
40 YEARS
OF CHANGING
THE WORLD
Intel Developer
FORUM

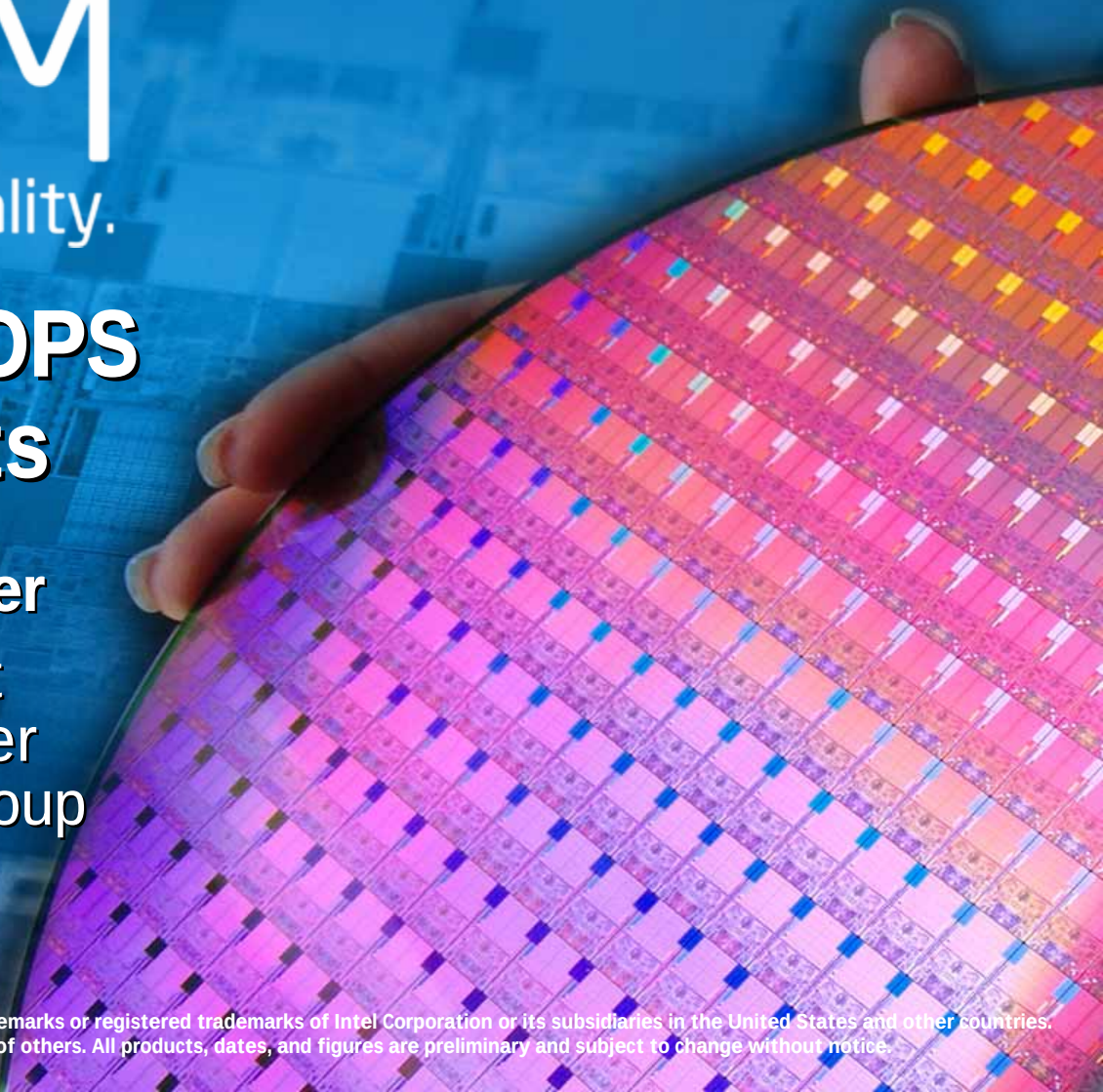
Intel Developer FORUM

Invent the new reality.

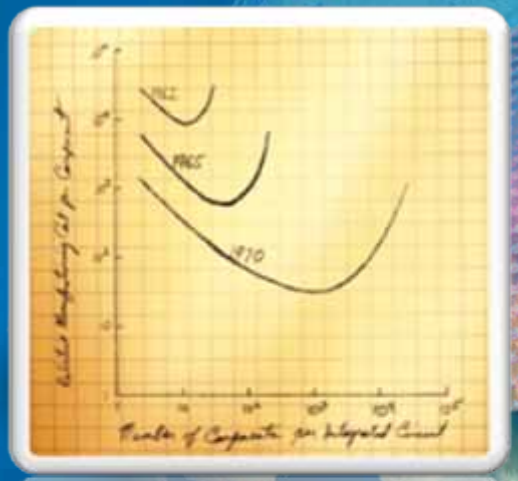
From Peta FLOPS to Milli Watts

Patrick P. Gelsinger

Sr. Vice President
Co-General Manager
Digital Enterprise Group



Intel Architecture

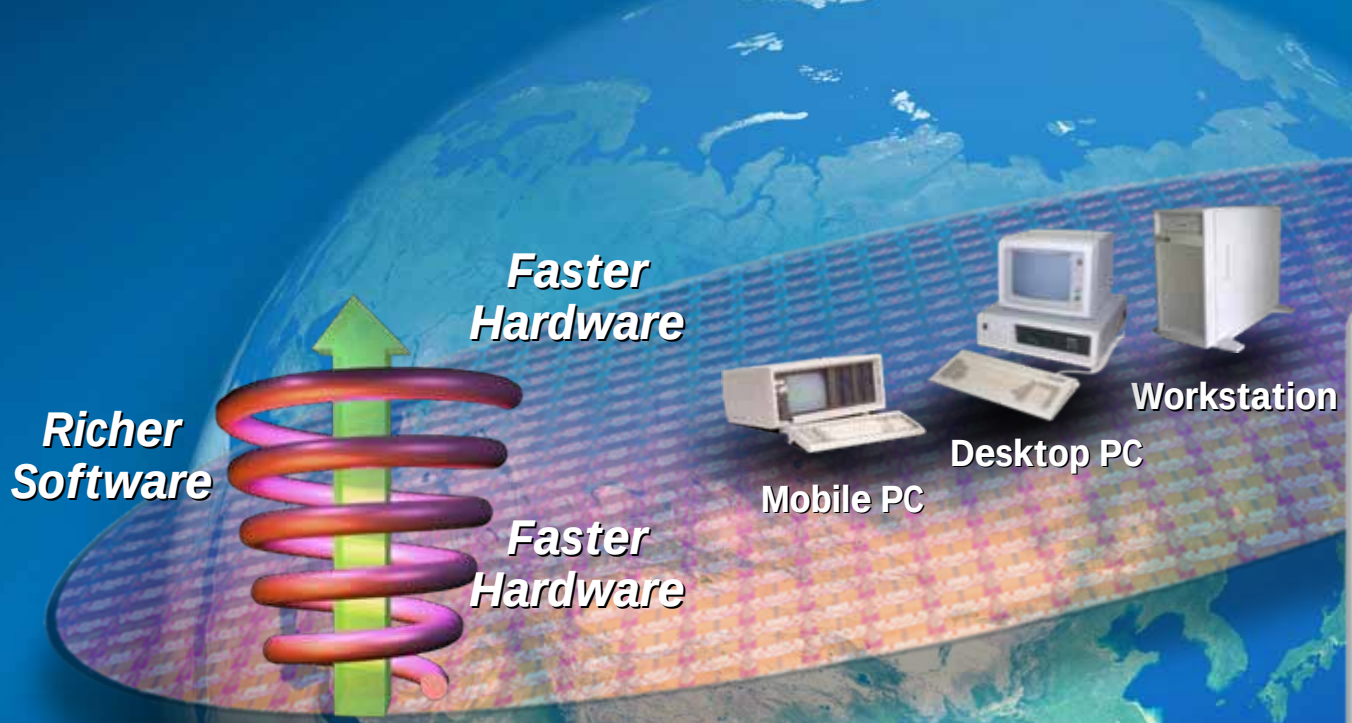


Desktop PC

Moore's Law

"The number of transistors per sq. in of IC doubles about every year." circa 1965

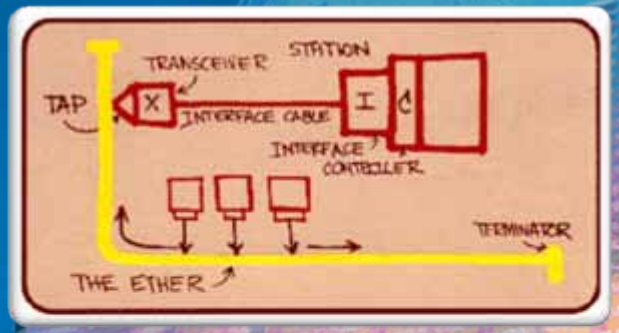
Intel Architecture

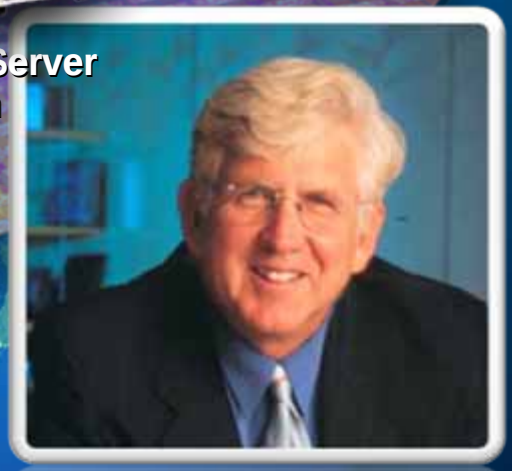


Dr. Andy Grove

"Software spiral is the dynamics of this industry where software evolves to take advantage of the hardware capabilities and hardware rises to the occasion, and this cycle repeats"

Intel Architecture





Metcalfe's Law

"The systemic value of compatibly communicating devices grows as the square of their number"

Intel Architecture

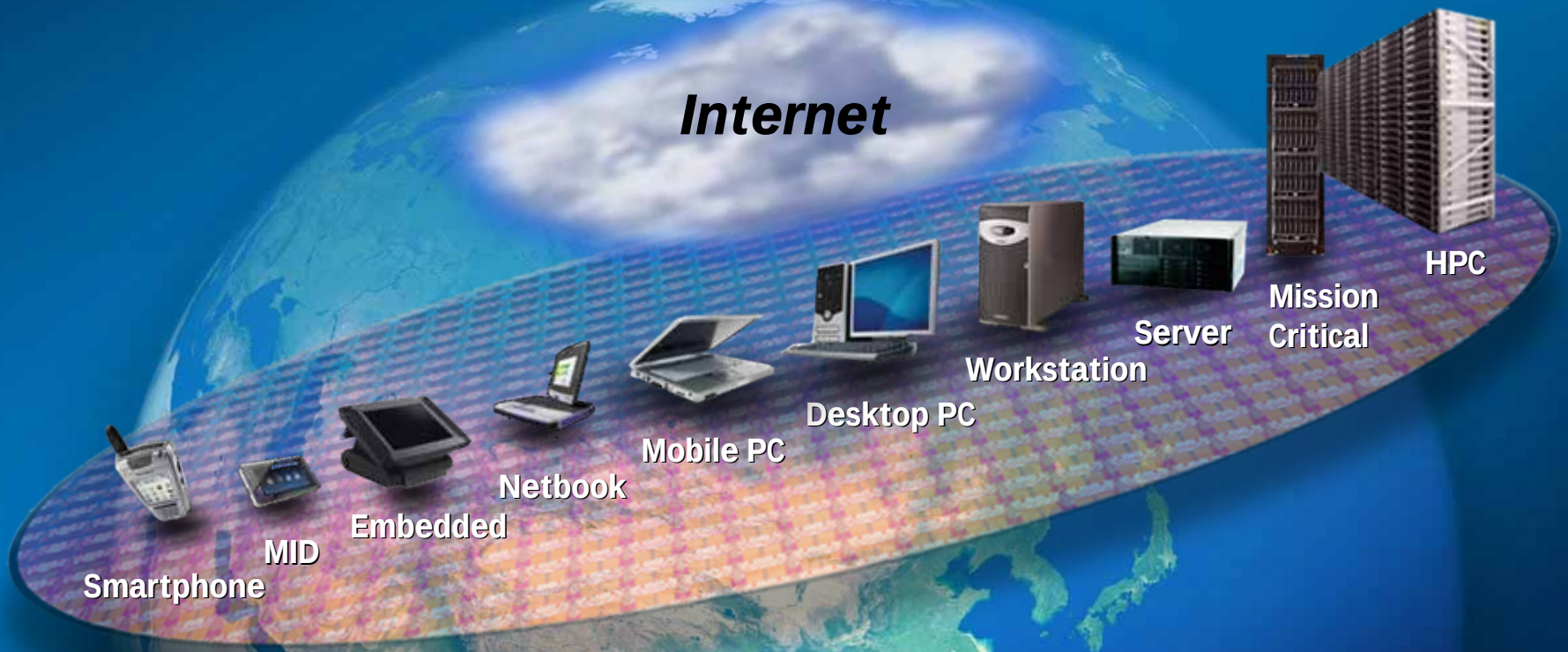
Internet

Smartphone
MID
Embedded
Netbook
Mobile PC
Desktop PC
Workstation
Server
Mission Critical
HPC

