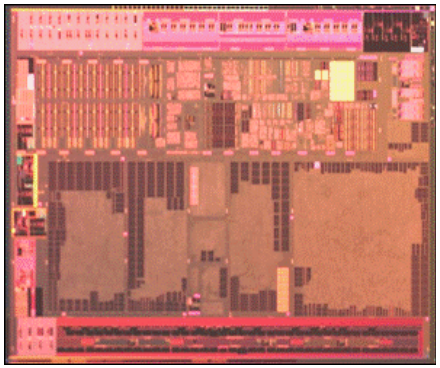


SoC products require a broader range of device types than mainstream CPU products

CPU vs. SoC Technology Comparison

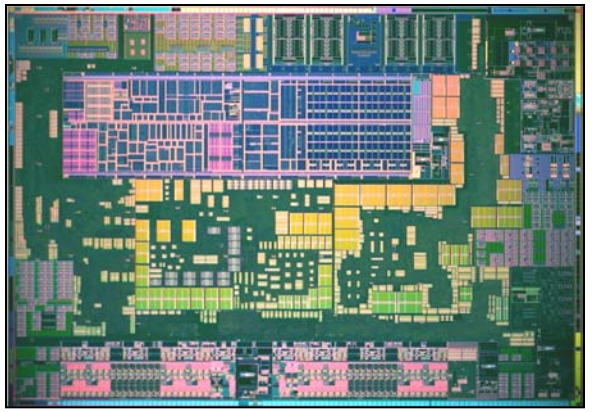
	CPU	SoC
Similarities		
High-k + Metal Gate	Same	Same
Tight Transistor Pitch	Same	Same
Dense SRAM Cell	Same	Same
Lower Level Interconnects	Same	Same
Fab Process Equipment	Same	Same
Pb-Free Packages	Same	Same
Differences		
Logic Transistors	High Speed	Low Leakage
I/O Transistors	Std Voltage	Std-High Voltage
Upper Level Interconnects	High Speed	Dense
Precision Passives	None	R, C and L

