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servers
From Nano-Scale to Peta-Scale
12 June 2009
Herbert Cornelius
Intel EMEA
intel

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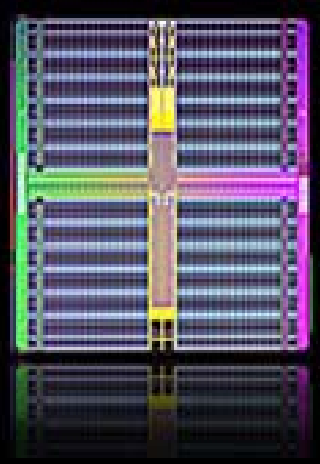
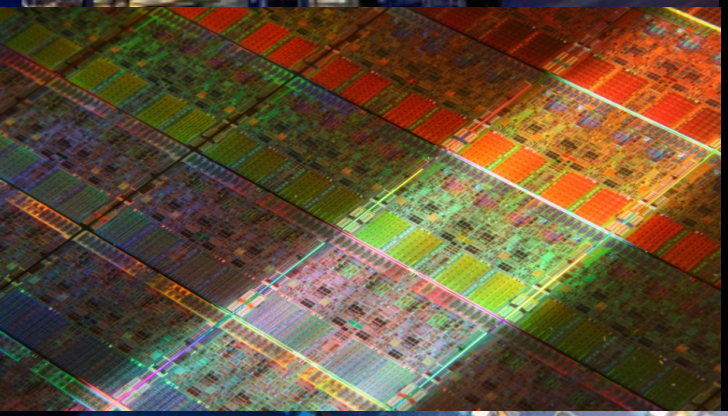
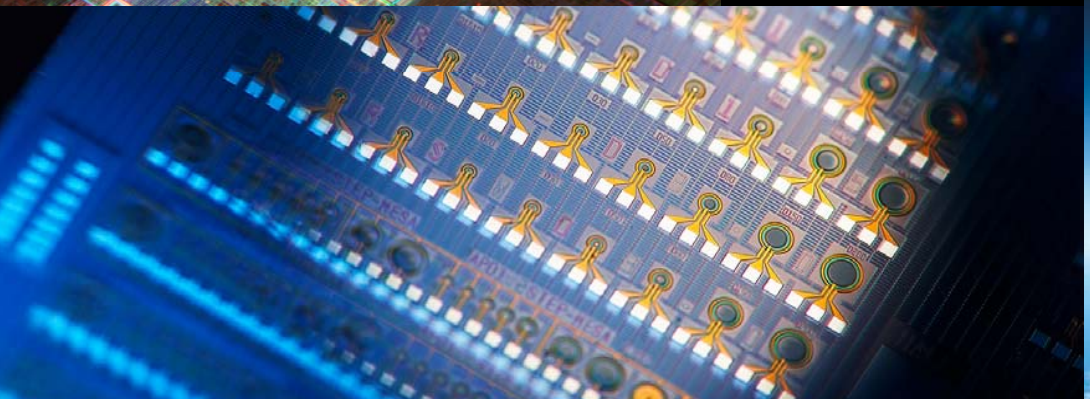




Investing $7B into 32nm fabs



STARING INTO THE ABYSS? DON'T BLINK.

How do we respond to the deepest economic crisis of a generation? Imagine a company with the nerve to look this challenge in the eye and invest $7 billion of its own money in America right now. Crazy? We think it's foresight.

Intel was in Washington this week to announce the single largest capital investment in a new manufacturing cycle in its history. The company is putting big money into factories that will produce next-generation 32 nanometer chips, tiny engineering marvels that will generate economic returns far beyond one company or industry. These factories are the lifeblood of communities in Oregon, New Mexico and Arizona, a major part of Intel sustaining 45,000 highly skilled jobs in America. We believe economic stimulus starts with words like ***build*** and ***invest***.

The commitment to new manufacturing capacity is, we think, a fundamental expression of faith in technology and faith in the future of the United States. It is not a blind faith, but a faith buttressed by years of experience.

Faith in technology. Just as American leaders like Teddy Roosevelt looked way into the future, our company has the confidence to invest in the downturns, knowing that is the surest path to a healthier tomorrow. These state-of-the-art factories will produce a whole new generation of extremely capable, yet ultra low power chips. These chips will animate a new class of computer servers, thin and light notebooks and a range of devices that deliver a rich Internet experience in your pocket or purse. We have a bedrock conviction that we will lift ourselves out of the economic funk not with today's products, but with tomorrow's.

Faith in the U.S. Intel is a global enterprise, with important factories and operations all over the world. While 75 percent of our chips are destined for export to world markets, we actually ***make*** 75 percent of the chips in U.S. factories. It makes good sense to upgrade manufacturing capacity where we have the skills, capital equipment and existing investments to accelerate our time to market and maintain process leadership.