Reed's Law

"The number of possible sub-groups of network participants is 2^n-n-1"

Intel Architecture



Intel Architecture Value

$$= f \left\{ \begin{array}{c} \text{Moore's Law,} \\ \text{Grove's SW Spiral,} \\ \text{Metcalfe's Law,} \\ \text{Reed's Law} \end{array} \right\}$$

Intel Architecture

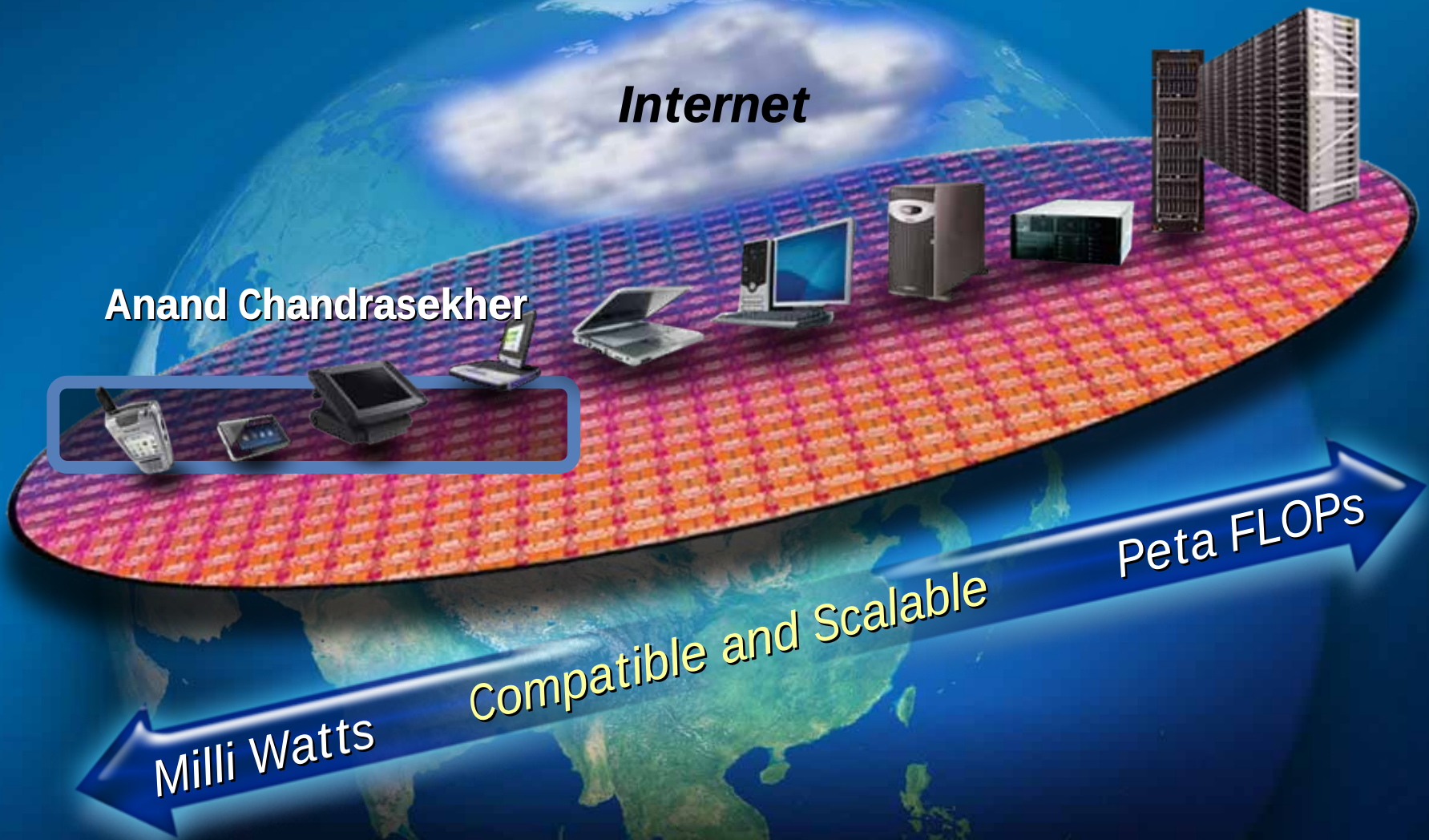
Intel Architecture

Milli Watts — Compatible and Scalable — Peta FLOPs

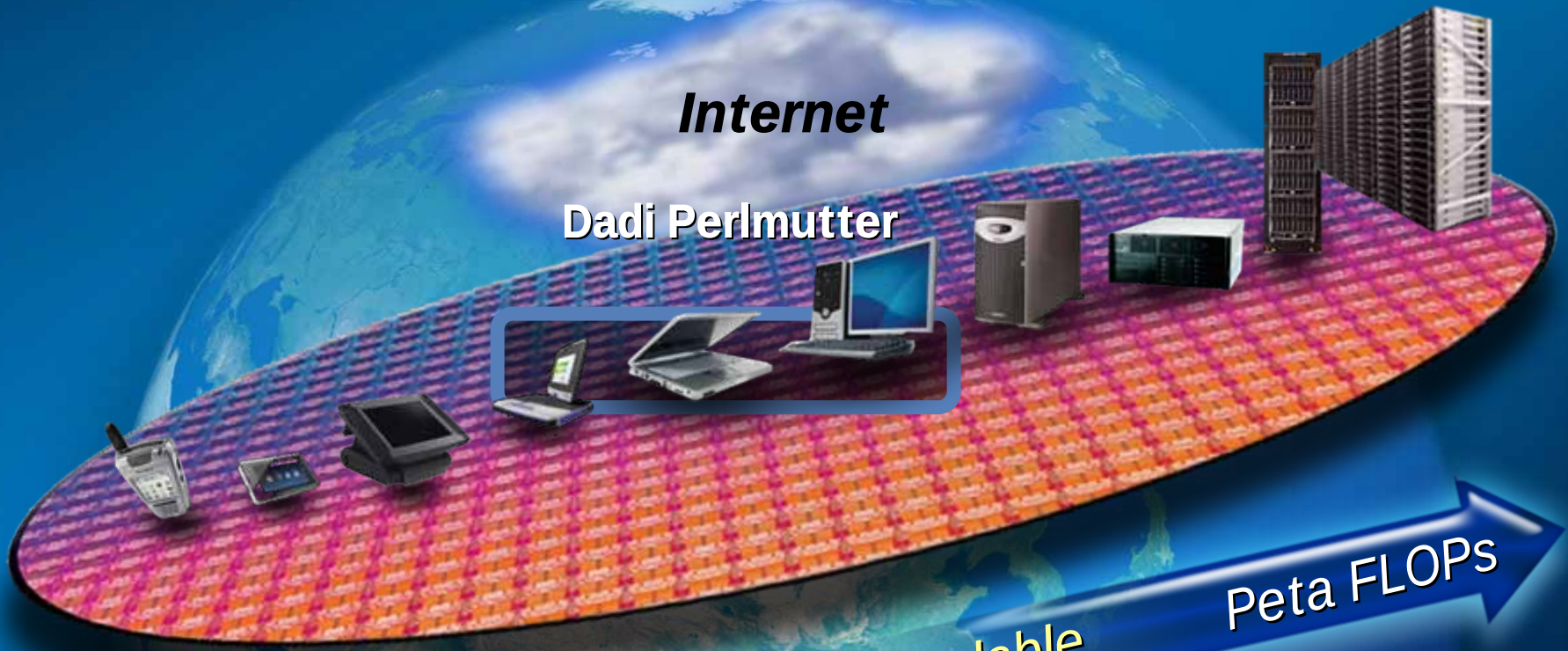
Intel: The Architecture for Life

Milli Watts — Compatible and Scalable — Peta FLOPs

Intel: The Architecture for Life



Intel: The Architecture for Life



Dadi Perlmutter

Milli Watts

Compatible and Scalable

Peta FLOPs

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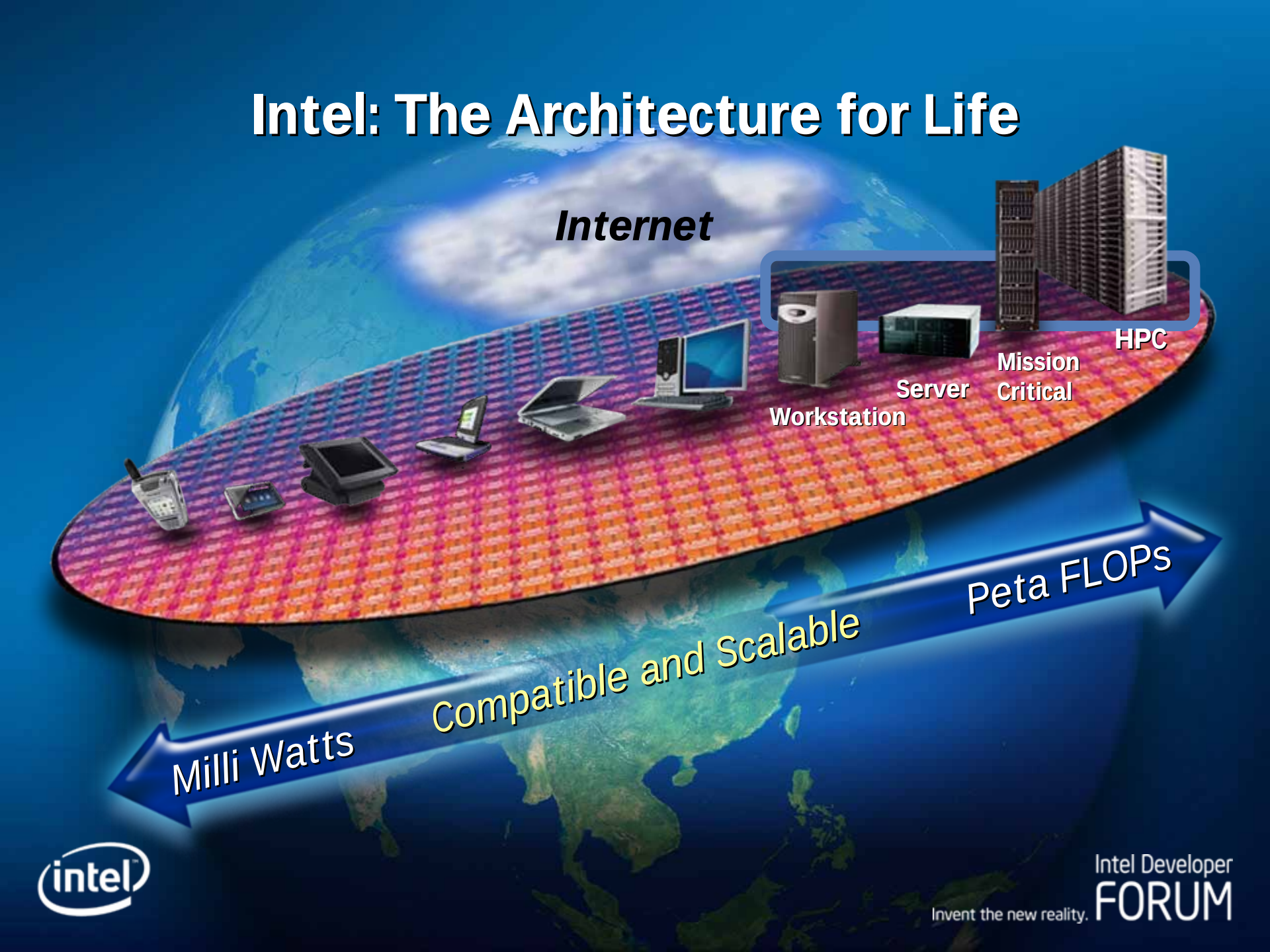
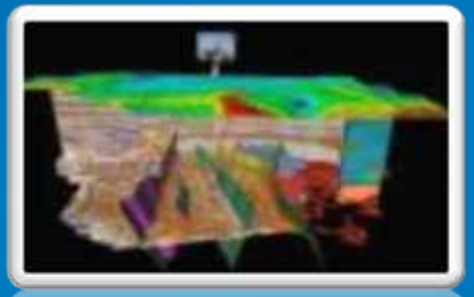
Intel: The Architecture for Life