45 nm SoC Products



Lincroft

Mobile Internet Devices

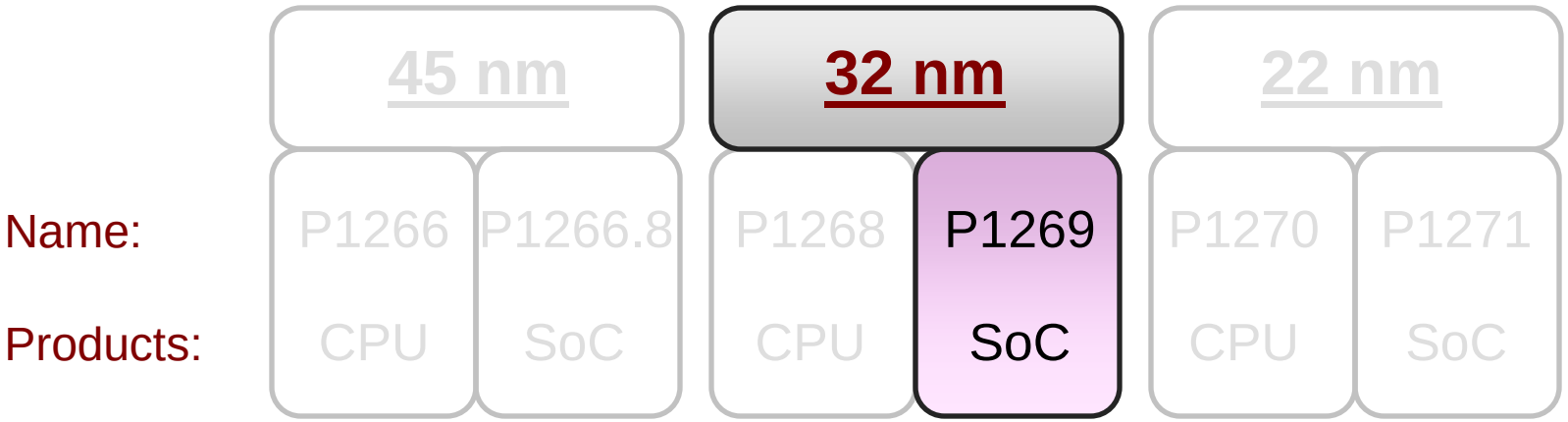


Sodaville

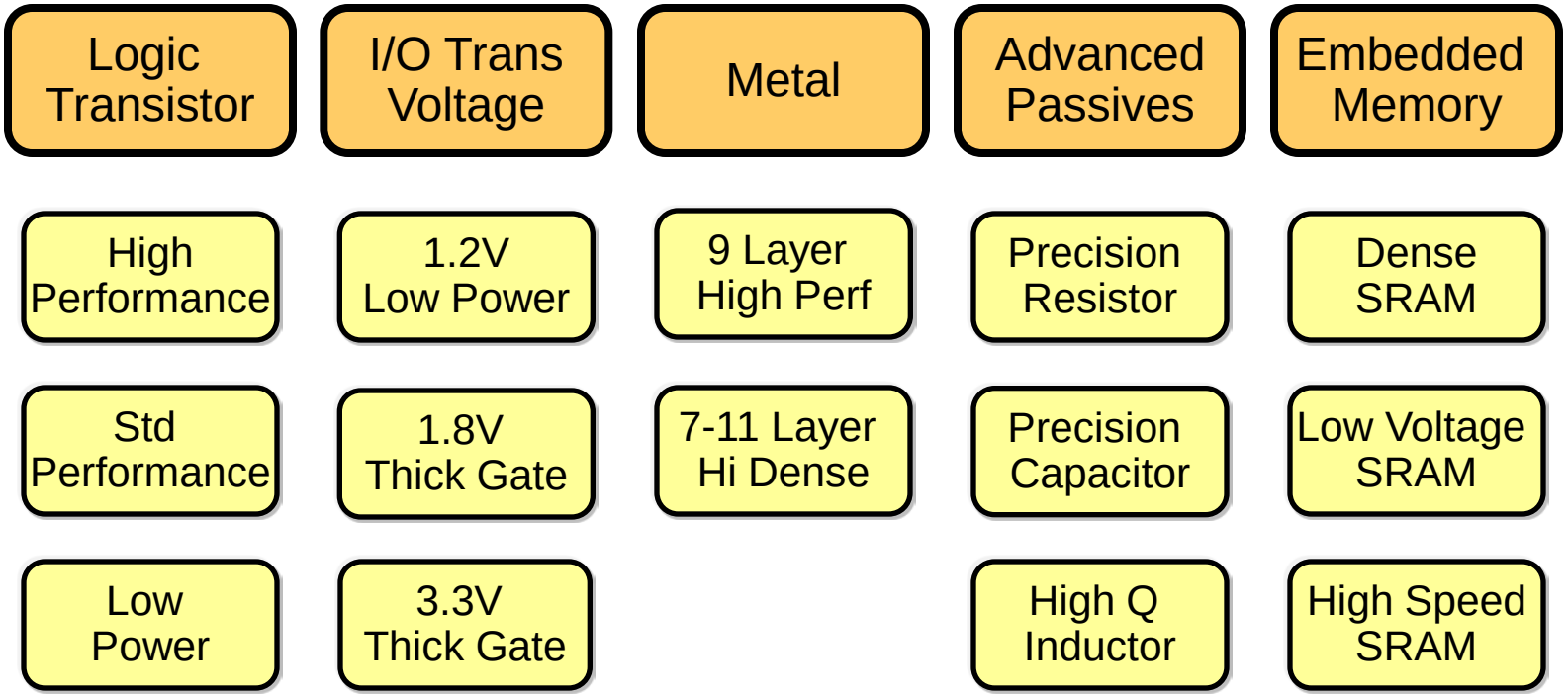
Set Top Boxes

Initial 45 nm Intel® Atom™ processor based SoC products

Intel Logic Technology Roadmap

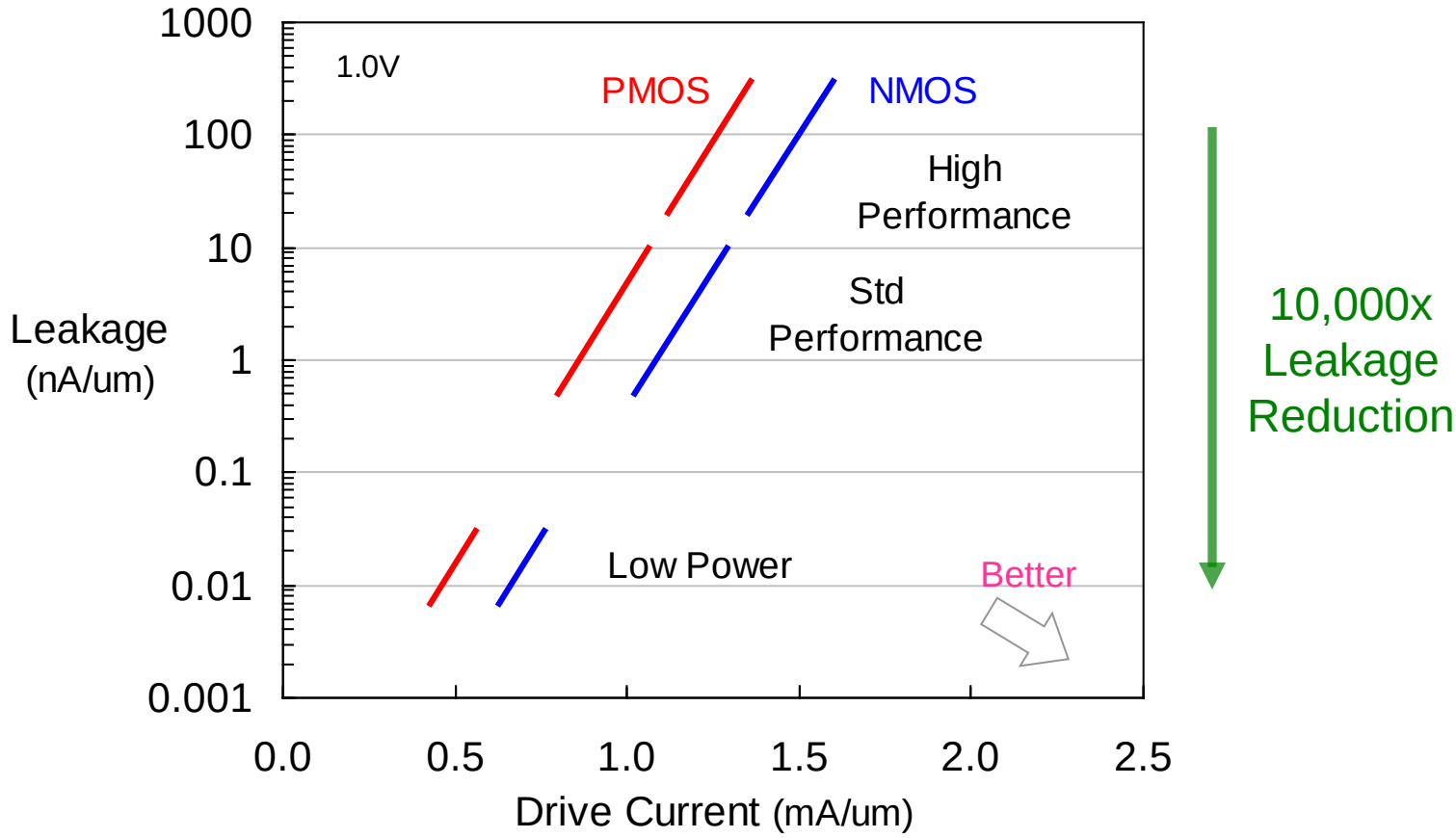


32 nm SoC Technology Feature Menu



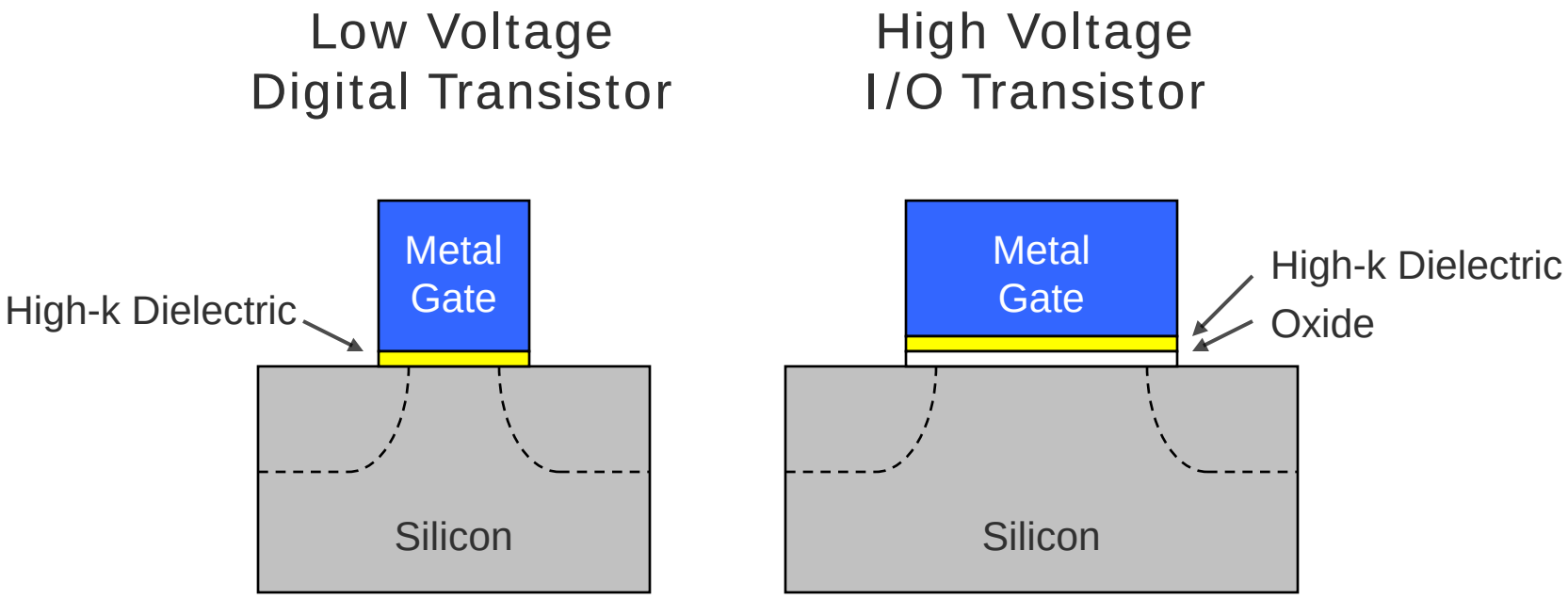