Come join us as we convene an important conversation over the next year. Partnering with The Aspen Institute and other thought leaders, Intel will stimulate a discussion about the importance of investing in technology to get the economy growing again.

intel.com/InnovationEconomy

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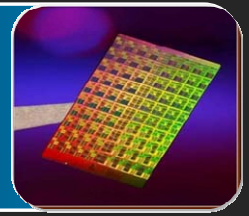
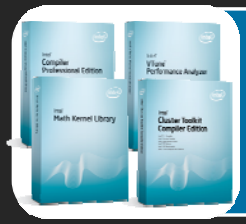
Intel in High-Performance Computing

Dedicated, renowned applications expertise

Teraflops Research Chip





Broad Software tools portfolio

Defined HPC application platform

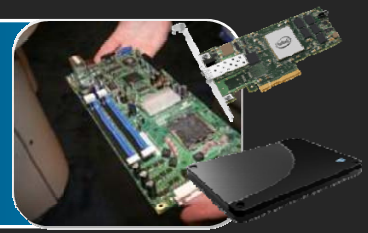
intel Cluster Ready

Large scale clusters for test & optimization

Manufacturing Process Technologies

Leading performance, performance/watt

Platform building blocks



A long term commitment to the HPC market segment

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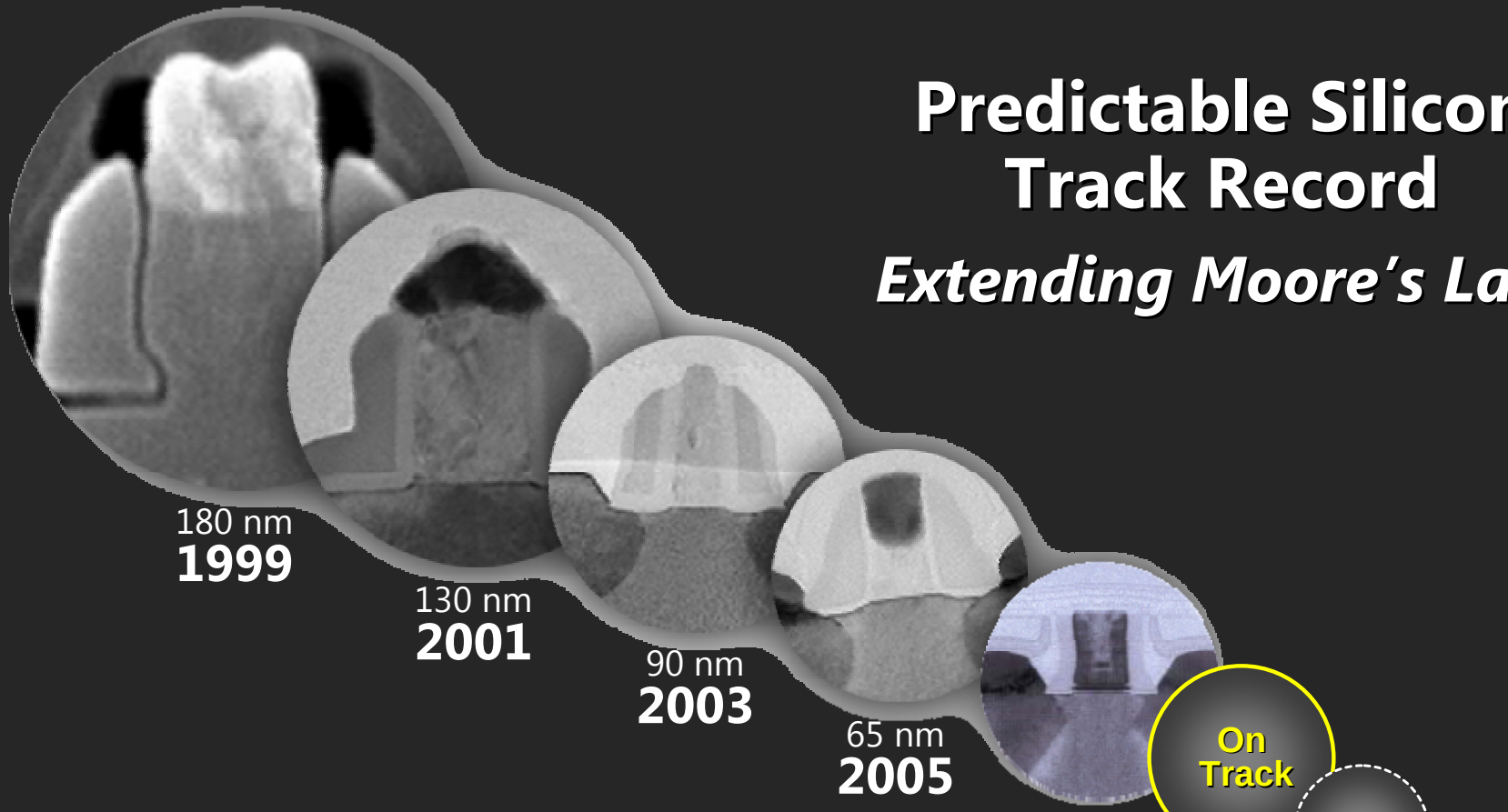
Predictable Silicon Track Record