High Performance Computing

Insatiable Demand for Performance

Weather Prediction



Oil Exploration

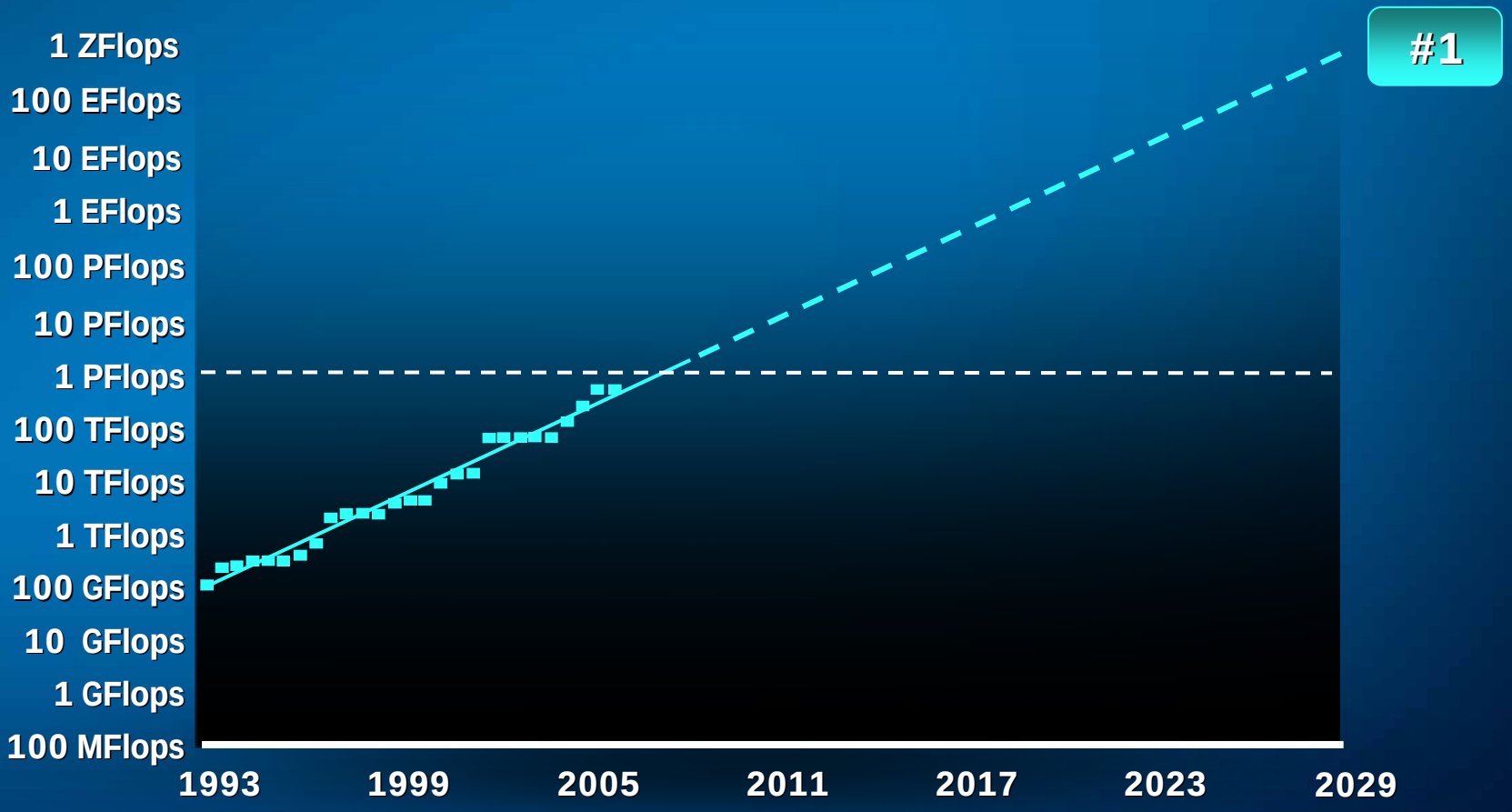
Design Simulation

Genomics Research

Financial Analysis

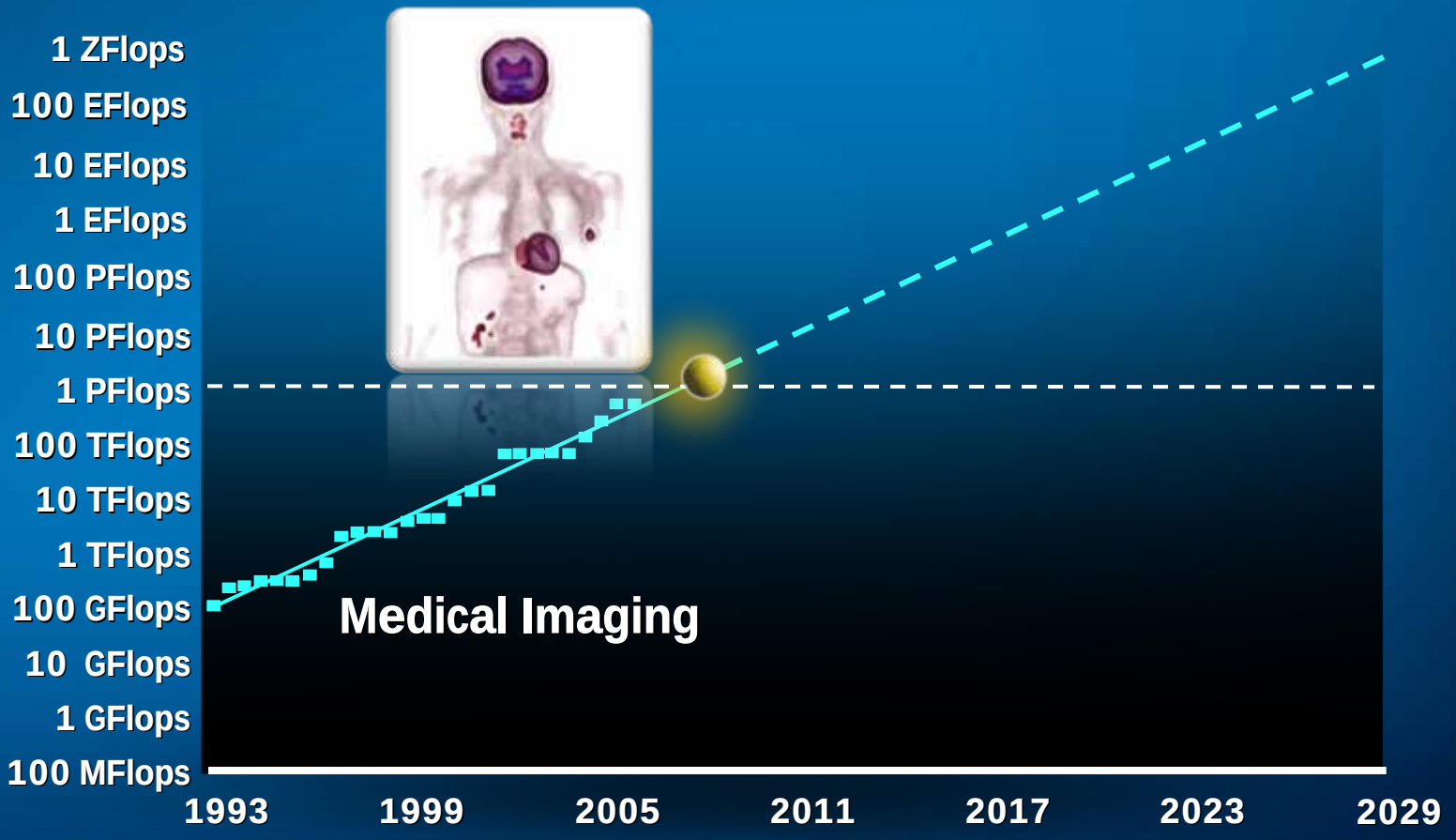
Medical Imaging

Petascale and Beyond

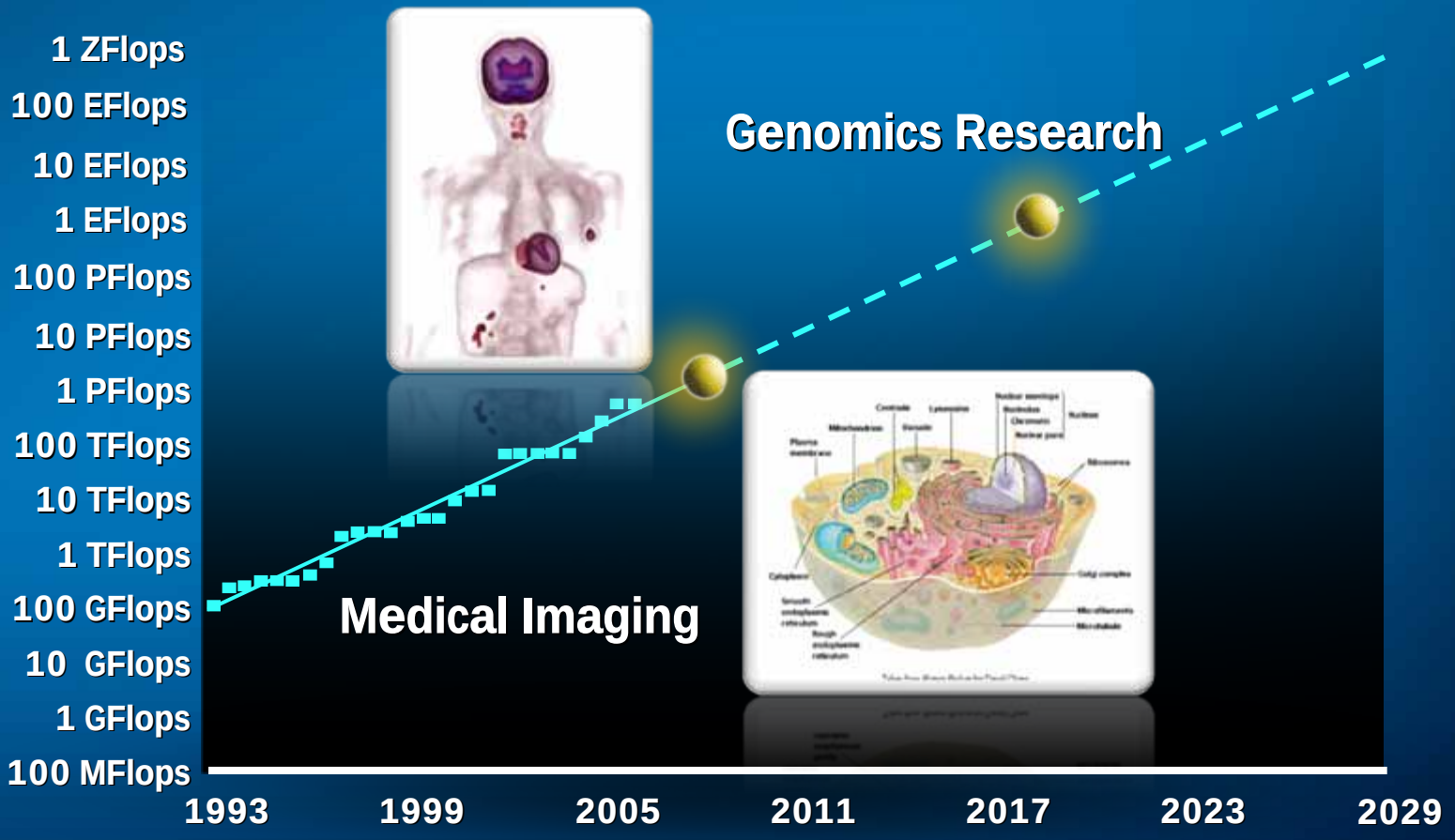


Source: Dr. Steve Chen, "The Growing HPC Momentum in China", June 30th, 2006, Dresden, Germany