32 nm SoC process offers a rich mix-and-match feature set

Transistor Performance vs. Leakage



High-k + metal gate transistors provide Intel an advantage for both high performance and low leakage

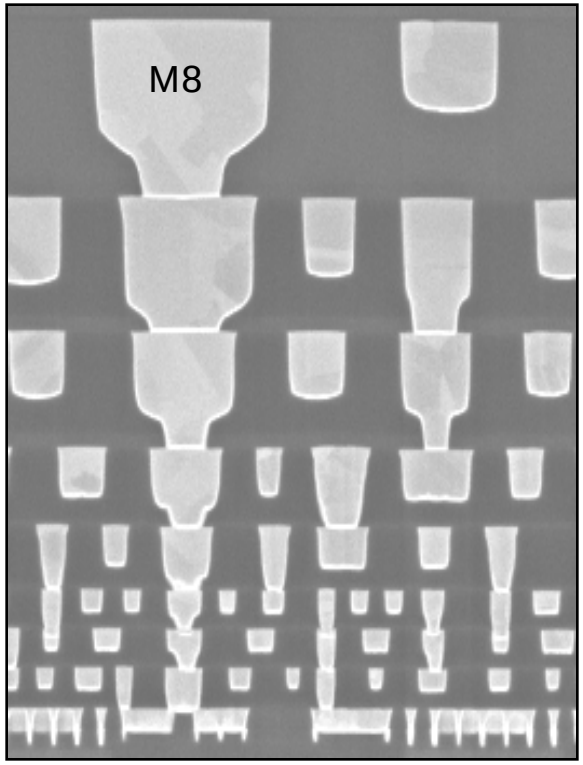
High Voltage I/O Transistors



Dual gate oxide process enables low voltage and high voltage transistors together on the same chip