Extending Moore's Law



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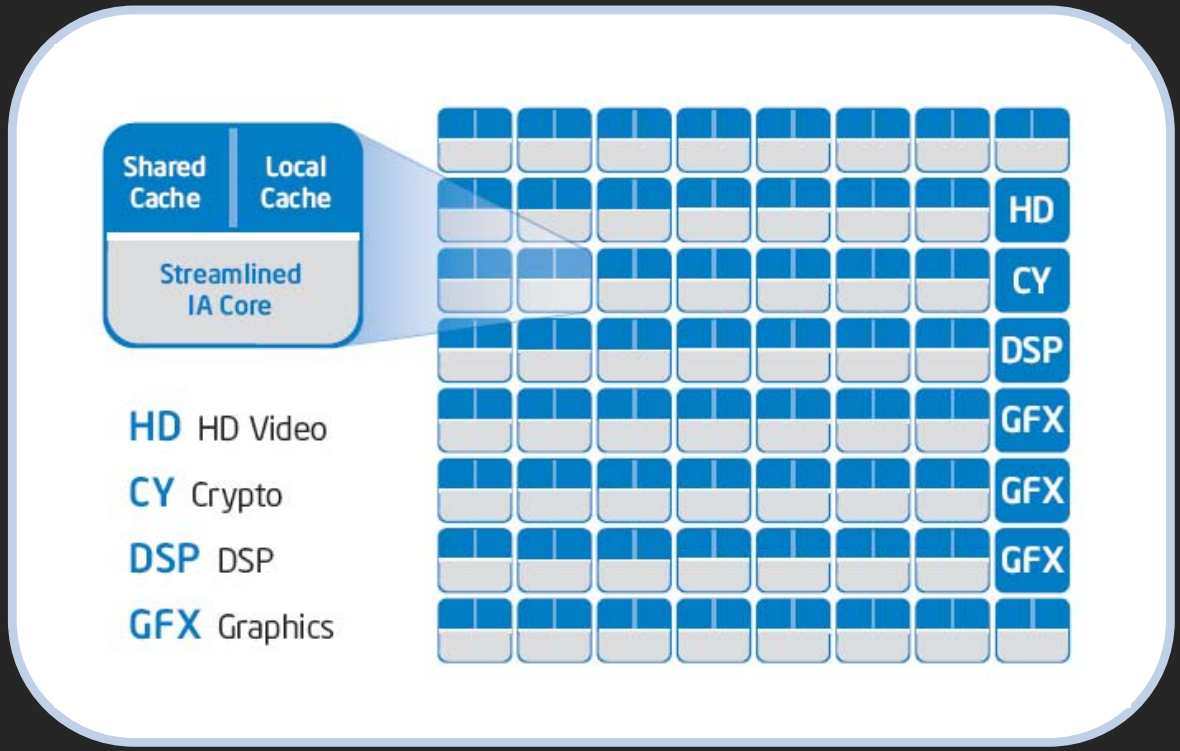
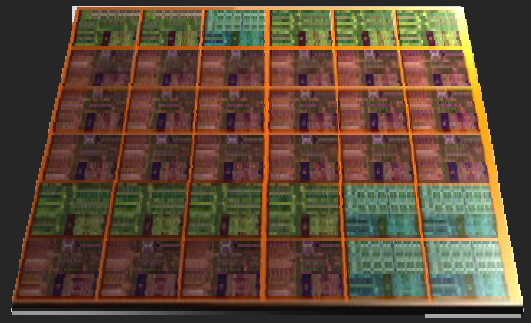
Multi/Many-Core Chip Research





Future tera-scale chips could use an array of tens to hundreds of cores with reconfigurable caches, as well as special-purpose hardware accelerators utilizing a scalable on-die interconnect fabric.