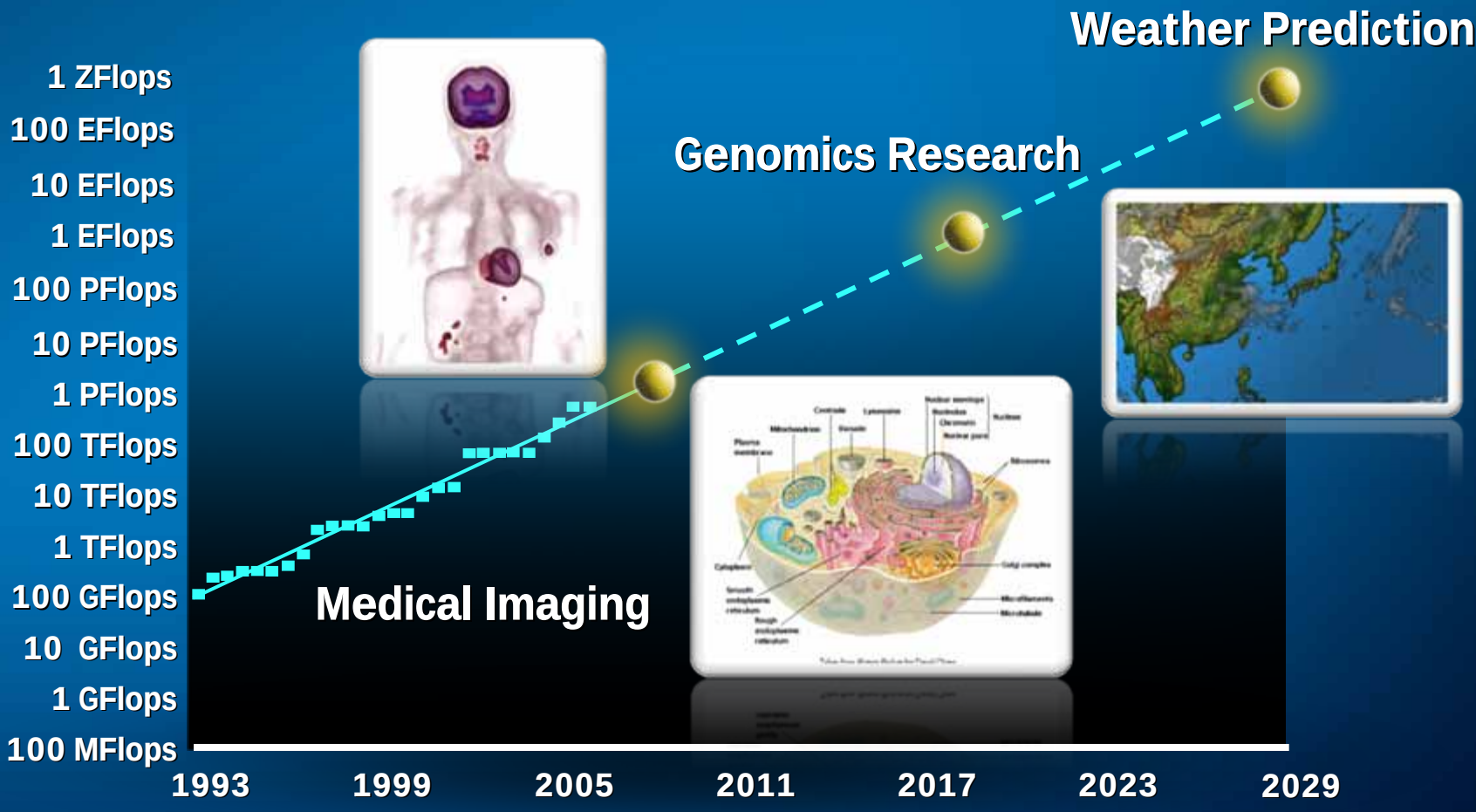
HPC Needs Decades of Moore's Law



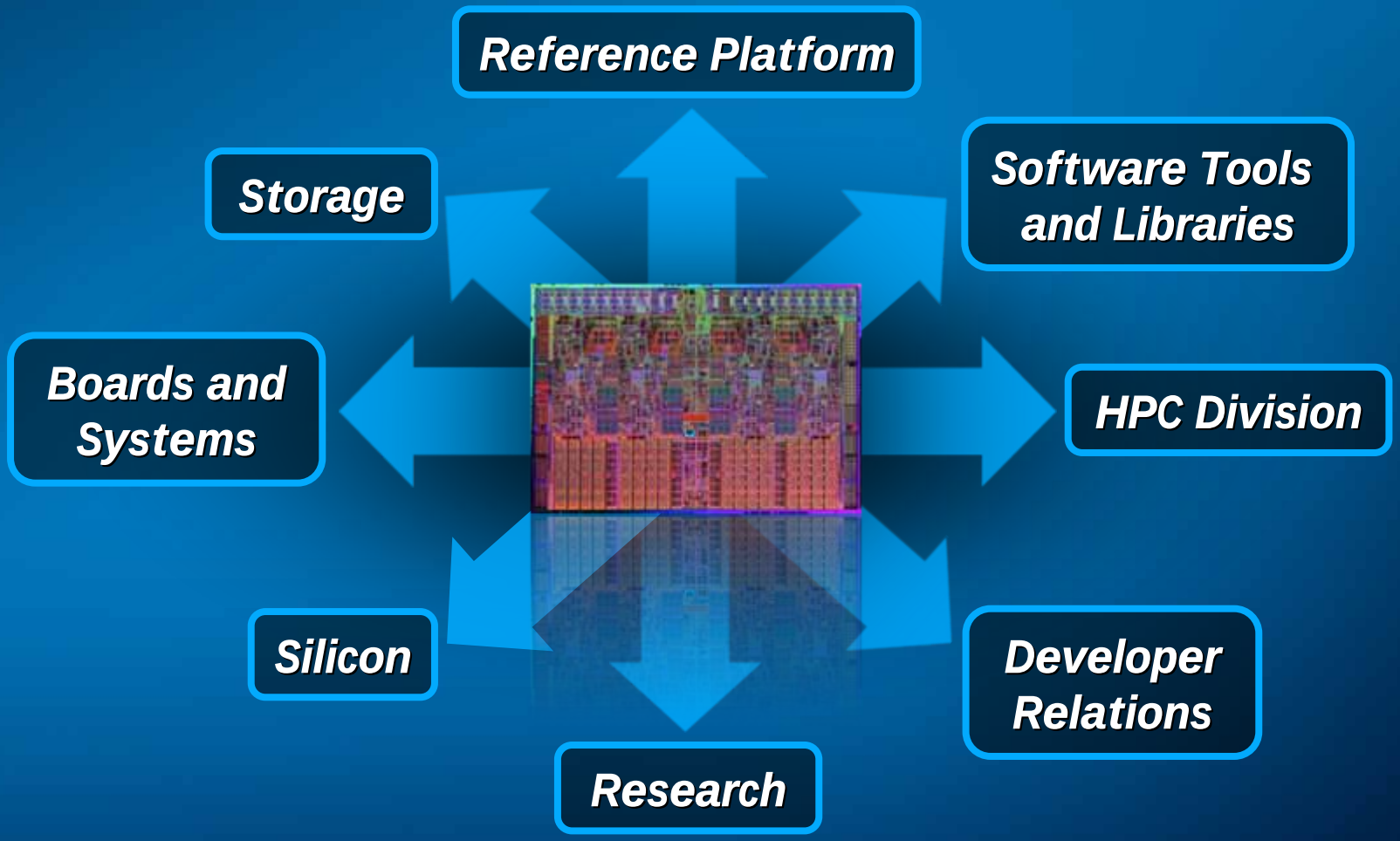
HPC Needs Decades of Moore's Law



HPC Needs Decades of Moore's Law



Intel's Commitment to HPC



Intel Based Supercomputers Powering Research Breakthroughs

Leading HPC Deployments

New Mexico Computing
Applications Center
126.9 T FLOPs
R&D Projects, Weather Research

*Source: www.top500.org

Leading HPC Deployments

Tata CRL- EKA Supercomputer
India
117.9 T FLOPs
Govt Scientific R&D, WW Services

*Source: www.top500.org

Leading HPC Deployments

National Defence Radio Establishment
Sweden
102.8 T FLOPs

*Source: www.top500.org

Leading HPC Deployments in 2007

Intel Supplied About 4 Out of 5 CPUs into HPC
354 Systems of Top 500* Built on IA

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*Source: www.top500.org

IA in PRC's Top 10 HPC Systems*

4. China Meteorological Administration, National Satellite Meteorological Center
5. Gaming Company B Shanghai 1
6. Gaming Company B Chengdu
7. Gaming Company B Shanghai 2
8. Gaming Company B Shanghai 3
9. Gaming Company B Beijing
10. Game Company B Xi'an

*Source: http://www.samss.org.cn

IA in PRC's Top 10 HPC Systems*

1. SINOPEC
4. China Meteorological Administration, National Satellite Meteorological Center
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7. Gaming Company B Shanghai 2
8. Gaming Company B Shanghai 3
9. Gaming Company B Beijing
10. Game Company B Xi'an

*Source: http://www.samss.org.cn

Sinopec

IA Powers Next Generation Petroleum Exploration

- SINOPEC Shengli Geophysical Institute
- 4X Improvement of Seismic Processing

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Li Jun

President
Dawning Information Industry Co., Ltd
Chairman
High Performance Computing Standard Committee