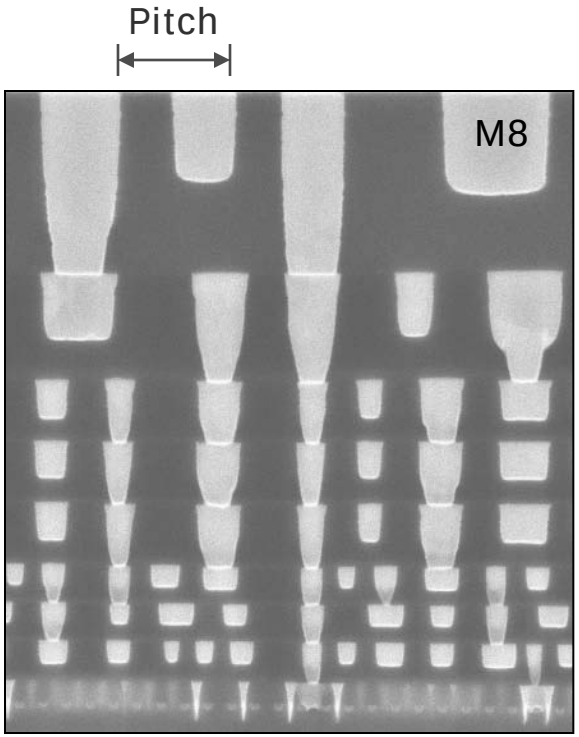
CPU vs. SoC Interconnects

CPU



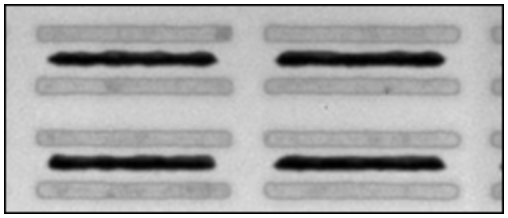
Pitch	Layer	Pitch
566.5	M8	450.1
450.1	M7	337.6
337.6	M6	168.8
225.0	M5	168.8
168.8	M4	112.5
112.5	M3	112.5
112.5	M2	112.5
112.5	M1	112.5
(nm)		(nm)