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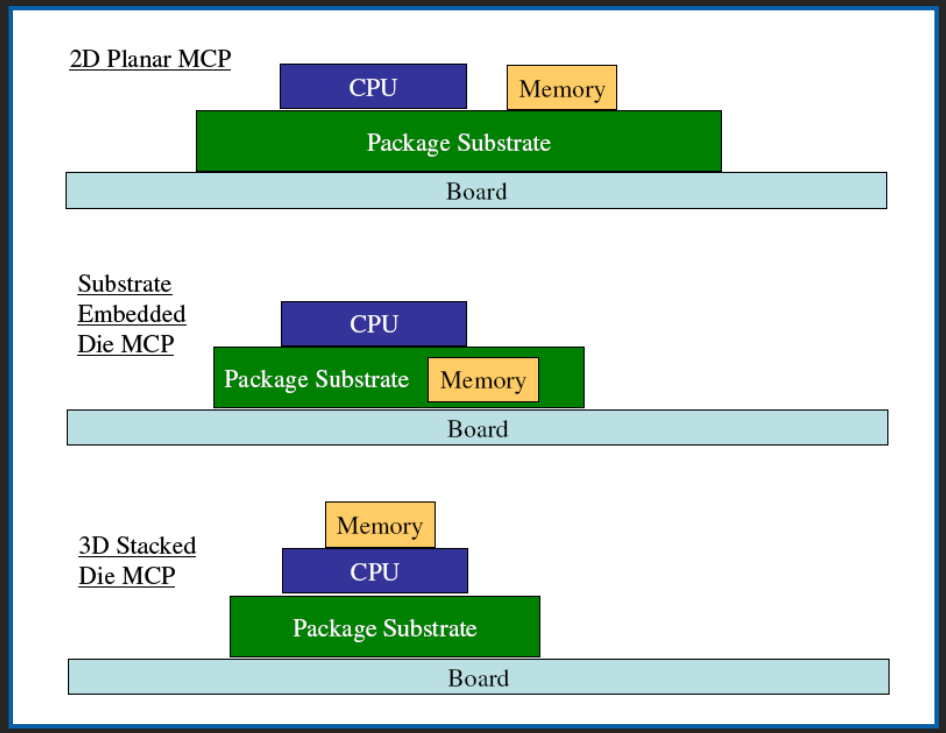
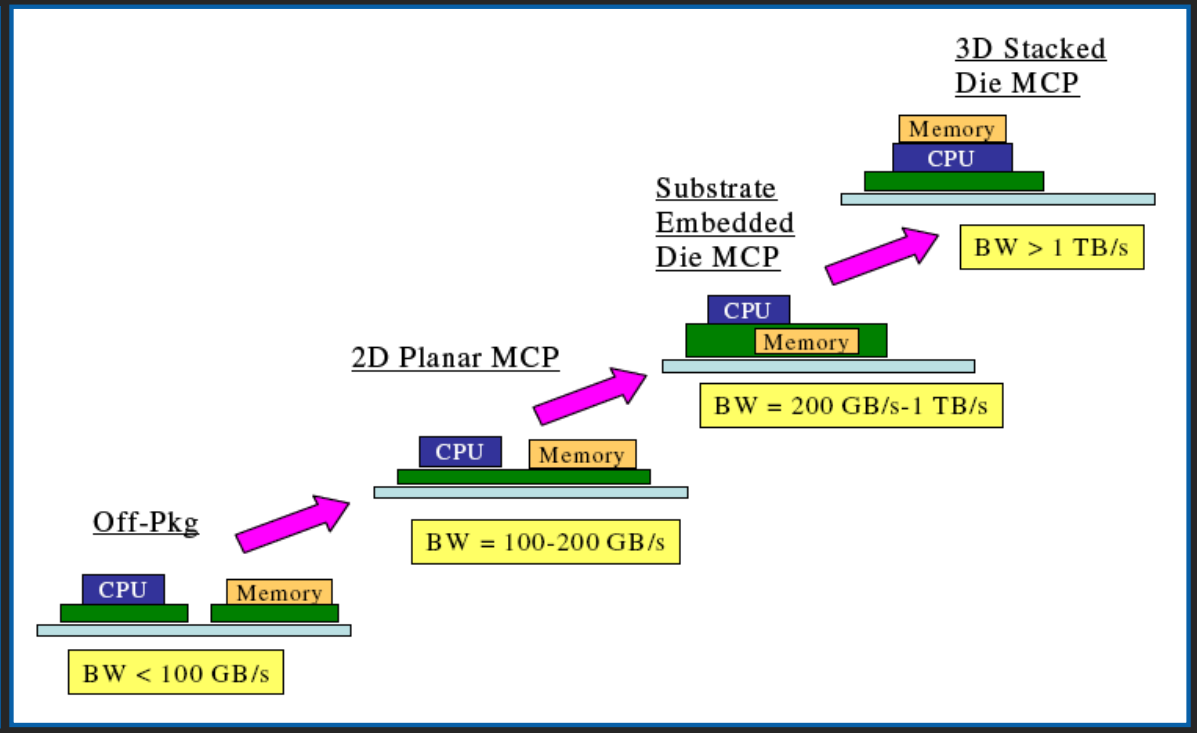
Memory and CPU package architectures for addressing bandwidth challenges