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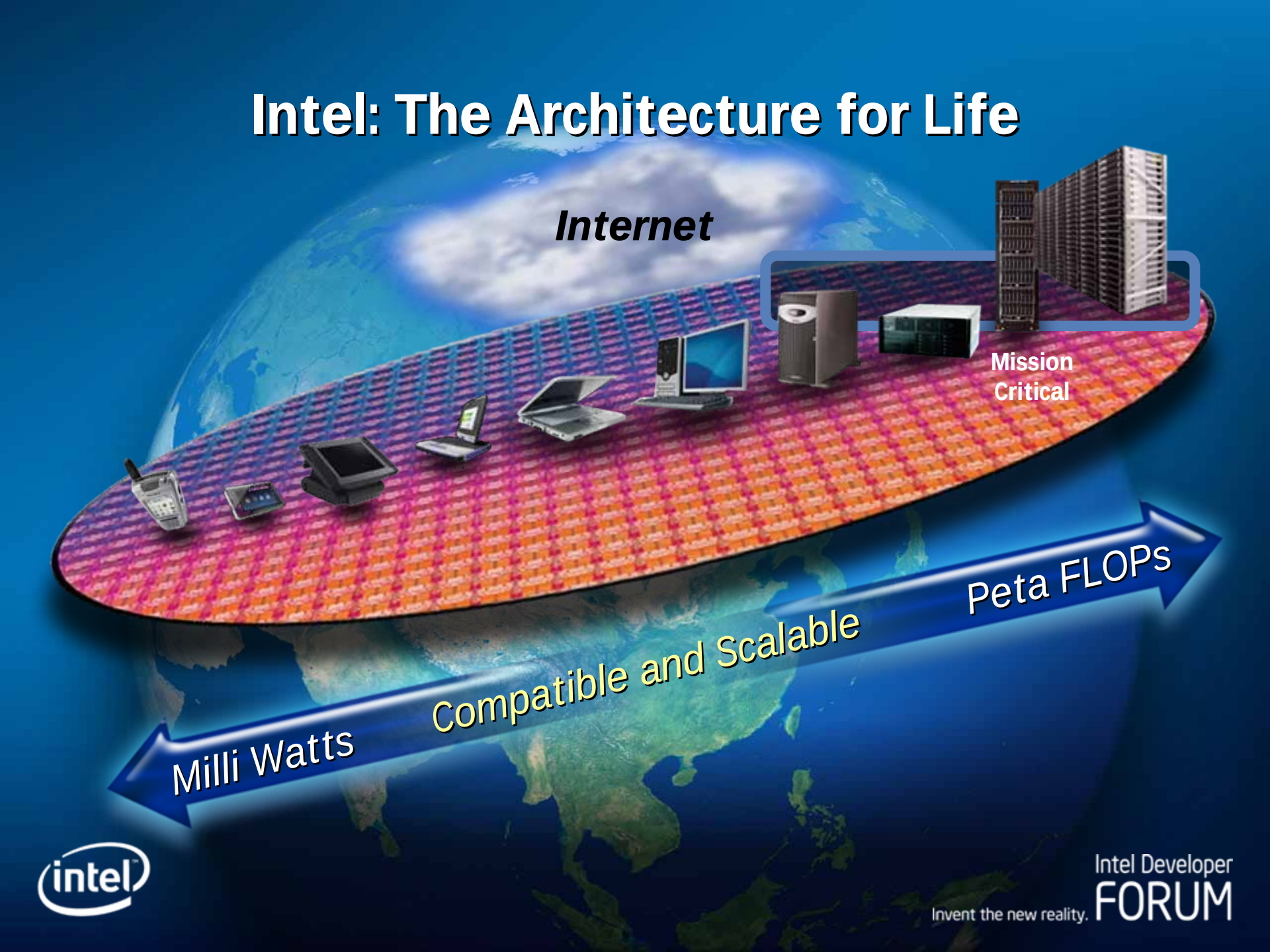
Intel: The Architecture for Life



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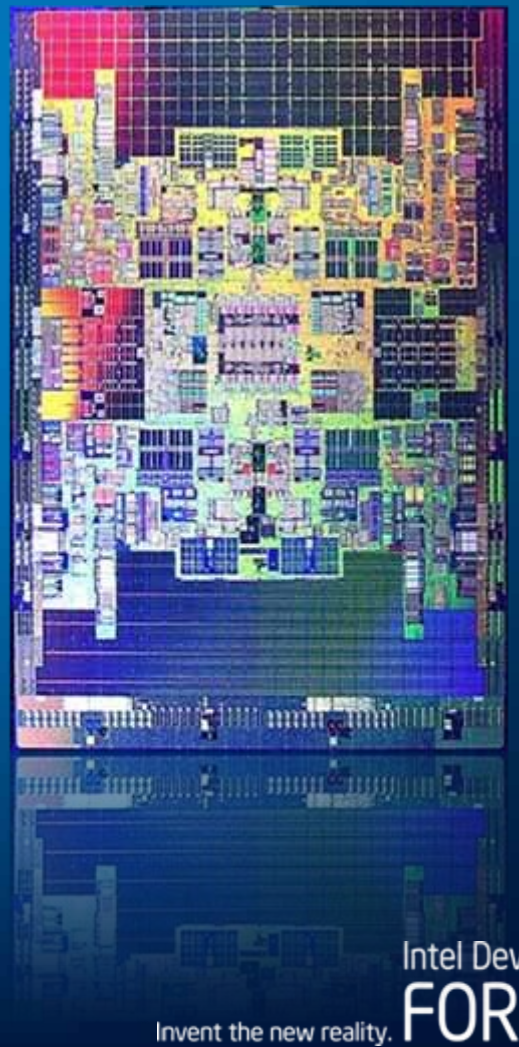
Tukwila for the World's Most Demanding Computers

- Quad-core with 30 MB cache
- 2 billion transistors
- Multi-threading technology
- Intel QuickPath interconnect
- Dual integrated memory controllers
- Estimate >2X* performance
- Mainframe-class RAS

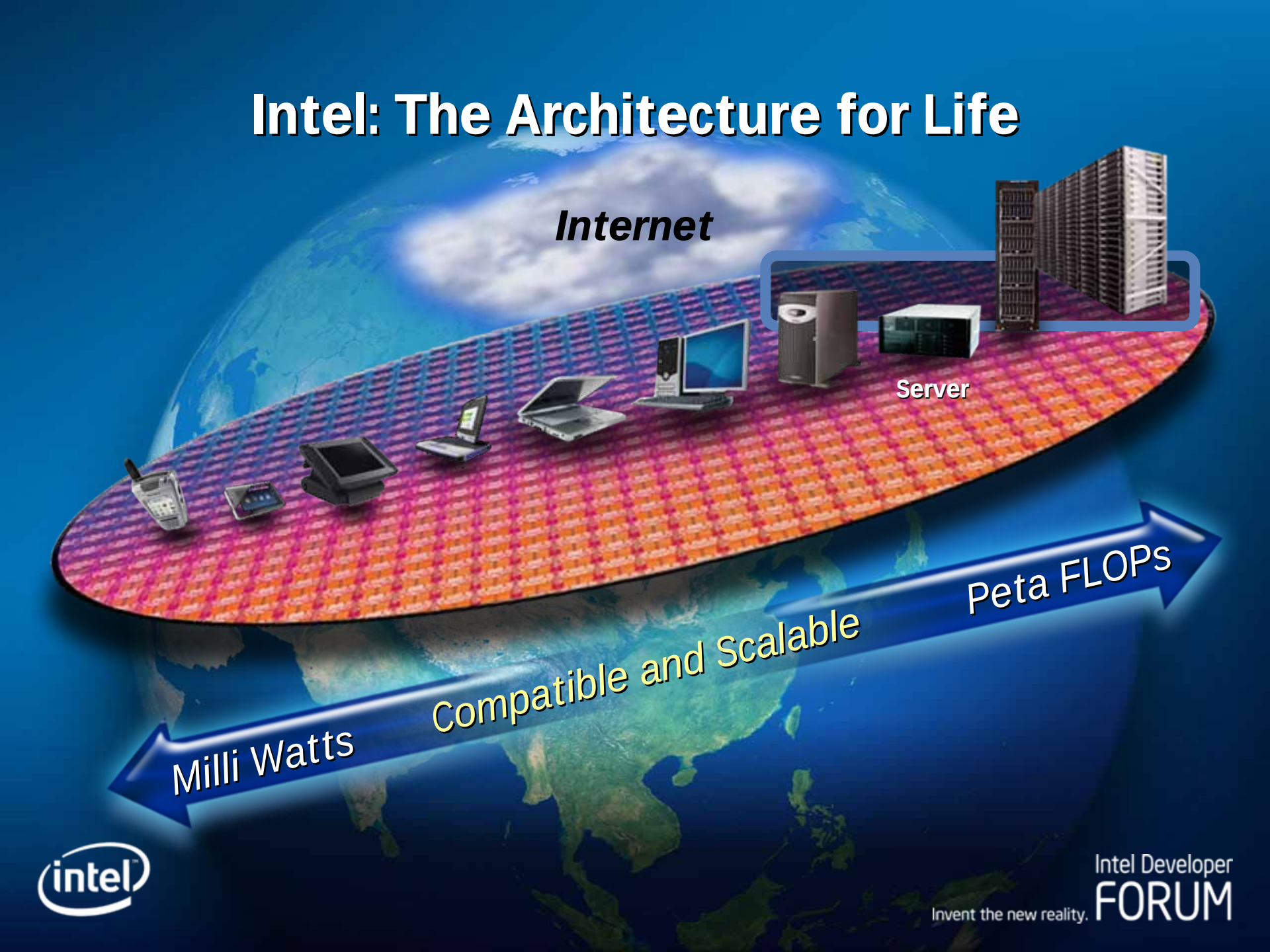


"HP has already successfully booted four key operating systems (Linux, Windows, HP-UX and OpenVMS) on our Tukwila-based Integrity servers….and have found the initial silicon to be robust and of high quality."

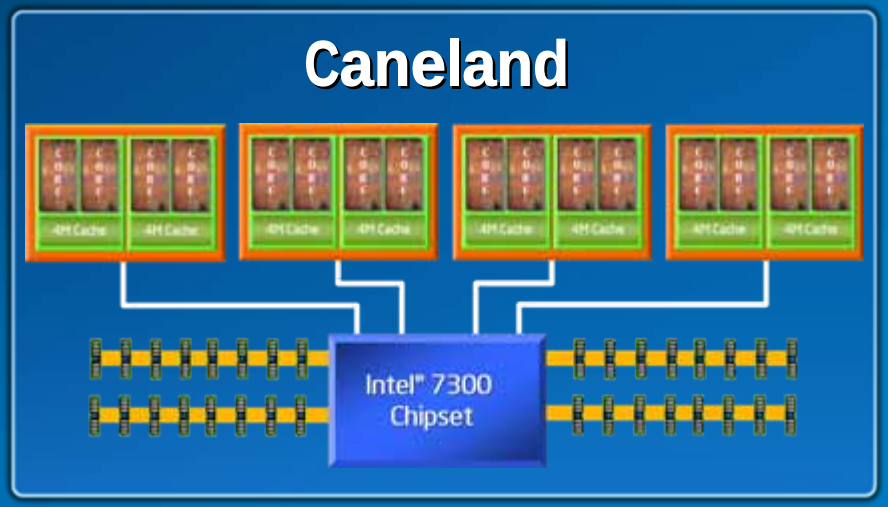
—Martin Fink, Senior VP & GM, Business Critical Systems, HP

*Compared to Dual-core Itanium® Processor 9100 series

Intel: The Architecture for Life



Quad-Core Intel® Xeon® Processor 7300



Platform For Virtualization

Scalable

Energy Efficient Performance

Investment Protection

Enterprise Proven Reliability

HUMANA · chico's · BMW · Baidu 百度 · Bumrungrad International · SONY PICTURES imageworks

DUPONT The miracles of science · FIS FIDELITY NATIONAL INFORMATION SERVICES · KT · Pfizer · YAHOO!