SoC

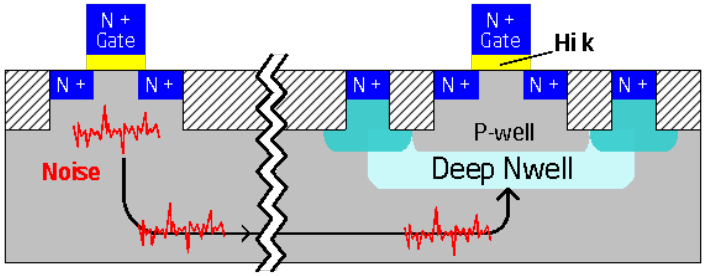


Interconnect system optimized for high performance CPUs vs. low power SoCs

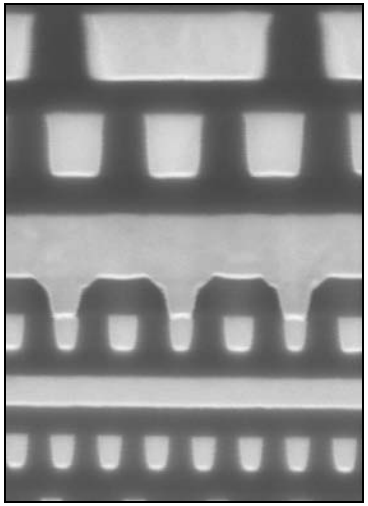
Passives Device Elements



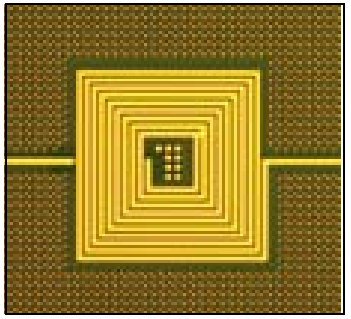
Linear Resistors

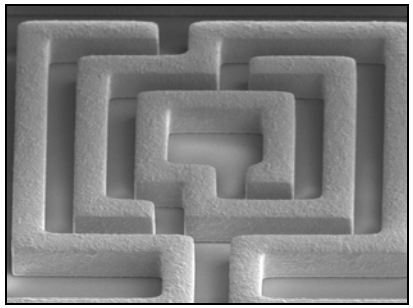


Noise Isolation



Finger Capacitors

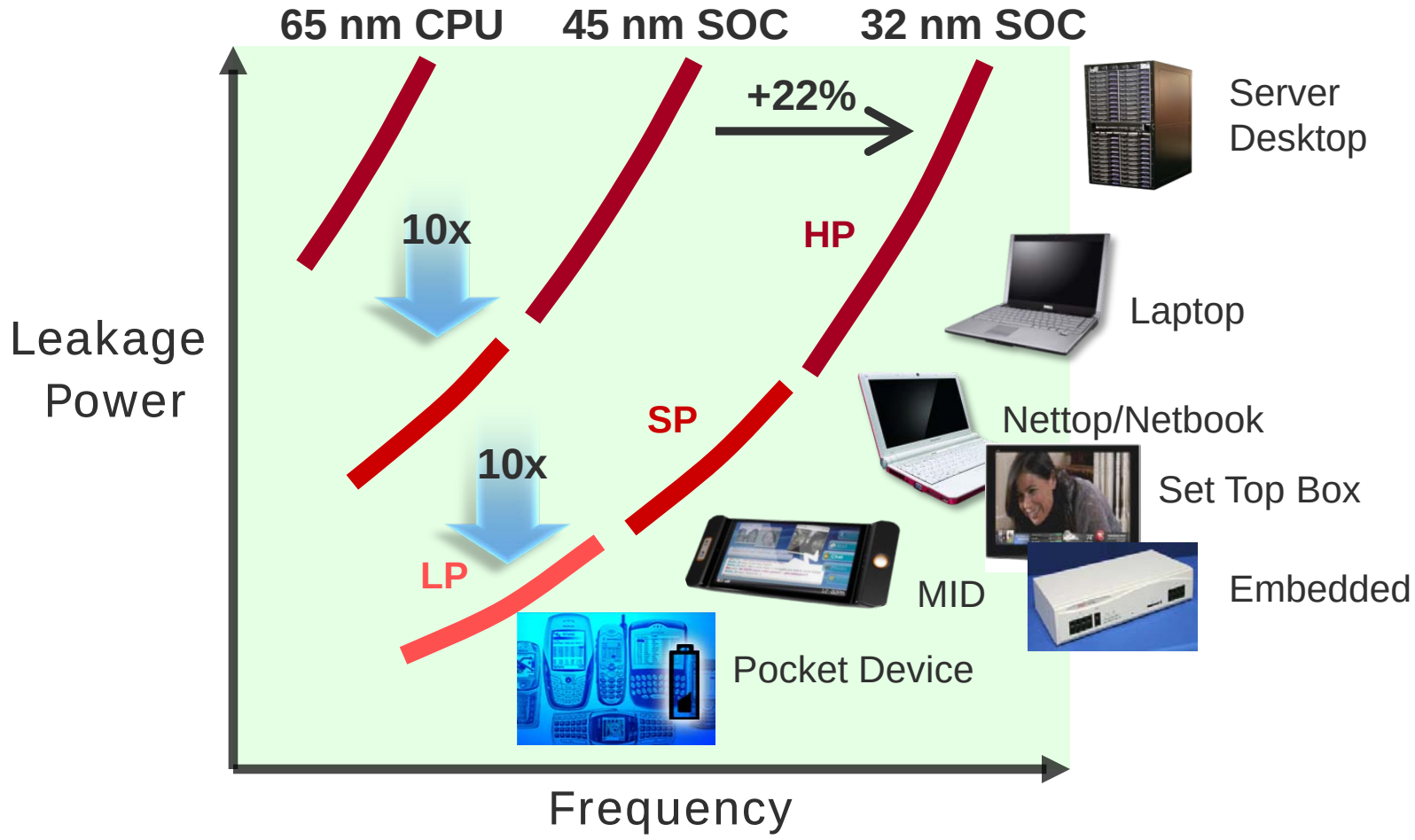




High-Q Inductors

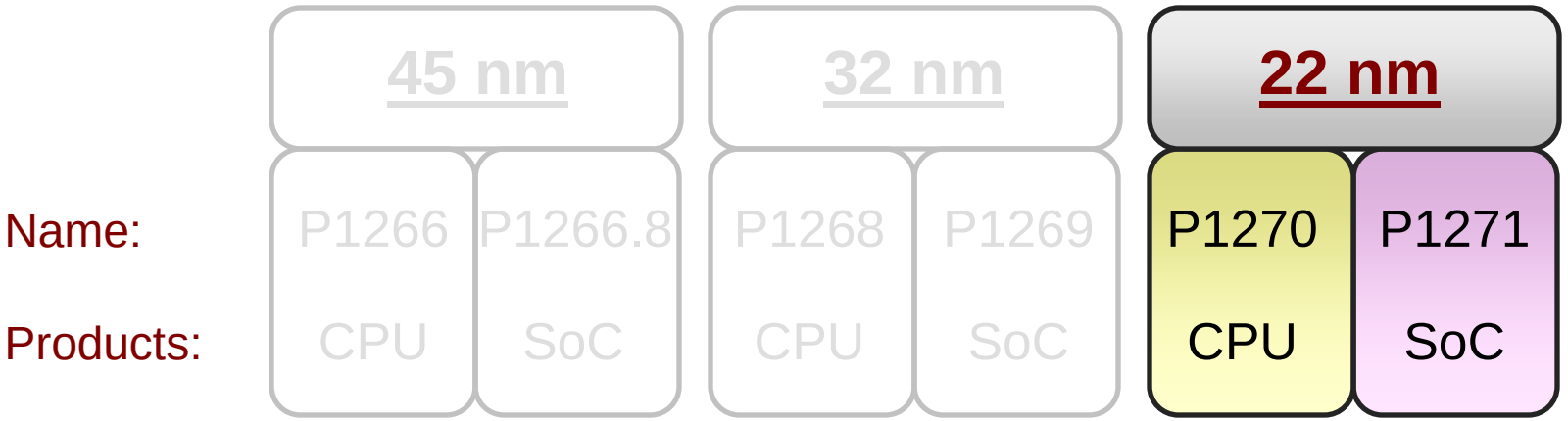
Precision passive devices and other on-chip features added to enable analog-digital mixed signal and radio frequency circuits