Package Technology to Address the Memory Bandwidth Challenge for Tera-scale Computing, Intel Technology Journal, Volume 11, Issue 3, 2007

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TERABITS OF I/O-THROUGHPUT

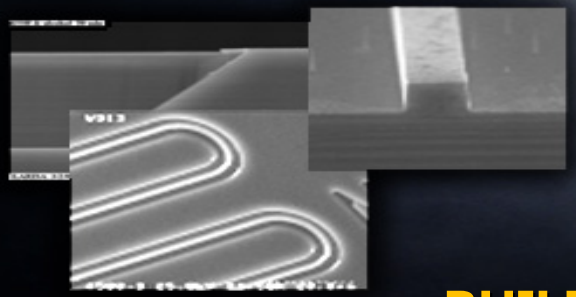
LASER

MODULATOR

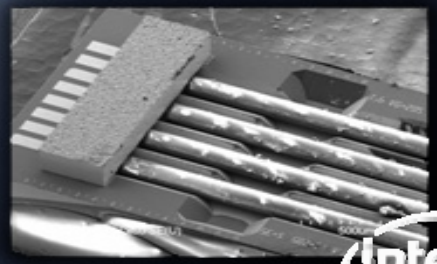
PHOTO-DETECTOR

LOGIC INTEGRATION

LIGHT GUIDES



SELF-ALIGNMENT



BUILDING BLOCKS OF SILICON PHOTONICS

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Intel Technology is Changing HPC

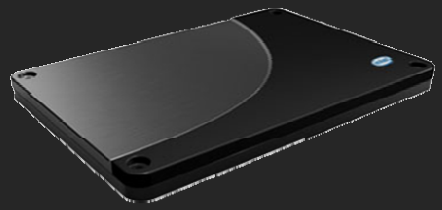
Performance, Energy Efficiency, Reliability, TCO

Extreme Performance | **Increased Reliability** | **Power Efficient** | **Reduce System Cost**

Processor

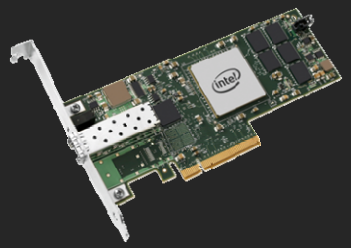
Scalable Performance and Energy Efficiency

Solid State Disk



Optimize Performance for I/O Intensive Apps and Boot Drive Replacement

10GbE



Bridging the Gap Between 1GbE and Infiniband®

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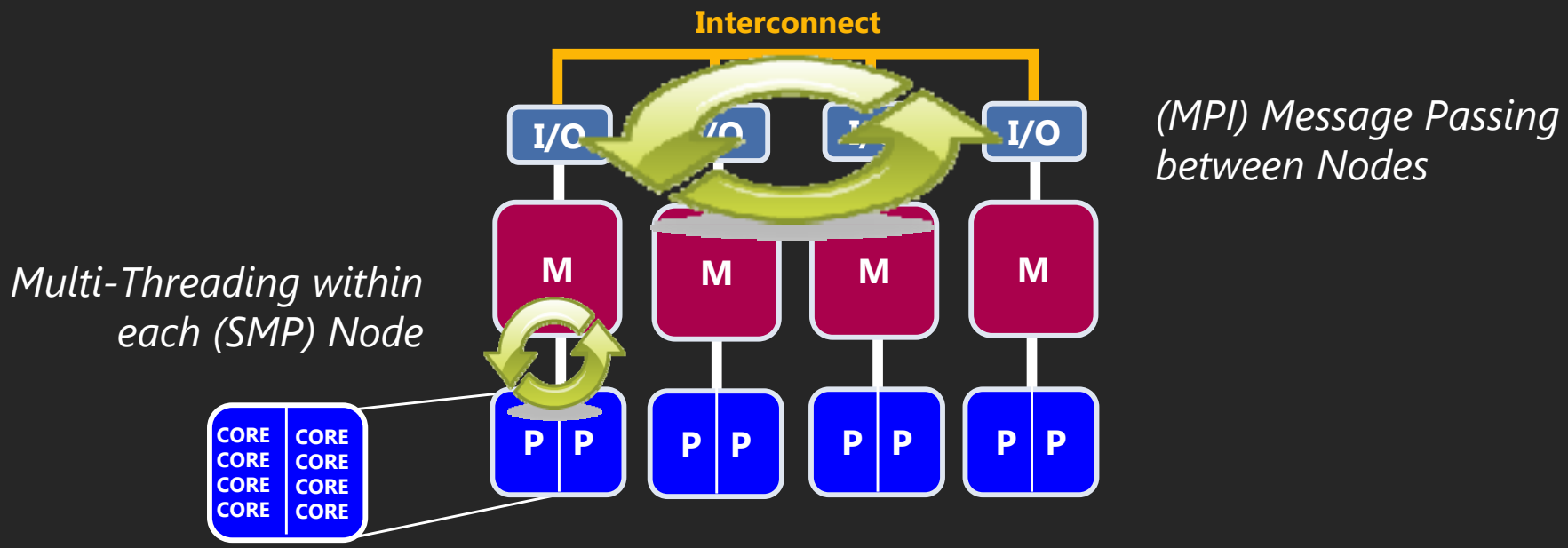
HPC Architecture