Virtualization Platform of Choice

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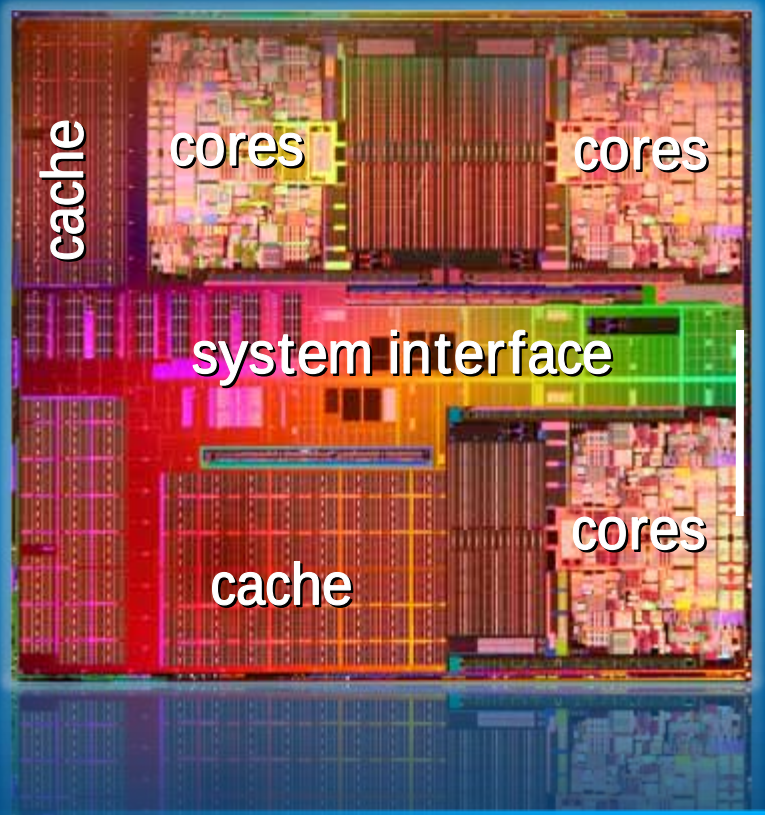
Dunnington with 6 Cores



- 45nm high-k technology
- 1.9B transistors
- 16 MB L3 cache
- Caneland socket compatible
- Latest Intel virtualization technologies
- 2H'08

Caneland Gets Better with Dunnington

Enterprise Need for Virtualization

Intel® Virtualization Technology Evolution

Hardware Enhanced VMMs

Intel® VT-x and VT-i

2005

Enabling New Usage Models

Intel® VT FlexMigration

Performance Acceleration

Intel® VT for Connectivity
Intel® VT FlexPriority

Enhanced Stability and Reliability

Intel® VT for Directed I/O

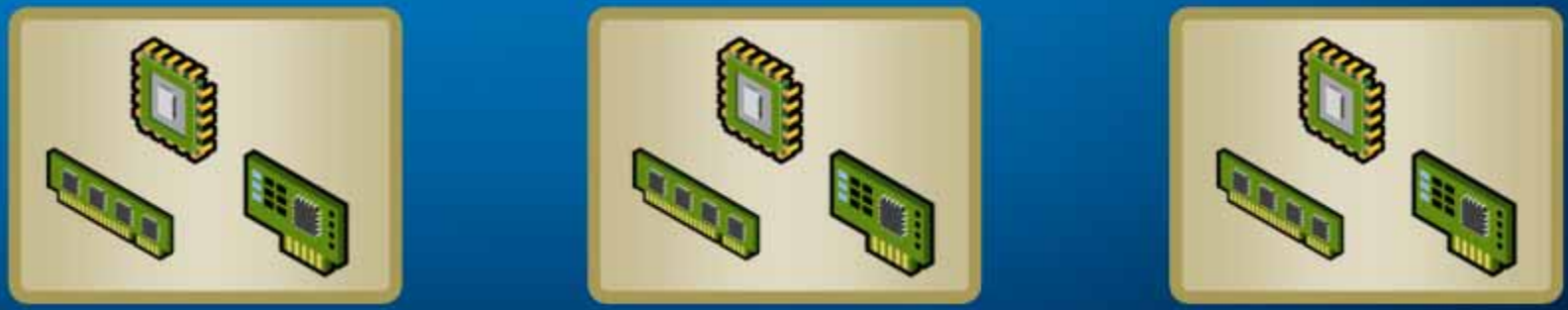
2007 and Beyond

Mendel Rosenblum

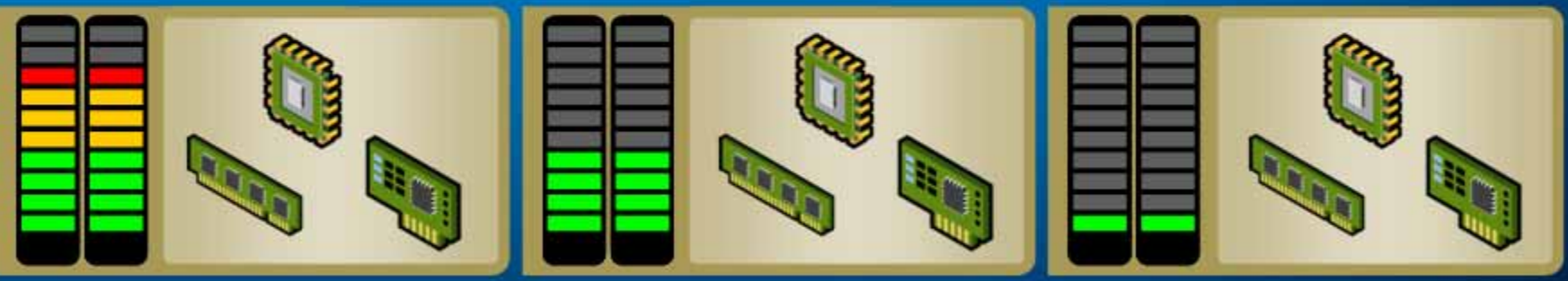
Founder and Chief Scientist

vmware™

Virtual Infrastructure



Virtual Infrastructure



vmware

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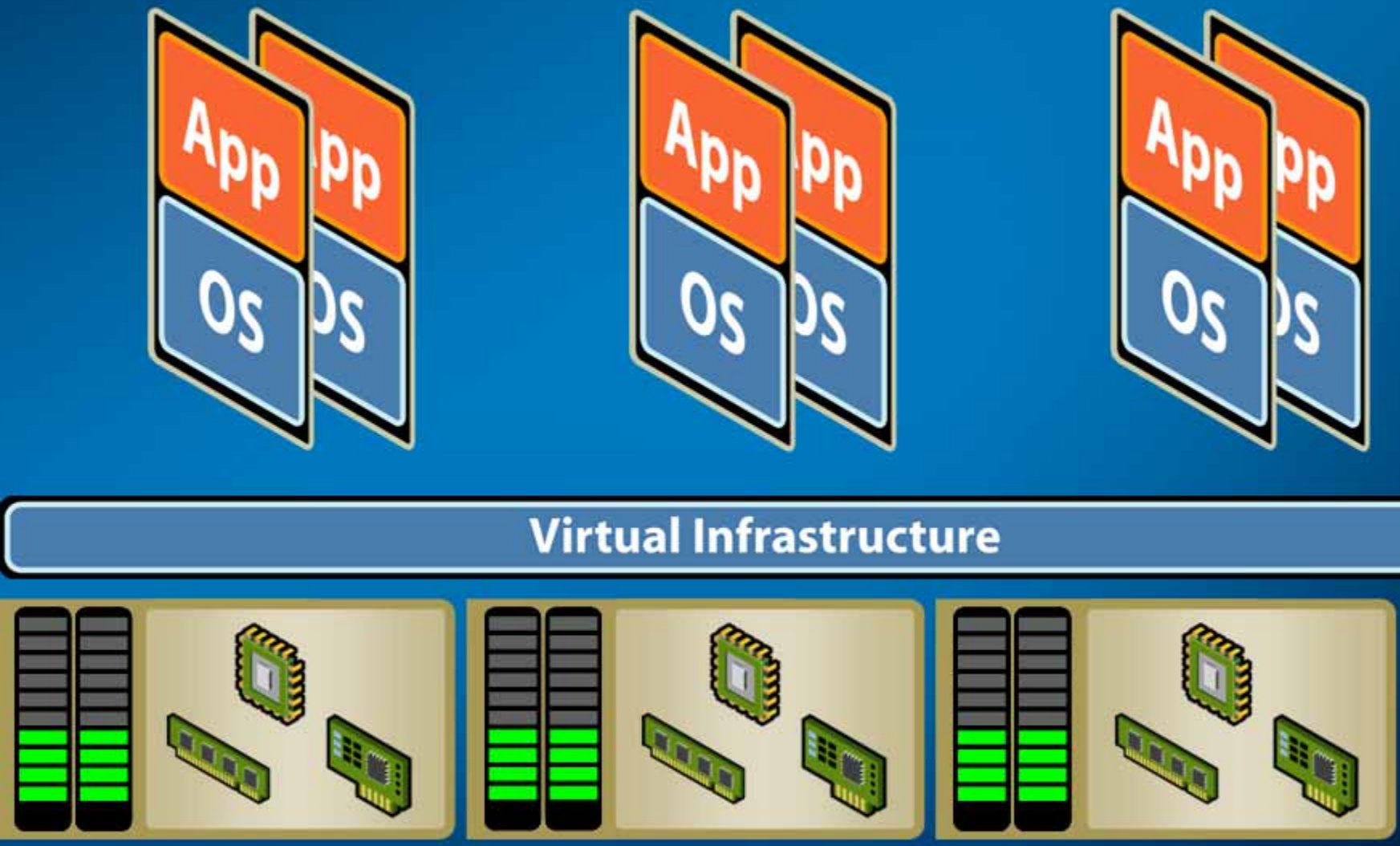
App
Os
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Virtual Infrastructure

Virtual Infrastructure

vmware


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Virtual Infrastructure

New Hardware Compatibility Problem

New Hardware Compatibility Solution

Virtual Infrastructure

Intel® Virtualization Technology FlexMigration

vmware

New Hardware Compatibility Solution

65nm DP Woodcrest (2 Core)	45nm DP Harpertown (4 Core)	65nm MP Tigerton (4 Core)	45nm MP Dunnington (6 Core)

Intel® Virtualization Technology FlexMigration

Quad-Core Intel® Xeon® Processor 5400

Virtualization

Energy Efficiency

Performance

lenovo 联想
国际奥委会全球合作伙伴

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搜狐 SOHU.com

Delivering Performance and Energy Efficiency...
On the Field, Behind the Scenes.

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Honglin Zhang
Deputy Chief Director
Ministry of Railways - IT Center
intel
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China – Ministry of Railways

2007	2020
80,000 KM of track	120,000 KM track
5,000+ stations	1,200 KM High-speed railway
1.4B passengers	
3.1B tons of goods	

China Railways: End to End IA Solutions

Mission Critical Train Dispatch
Reliable Monitoring and Operation Control
Cost-effective Services at Stations
Flexible Emergency Response

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China Railways: End to End IA Solutions

Mission Critical Train Dispatch
Reliable Monitoring and Operation Control
Cost-effective Services at Stations
Flexible Emergency Response

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Intel: The Architecture for Life

Intel's Approach to Eco-Technology

Processor

Platform

Rack and Data Center

climate savers smart computing

the green grid™

ENERGY STAR

spec

Industry Leadership

Comprehensive Focus on Energy Efficiency

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Impact by 2010

climate savers
smart computing

- Improve computing platform energy efficiency by 50%
  - Save an estimated $5.5 billion in energy costs
- Reduce CO_2 emissions by 54M tons/year. Equivalent of:
  - Removal of 11 million autos
  - Eliminating 20 coal plants from the planet
  - Planting 25,000 sq. miles (~65,000 km2) of trees

Eco-Technology

Liu Rulin

Vice President & Secretary General
China Institute of Electronics

Co-Chair
China Electronics Energy Saving Council

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Founding Members of CEESC

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CEESC and Climate Savers

- Reached the agreement of cooperation with CSCI
- Bridge together the efforts on saving energy and reducing greenhouse gas emissions

climate savers
smart computing

Energy Efficiency: SPECpower*

- Measures server power and performance
  - SPECpower_ssj2008*
- Complete dynamic range across eleven load levels

First Industry Standard Energy Efficiency Benchmark

Top SPECpower* Results

Rank	Sponsor	SPECpower_ssj2008 overall ssj_ops/watt	Platform	Processors (Two Socket)
2	IBM	854	X3450	2x Intel® Xeon® E5462
3	HP	778	DL180 G5	2x Intel® Xeon® E5450
4	Dell	719	PE 2950 III	2x Intel® Xeon® E5440
5	Dell	712	PE 1950 III	2x Intel® Xeon® E5440
6	HP	698	DL160 G5	2x Intel® Xeon® E5450
7	FSC	690	RX300 S4	2x Intel® Xeon® E5440
8	Dell	682	PE 2950 III	2x Intel® Xeon® E5440
9	HP	662	DL360 G5	2x Intel® Xeon® E5450
10	Intel	468	6025B-TR+	2x Intel® Xeon® L5335