Performance vs. Power Landscape



32 nm SoC covers a broad performance/power landscape

Intel Logic Technology Roadmap

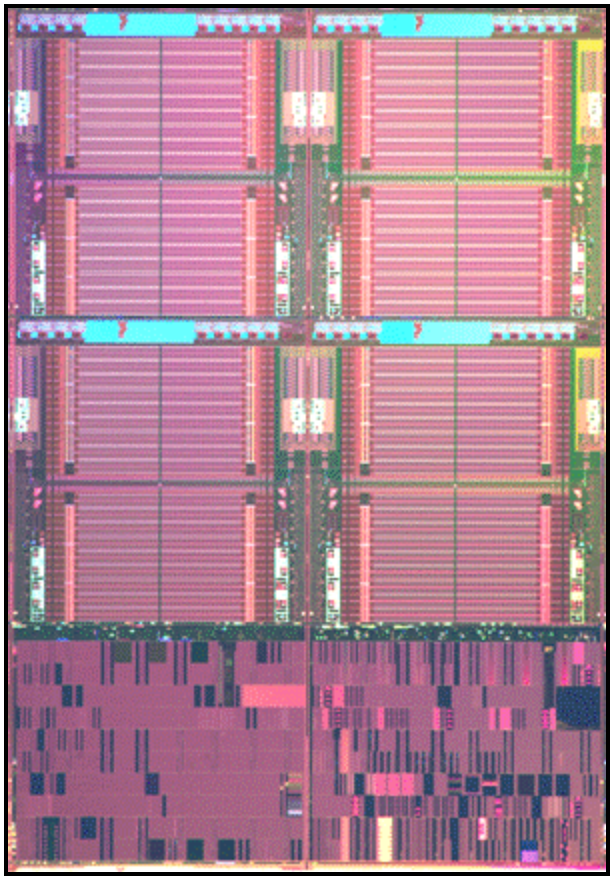


22 nm Shuttle Test Chip

SRAM, Logic, Mixed-Signal
Test Circuits

SRAM, Logic, Mixed-Signal
Test Circuits

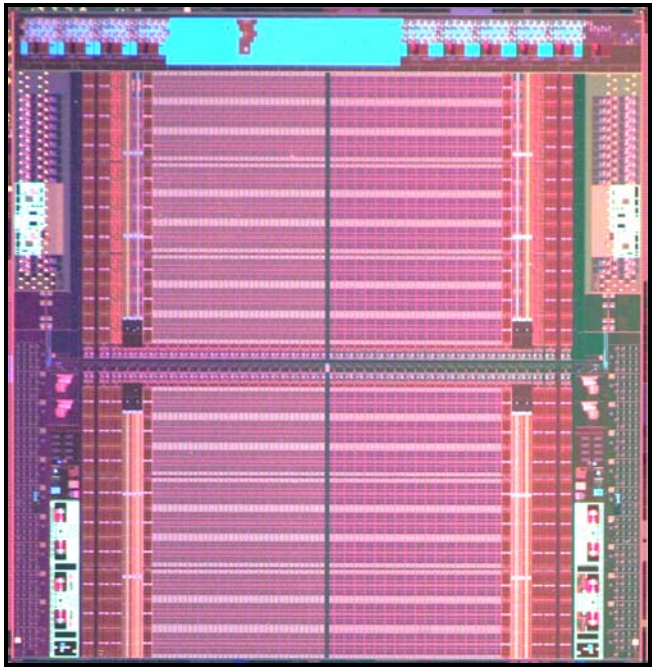
Discrete
Test Structures



Intel is first in the industry to demonstrate working 22 nm circuits

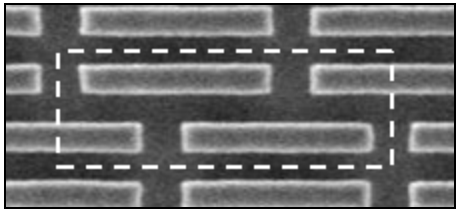
22 nm SRAM Test Chip

- 364 Mbit array size
- >2.9 billion transistors
- 3rd generation high-k + metal gate transistors
- Same transistor and interconnect features as on 22 nm CPUs

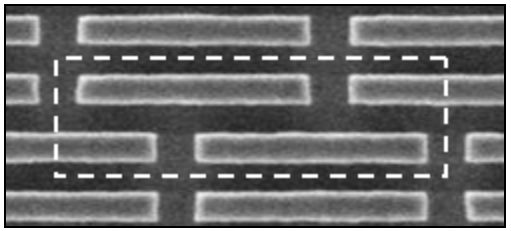


Demonstrating working 22 nm SRAMs is an important milestone towards building working 22 nm microprocessors