CLUSTER OF SHARED MEMORY NODES



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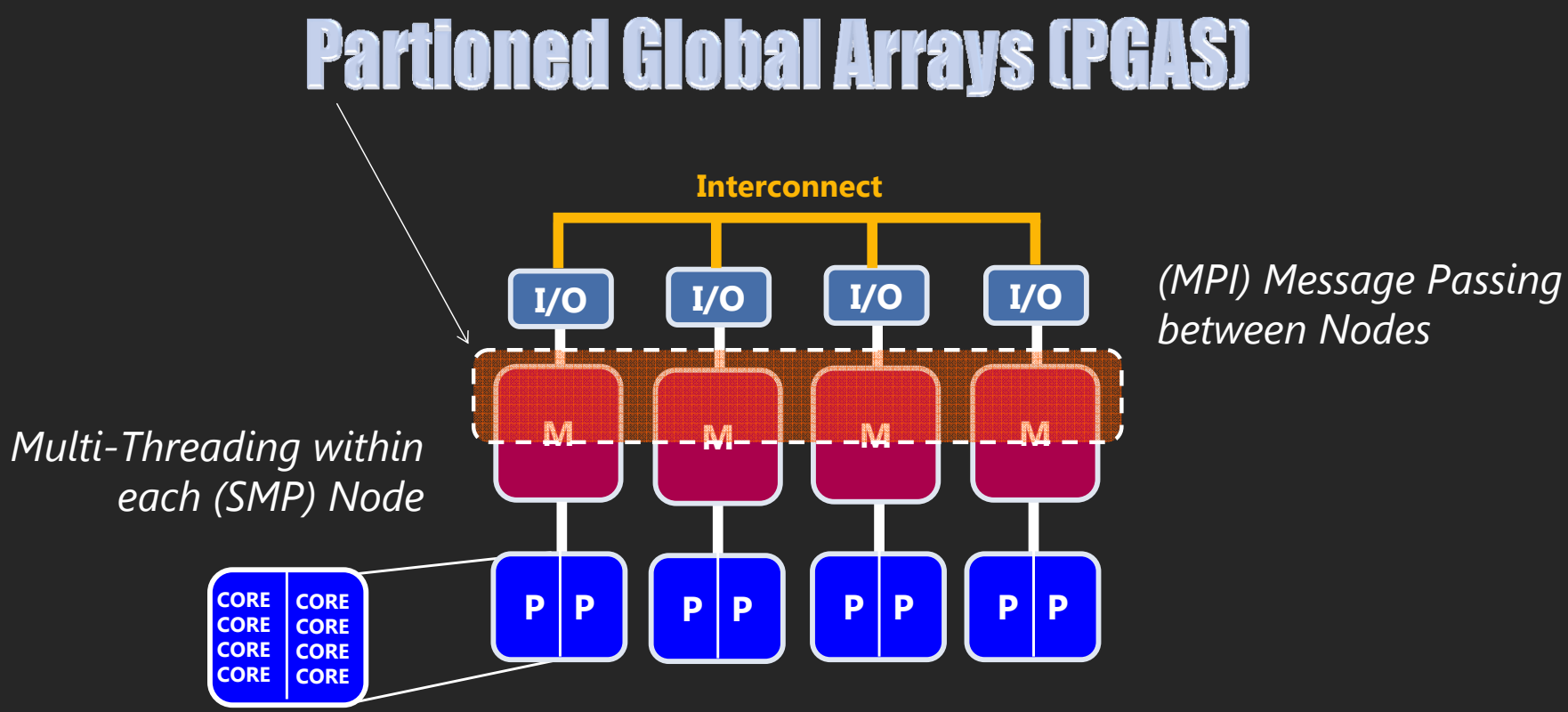
HPC Architecture



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Some (HPC) Technology Trend Predictions