Public SPECpower results from http://www.spec.org/power_ssj2008/results/power_ssj2008.html as of March 27, 2008

Top SPECpower* Results

Rank	Sponsor	SPECpower_ssj2008 overall ssj_ops/watt	Platform	Processors (Two Socket)
1	Inspur	910	NF290D2	2x Intel® Xeon® L5420

"SPECpower is an important industry benchmark to reflect performance-per-watt and I am very pleased today that Inspur has achieved the #1 result for dual processor systems worldwide"

Wang Endong

President

Inspur Beijing Information Corp

inspur 浪潮

Public SPECpower results from http://www.spec.org/power_ssj2008/results/power_ssj2008.html as of March 27, 2008

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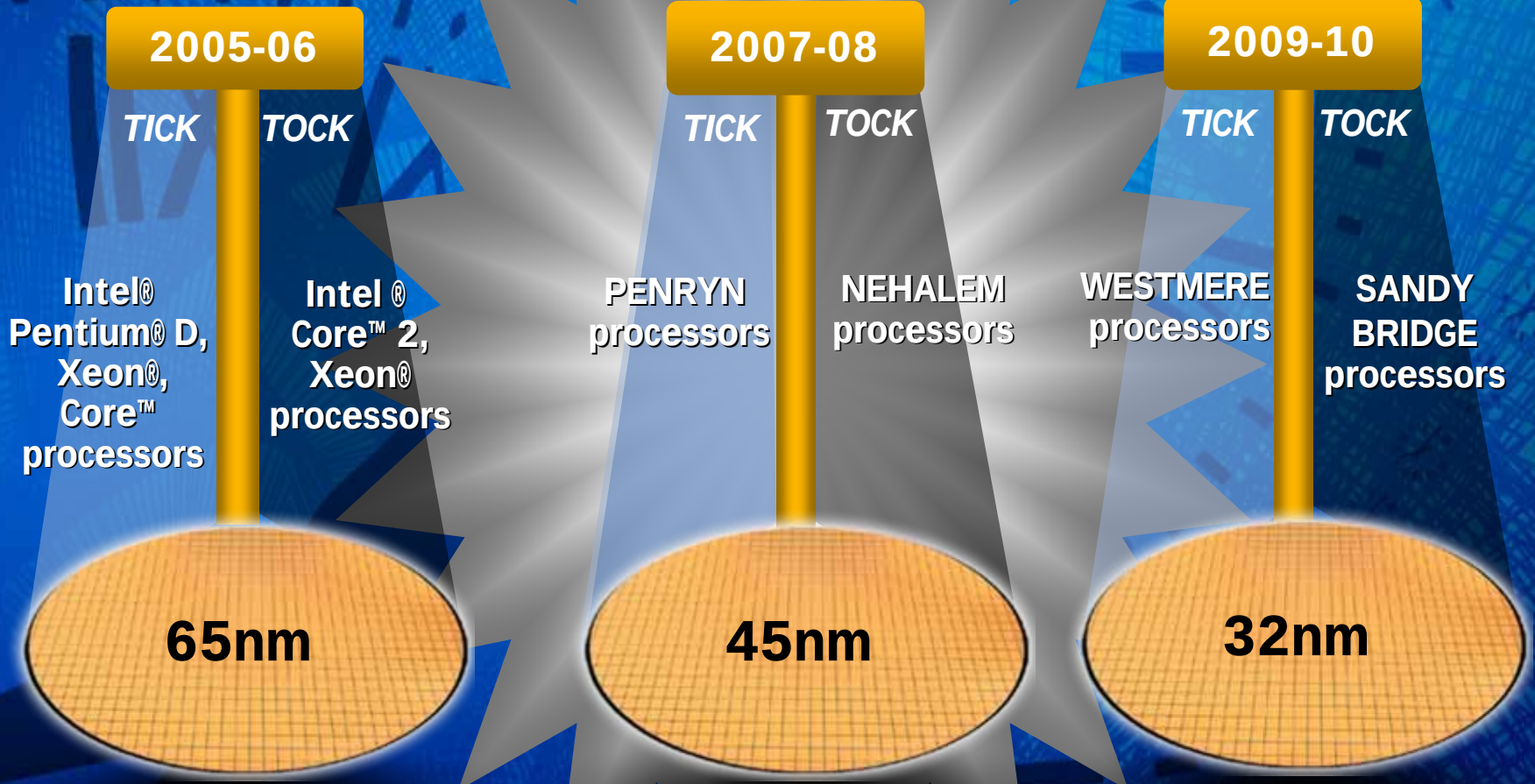
Intel's Tick Tock Development Model



Nehalem: Innovative New Architecture

2, 4 or 8 Cores

Integrated Memory Controller

QuickPath Interconnect

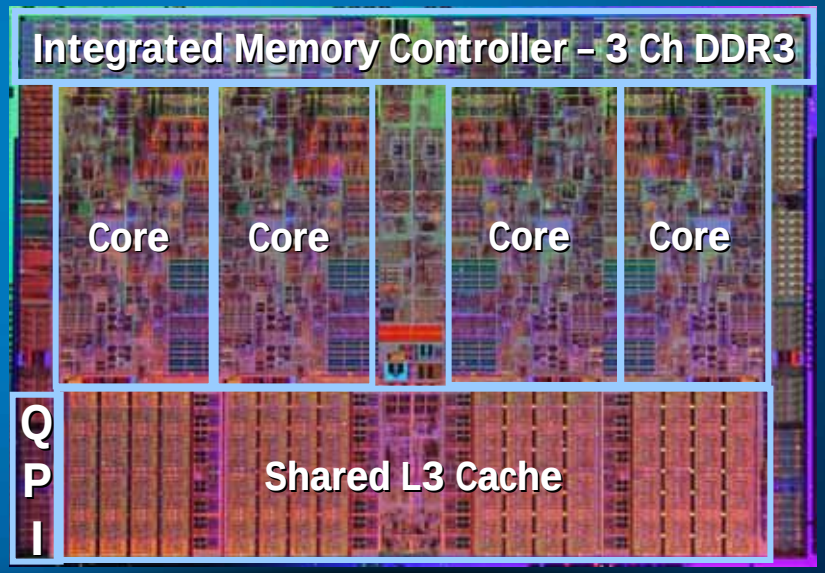
2-way Simultaneous Multi-threading

Microarchitecture Enhancements

Dynamic Power Management

SSE 4.2

Q4'08 Production



Fall IDF 2007

ISA Innovation Continues …

SSE4.2	AES-NI
Efficient Accelerated String and Text Processing	Instructions To Accelerate AES Encryption And Decryption
Implemented in Nehalem 256 compares in one instruction Financial Market Data Parser • 75% reduction in instructions • >3x performance increase	Implemented in Westmere >3x performance improvement • Enables broad use of AES • Improves security • Simplifies software

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Sandy Bridge: Intel® Advanced Vector Extensions

256-bit Vector Extension to SSE for FP Intensive Applications

New Instructions	Benefits
Wider Vectors Increased from 128 bit to 256 bit	Up to 2x Peak FLOPs Output
Enhanced Data Rearrangement New 256 bit Primitives for Data Permutes	Efficient Data Access
Three Operand **Non Destructive Syntax** Efficient and Extensible	Smaller Code Size Parallel Operations

Sandy Bridge: Intel® Advanced Vector Extensions

256-bit Vector Extension to SSE for FP Intensive Applications

"The Microsoft and Intel UC engagement continues its multi-year history of innovation. Intel processors help enable higher definition video conferencing, better power management, and enhanced security, and we are excited about the additional capabilities that Intel® Advanced Vector Extensions will *make possible".*

Gurdeep Singh Pall,
Unified Communications Group
Corporate VP,
Microsoft

Microsoft

"Floating point and SIMD processing are important to the performance of Adobe software products," said ***Hart Shafter, Senior Product Manager for Production Premium at Adobe.*** "We welcome Intel's ongoing innovation in this space and plan to work with Intel to reap the maximum benefit from the new Intel™ Advanced Vector Extensions".