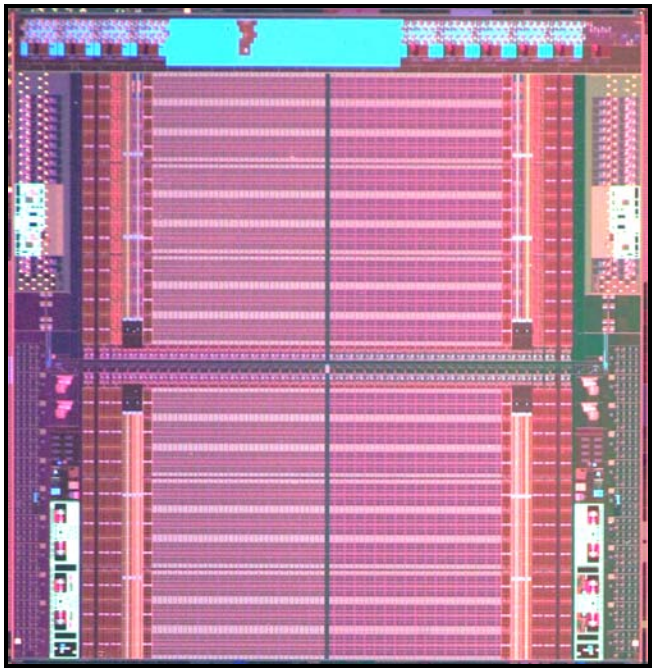
22 nm SRAM Test Chip



0.092 um^2 SRAM cell
for high density applications



0.108 um^2 SRAM cell
for low voltage applications

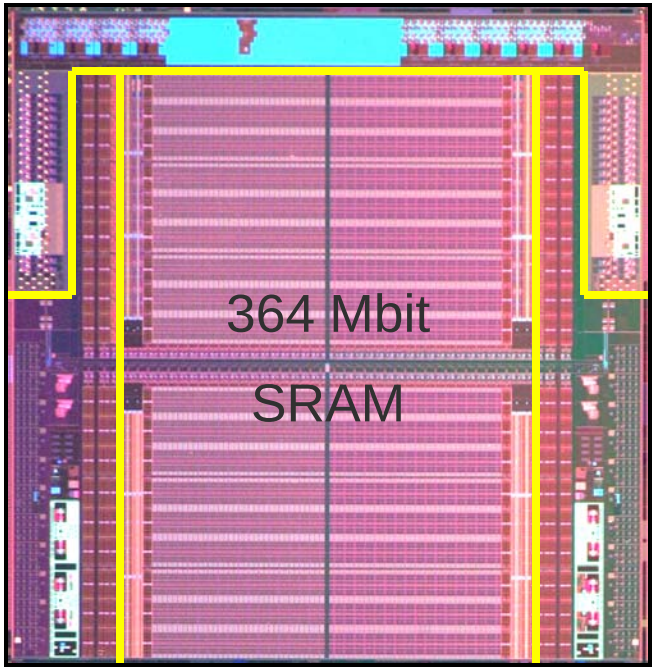


0.092 um^2 is the smallest SRAM cell in working circuits reported to date

22 nm SRAM Test Chip

I/O Circuits

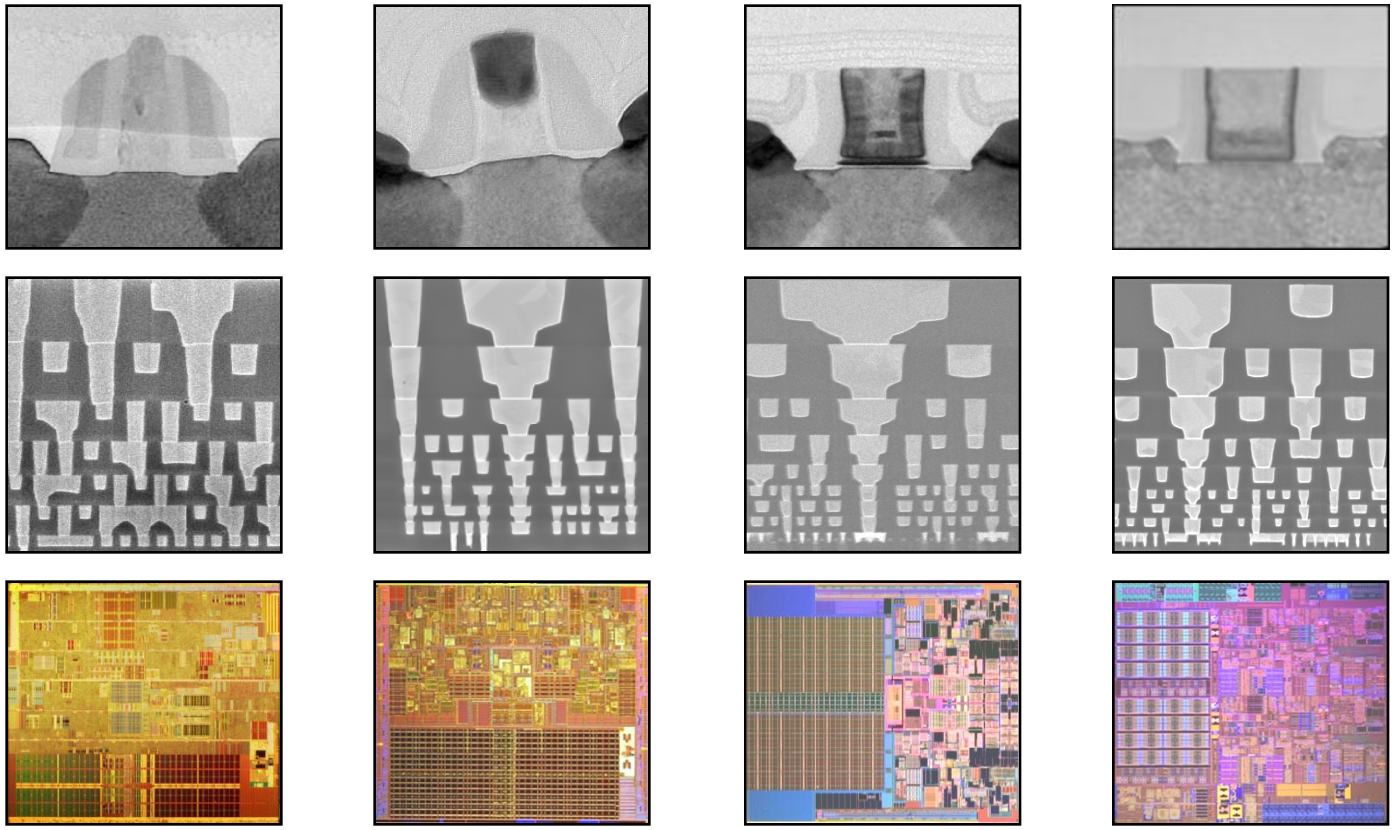
Register File and
Mixed-Signal Circuits



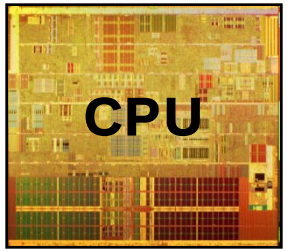
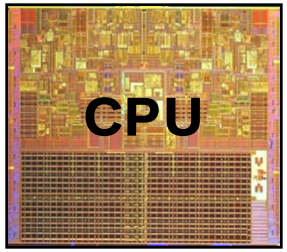
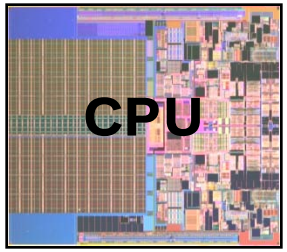
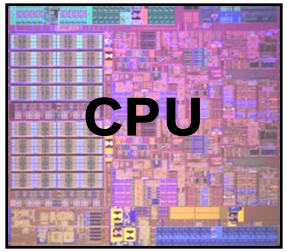
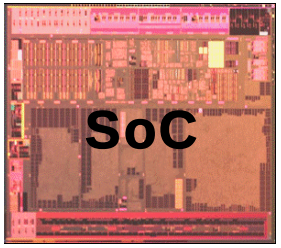
Test chip includes logic and mixed-signal circuits to be used on 22 nm microprocessors