Processor #Cores	2 ▶ 4 ▶ 8 ▶ O(10) ▶ O(100)
SIMD	64b ▶ 128b ▶ 256b ▶ 512b
Memory	DDR2 ▶ DDR3 ▶ DDR4
I/O	PCI ▶ PCIe ▶ PCIe Gen2 ▶ PCIe Gen3
Storage	HDD ▶ SSD
Infiniband*	SDR ▶ DDR ▶ QDR ▶ EDR
GbE	0.1 ▶ 1 ▶ 10 ▶ 40 ▶ 100

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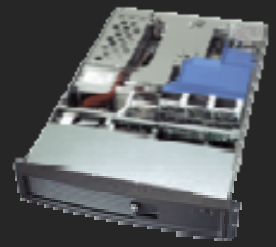
Levels of Parallelism

- Clustering
- Multi-Threading
- SIMD
- ILP



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Market Leading Software Development Tools

Intel Software Products

Message Passing
Multi-Threading
Vectorization
Optimization

Performance
Confidence
Analysis
Implementation

Performance | Compatibility | Support | Productivity | Cross-Platform

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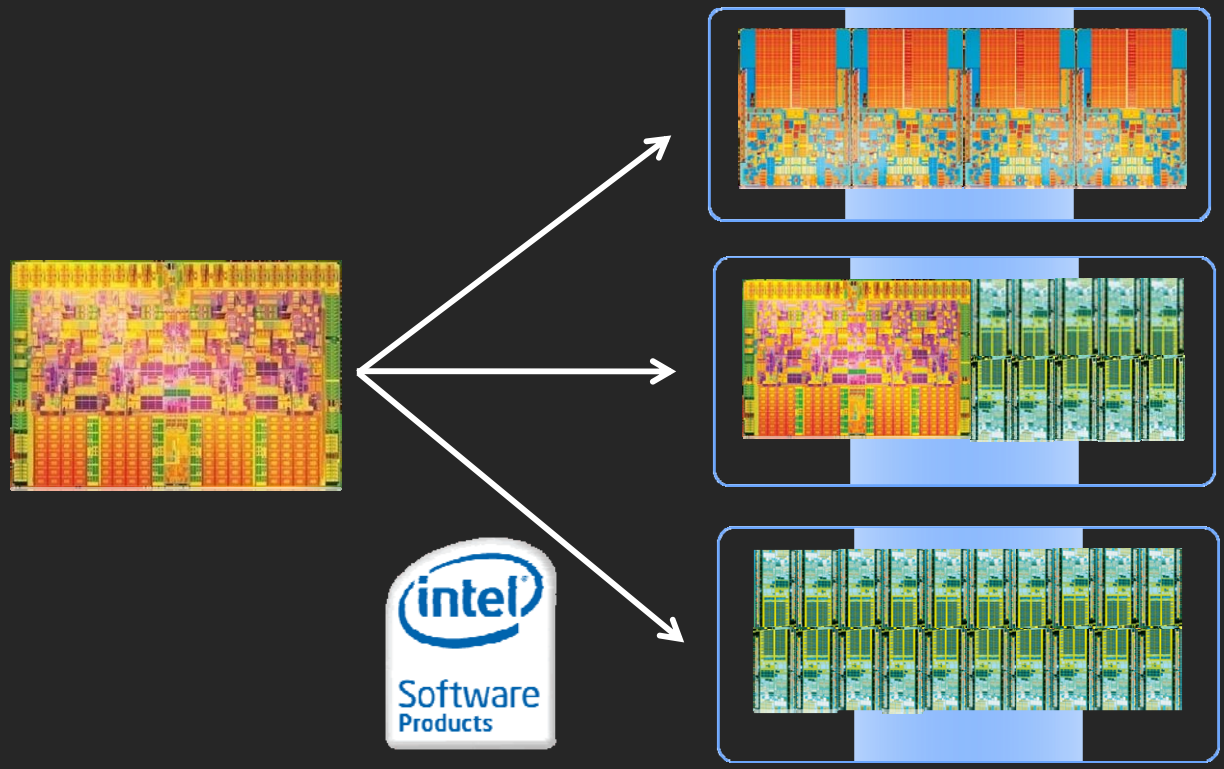
Forward Scaling Software Tools Vision



Employ uniform development tools across all architectures

Single Source Code Flexible Programmability

Data-Parallelism (SIMD)

Thread-Parallelism (MT)

Message Passing (MPI)

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Programming Languages - Ct hroughput

All Programs Become Parallel Programs

Beta in 2H09

User Writes Serial-Like
Core Independent C++ Code

Primary Data Abstraction is the Nested Vector
Supports Dense, Sparse, and Irregular Data