Adobe

Intel® AVX: Performance, Energy Efficient and Extensible

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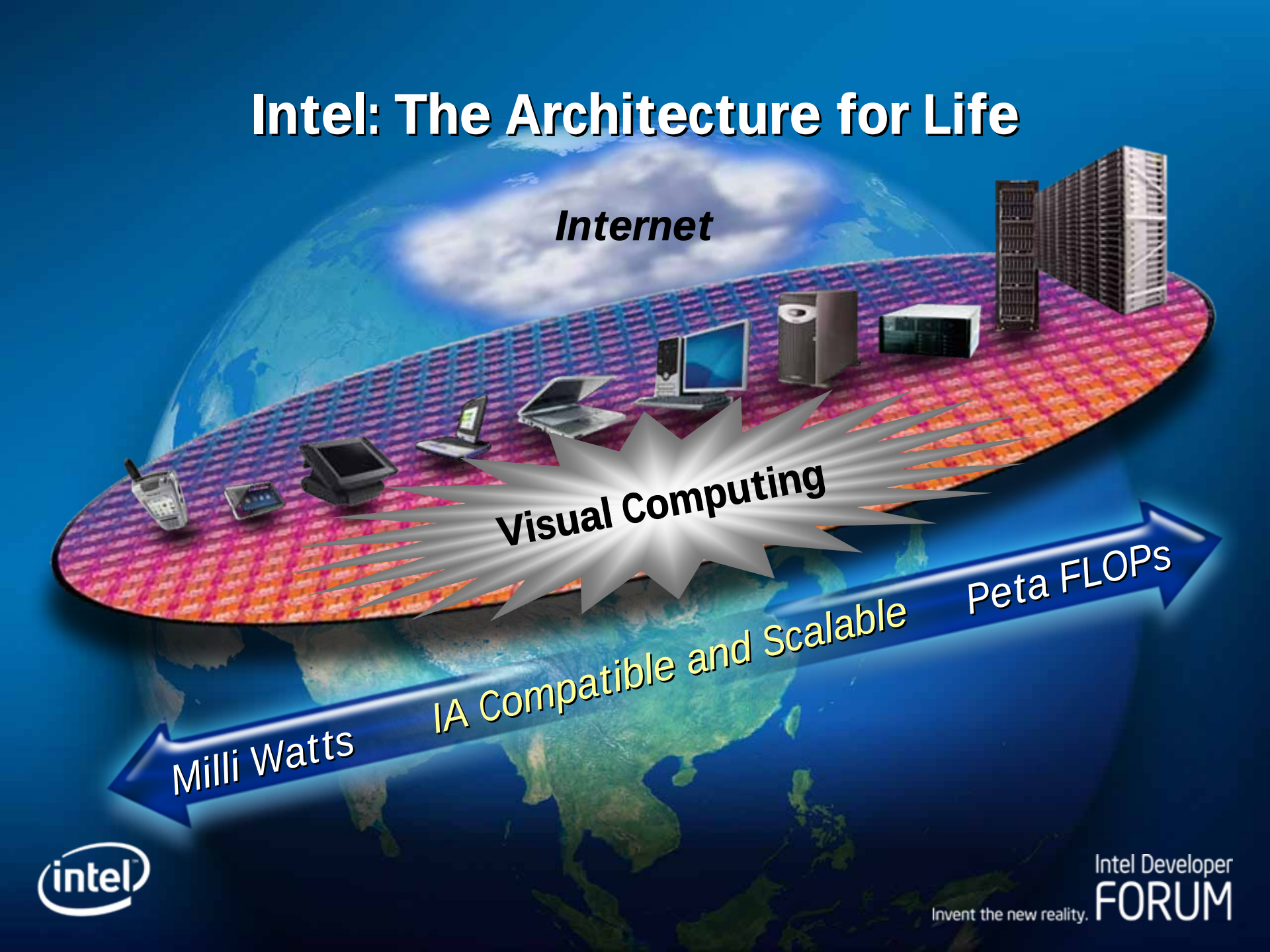
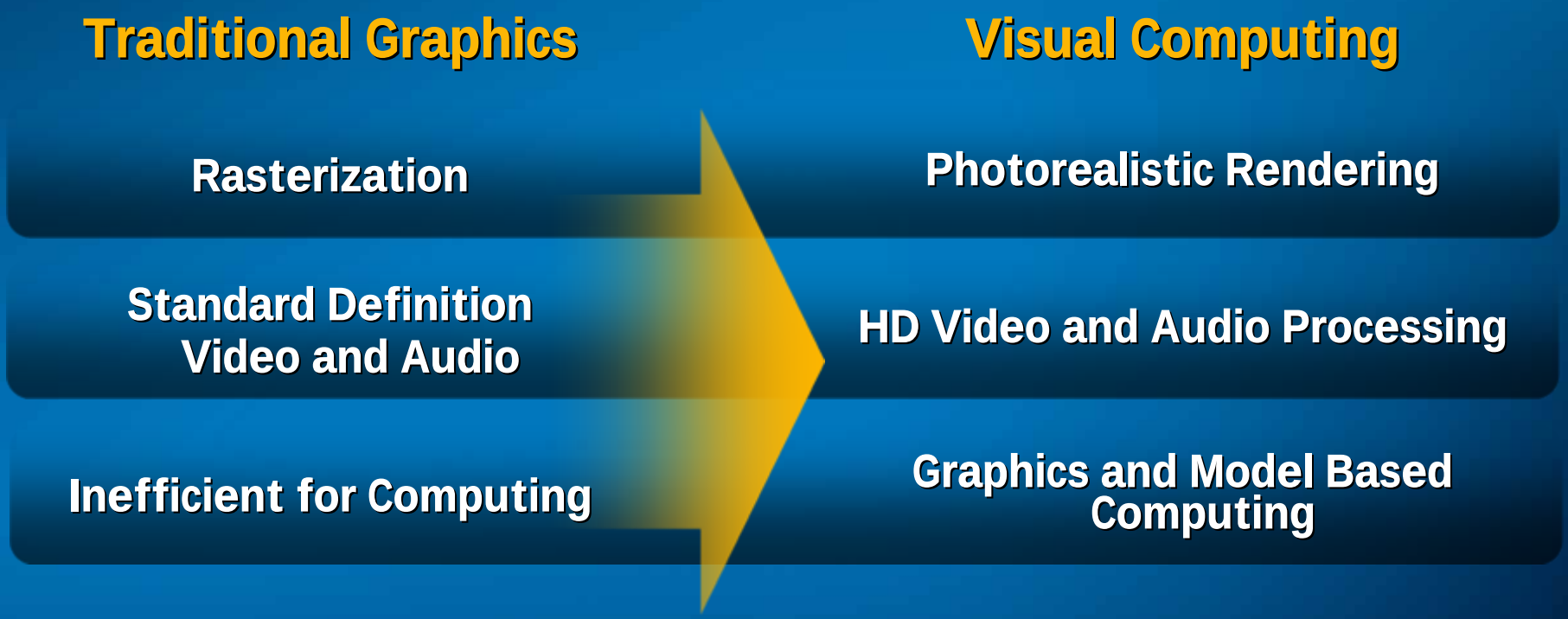
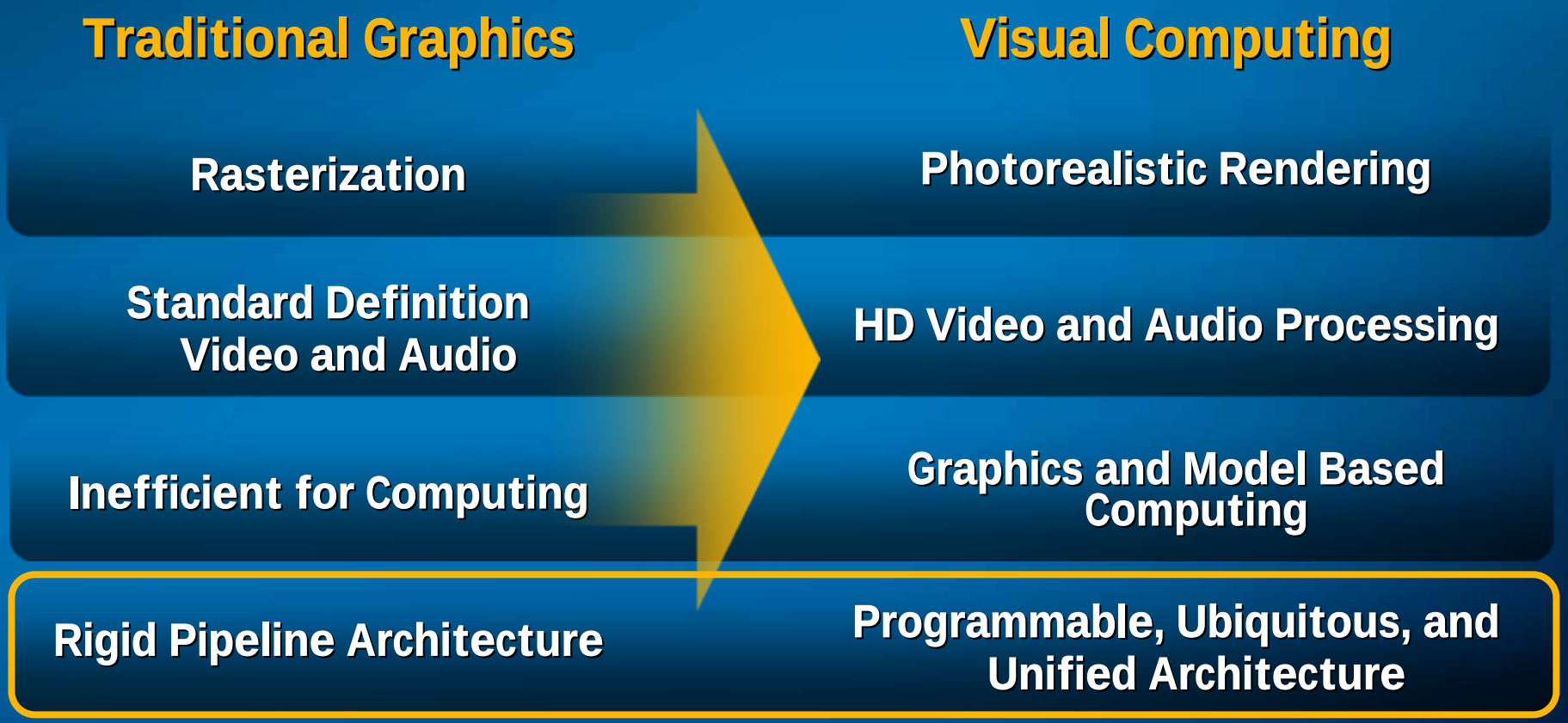


Visual Computing: Graphics Re-defined



Visual Computing: Graphics Re-defined



Looks Real → Acts Real = Feels Real

Visual Computing:

Acquiring, Analyzing, Modeling and Synthesizing Visual Workloads

Photorealistic 3D Rendering

Immersive User Interface

High Definition Audio, Video

Computational Modeling

Visual Computing:

Acquiring, Analyzing, Modeling and Synthesizing Visual Workloads

Photorealistic 3D Rendering

Immersive User Interface

High Definition Audio, Video

Computational Modeling

Programmable, Ubiquitous, and Unified Architecture

Multi-core Helps Ensure Games Act Real

FARCRY2

Multi core ba
enable high q
simulation, e
game enviro
fidelity anim
realistic AI an

"This is the cl
living, breath
we've seen in

– GameSpot

UBISOFT

WWW.FARCRYGAME.COM

*Other names and brands may be claimed as the property of others

Processor: Delivering Photo Realism

*"Multi-threaded processors are enabling **ray-tracing** to reach new levels of **realism**, content generation, & quality previously unheard of in our industry."*

– Richard Jones, Vice President of Alias at Autodesk

Model courtesy by Volvo Cars

Processor: Quake Ray-Tracing Vision

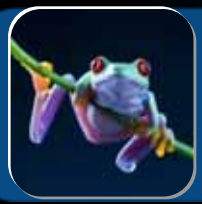
Visual Computing : What Does it Take?

Multi-threaded High-performance CPU

High Performance Memory and I/O

intel Software Products

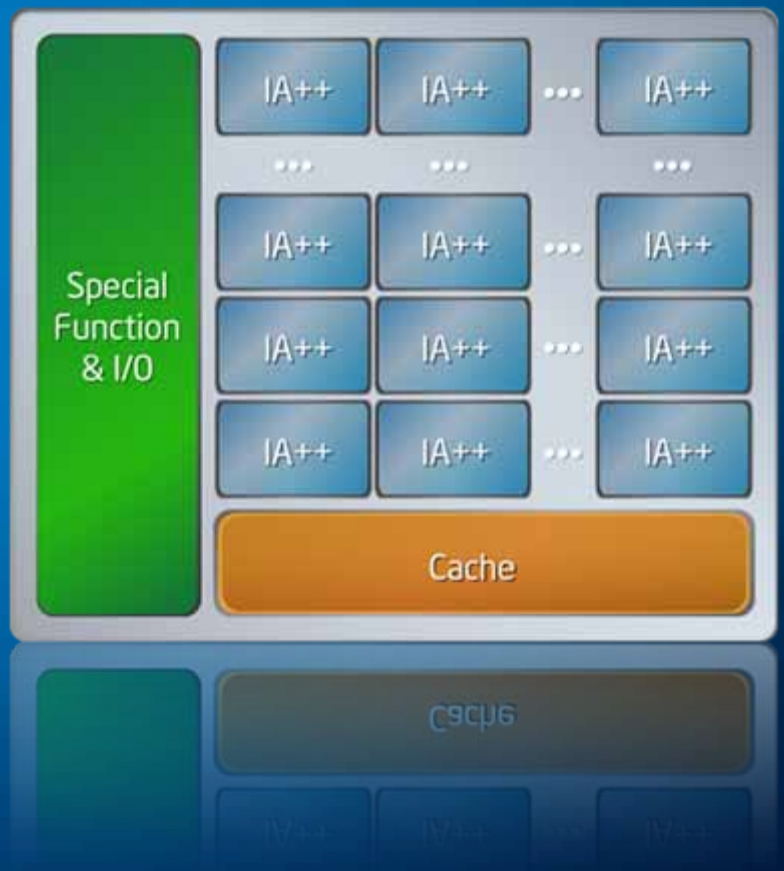
IA Programming, Software Tools, and Support



Integrated or Discrete Graphics
Larrabee: Scalable Many-core IA Architecture

Larrabee Architecture for Visual Computing

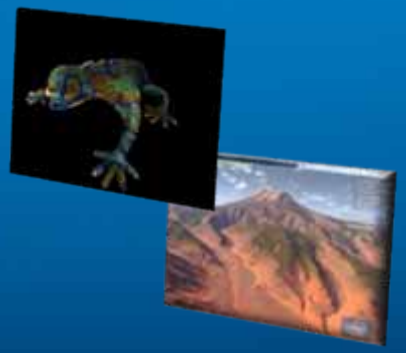
- Many IA cores
  - Scalable to TeraFLOPS
- New cache architecture
- Throughput architecture
- New vector instruction set
  - Vector memory operations
  - Conditionals
  - Integer and FP arithmetic
- New vector processing unit / wide SIMD



Intel Software Unleashes Developer Freedom

Industry Leading Intel® Software Tools

Addresses Development and Performance Tuning Needs



Visual Computing Tools & Resources

Extending Intel® Software for Larrabee Architecture

Supports Industry Standard APIs (DirectX* and OpenGL*)

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Intel: The Architecture for Life

Energy Efficient Performance
Solid Tick-tock Execution

Intel: The Architecture for Life


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