On-Time 2 Year Cycles

90 nm	65 nm	45 nm	32 nm
2003	2005	2007	2009



CPU and SoC Product Lines

90 nm	65 nm	45 nm	32 nm	22 nm
				CPU
			SoC	SoC

CPU and SoC process versions will support separate product lines at each generation

Summary

- Intel leads the industry in introducing new technology generations every 2 years
  - 32 nm process is certified and has started production
  - Intel is first to demonstrate working 22 nm circuits
- Intel has added process features to our advanced logic technologies to enable low power System-on-Chip products
  - High-k + metal gate transistors provide a wide range of high performance to low leakage capabilities
  - 45 nm HK+MG SoC products are entering the market
  - 32 nm HK+MG SoC technology provides industry-leading process features for next-generation SoC products
- Intel process technologies continue to deliver the promise of Moore's Law: higher performing, lower power, and lower cost transistors

Additional Information

Intel will be presenting two papers on our 32 nm technology at the International Electron Devices Meeting in Baltimore, MD on Dec 7-9, 2009:

- C. Jan, “A 32nm SoC Platform Technology with 2nd Generation High-k/Metal Gate Transistors Optimized for Ultra Low Power, High Performance, and High Density Product Applications”
- P. Packan, “High Performance 32nm Logic Technology Featuring 2nd Generation High-k + Metal Gate Transistors”

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- Nehalem, Lincroft, Pineview, Sandy Bridge, Westmere, Merom, Penryn, and other code names featured are used internally within Intel to identify products that are in development and not yet publicly announced for release. Customers, licensees and other third parties are not authorized by Intel to use code names in advertising, promotion or marketing of any product or services and any such use of Intel's internal code names is at the sole risk of the user
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Risk Factors

The above statements and any others in this document that refer to plans and expectations for the third quarter, the year and the future are forward-looking statements that involve a number of risks and uncertainties. Many factors could affect Intel's actual results, and variances from Intel's current expectations regarding such factors could cause actual results to differ materially from those expressed in these forward-looking statements. Intel presently considers the following to be the important factors that could cause actual results to differ materially from the corporation's expectations. Ongoing uncertainty in global economic conditions pose a risk to the overall economy as consumers and businesses may defer purchases in response to tighter credit and negative financial news, which could negatively affect product demand and other related matters. Consequently, demand could be different from Intel's expectations due to factors including changes in business and economic conditions, including conditions in the credit market that could affect consumer confidence; customer acceptance of Intel's and competitors' products; changes in customer order patterns including order cancellations; and changes in the level of inventory at customers. Intel operates in intensely competitive industries that are characterized by a high percentage of costs that are fixed or difficult to reduce in the short term and product demand that is highly variable and difficult to forecast. Additionally, Intel is in the process of transitioning to its next generation of products on 32nm process technology, and there could be execution issues associated with these changes, including product defects and errata along with lower than anticipated manufacturing yields. Revenue and the gross margin percentage are affected by the timing of new Intel product introductions and the demand for and market acceptance of Intel's products; actions taken by Intel's competitors, including product offerings and introductions, marketing programs and pricing pressures and Intel's response to such actions; and Intel's ability to respond quickly to technological developments and to incorporate new features into its products. The gross margin percentage could vary significantly from expectations based on changes in revenue levels; capacity utilization; start-up costs, including costs associated with the new 32nm process technology; variations in inventory valuation, including variations related to the timing of qualifying products for sale; excess or obsolete inventory; product mix and pricing; manufacturing yields; changes in unit costs; impairments of long-lived assets, including manufacturing, assembly/test and intangible assets; and the timing and execution of the manufacturing ramp and associated costs. Expenses, particularly certain marketing and compensation expenses, as well as restructuring and asset impairment charges, vary depending on the level of demand for Intel's products and the level of revenue and profits. The current financial stress affecting the banking system and financial markets and the going concern threats to investment banks and other financial institutions have resulted in a tightening in the credit markets, a reduced level of liquidity in many financial markets, and heightened volatility in fixed income, credit and equity markets. There could be a number of follow-on effects from the credit crisis on Intel's business, including insolvency of key suppliers resulting in product delays; inability of customers to obtain credit to finance purchases of our products and/or customer insolvencies; counterparty failures negatively impacting our treasury operations; increased expense or inability to obtain short-term financing of Intel's operations from the issuance of commercial paper; and increased impairments from the inability of investee companies to obtain financing. The majority of our non-marketable equity investment portfolio balance is concentrated in companies in the flash memory market segment, and declines in this market segment or changes in management's plans with respect to our investments in this market segment could result in significant impairment charges, impacting restructuring charges as well as gains/losses on equity investments and interest and other. Intel's results could be impacted by adverse economic, social, political and physical/infrastructure conditions in countries where Intel, its customers or its suppliers operate, including military conflict and other security risks, natural disasters, infrastructure disruptions, health concerns and fluctuations in currency exchange rates. Intel's results could be affected by adverse effects associated with product defects and errata (deviations from published specifications), and by litigation or regulatory matters involving intellectual property, stockholder, consumer, antitrust and other issues, such as the litigation and regulatory matters described in Intel's SEC reports. A detailed discussion of these and other risk factors that could affect Intel's results is included in Intel's SEC filings, including the report on Form 10-Q for the quarter ended June 27, 2009.