Ct Parallel Runtime:
Auto-Scale to Increasing Cores

Ct JIT Compiler:
Auto-vectorization, SSE, AVX, Larrabee

Programmer Thinks Serially; Ct Exploits Parallelism

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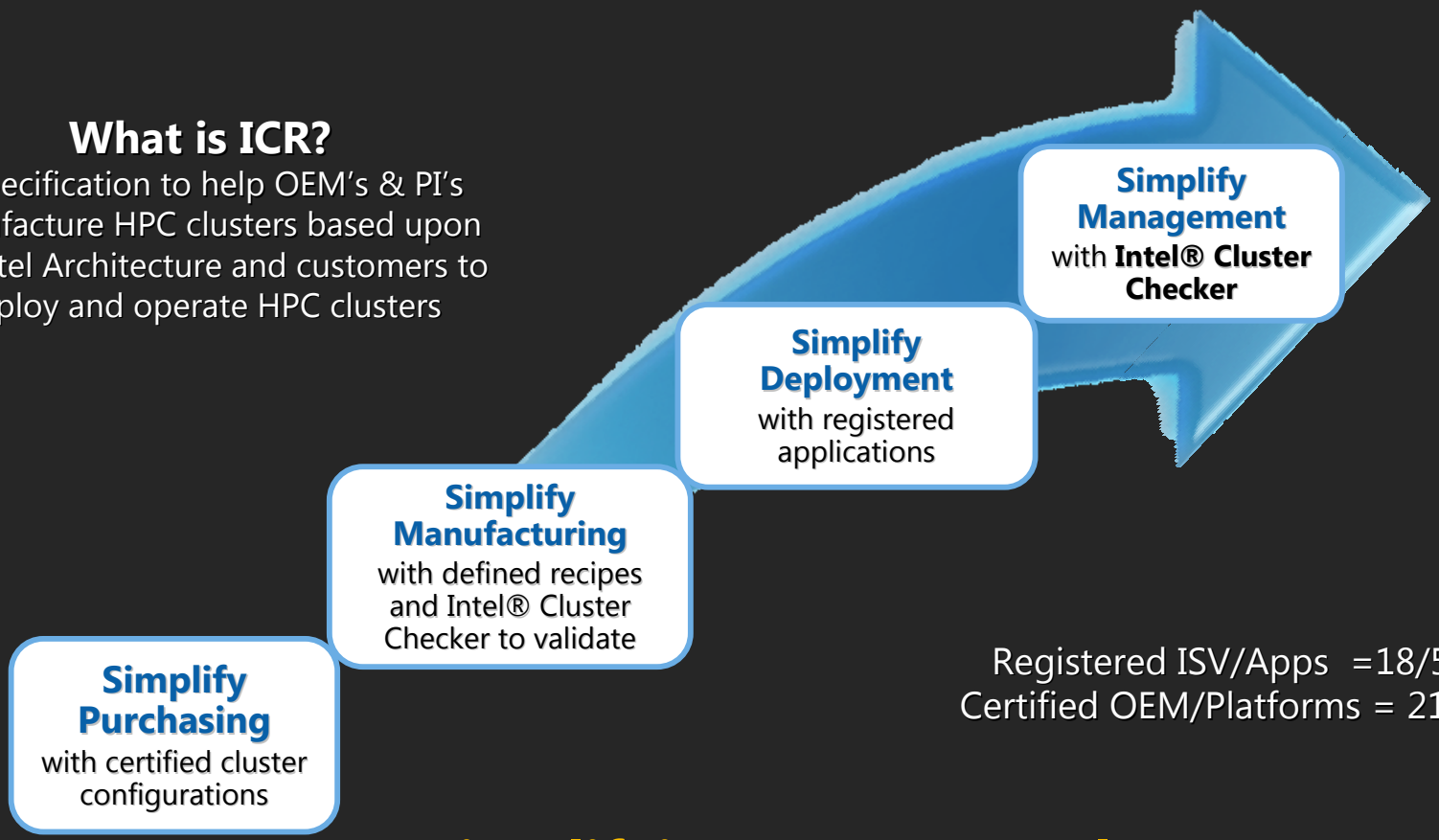
Intel® Cluster Ready Industry Program

What is ICR?

A specification to help OEM's & PI's manufacture HPC clusters based upon the Intel Architecture and customers to deploy and operate HPC clusters



Registered ISV/Apps =18/53
Certified OEM/Platforms = 21/89

Simplifying Your HPC-Cluster

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Solving Your HPC Challenges with Intel® Architecture

Intelligent Performance

- Large performance gains to decrease time to discovery
- Improved power technology to provide a more energy efficient data center solution

Software Versatility

- Easily optimize application performance and eliminate the need to increase software resources
- Develop highly portable and scalable parallel software

Deployment Ease of Use

- Certified cluster configurations to simplify cluster deployment

Scaling Performance Forward

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