# Тренинг "Программирование на Intel Xeon Phi"

## Современные тенденции разработки высокопроизводительных приложений

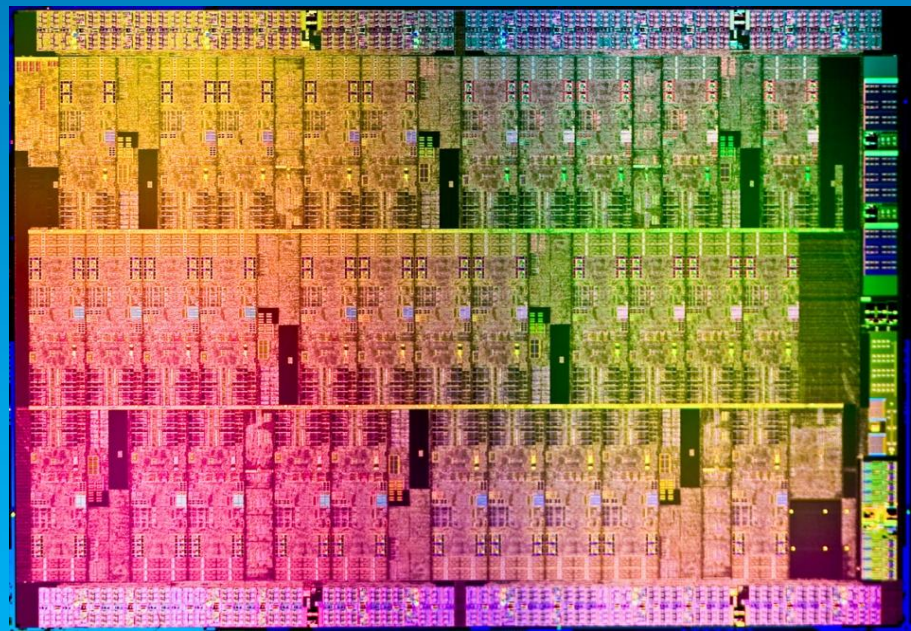
Игорь Одинцов, Intel

# 5 лет до экзафлопса. Что делать?

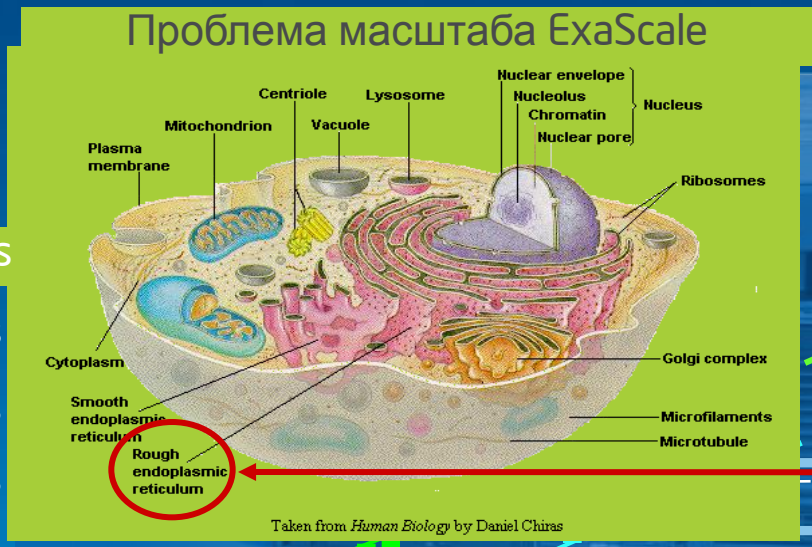
Вице-президент корпорации Intel Кирк Скауген: Предполагается, что мощность суперкомпьютера преодолеет отметку в 1 экзафлопс в 2018 г.

2018

2013



# Проблемы и задачи




1 ZFlops
100 EFlops
10 EFlops
1 EFlops
100 PFlops
10 PFlops
1 PFlops
100 TFlops
10 TFlops
1 TFlops
100 GFlops
10 GFlops
1 GFlops
100 MFlops

Сумма
Of Top500

№1

Что можно моделировать сегодня ~100TF

Примеры задач:

- Полное моделирование поведения самолета
- Использование знаний о геноме в медицине
- Исследование Большого Взрыва Вселенной
- Синтетические топлива
- Точное моделирование и прогноз погоды

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

1993 1999 2005 2011 2017 2023 2029

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# Кто получает преимущество от параллелизма?

3D Modeling & Visualization

Bioinformatics

Broadcast & Film

Database Search & Business Intelligence

Digital Content Creation

Defense & Security

Engineering Design

Energy

Financial Analytics

Game Development

GIS & Satellite Imagery

Medical Imaging & Analysis

Science & Research

Signal Processing

Telecommunications

# HPC: Not an Optional Investment

*To Compete You Must Compute.*

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# Высокопроизводительные вычисления и **компьютерный континуум**

**суперкомпьютеры**

**центры обработки данных**

**облачные среды**

intel inside CORE

intel Atom inside

**ЭНЕРГОЭФФЕКТИВНАЯ ПРОИЗВОДИТЕЛЬНОСТЬ**

**БЕЗОПАСНОСТЬ И ЗАЩИТА ДАННЫХ**

**ИНТЕРНЕТ-ДОСТУП И СЕТЕВАЯ СРЕДА**

**десктопы** **ноутбуки** **нетбуки** **планшеты** **смартфоны** **«умные» телевизоры** **встроенные устройства**

Мы работаем
ПО ЗАКОНУ МУРА
Больше функциональных возможностей
для новых устройств,
контроль энергопотребления,
себестоимости и размера
180 nm
1999
130 nm
2001
90 nm
2003
65 nm
2005
45 nm
2007
32 nm
2009
22 nm
2011
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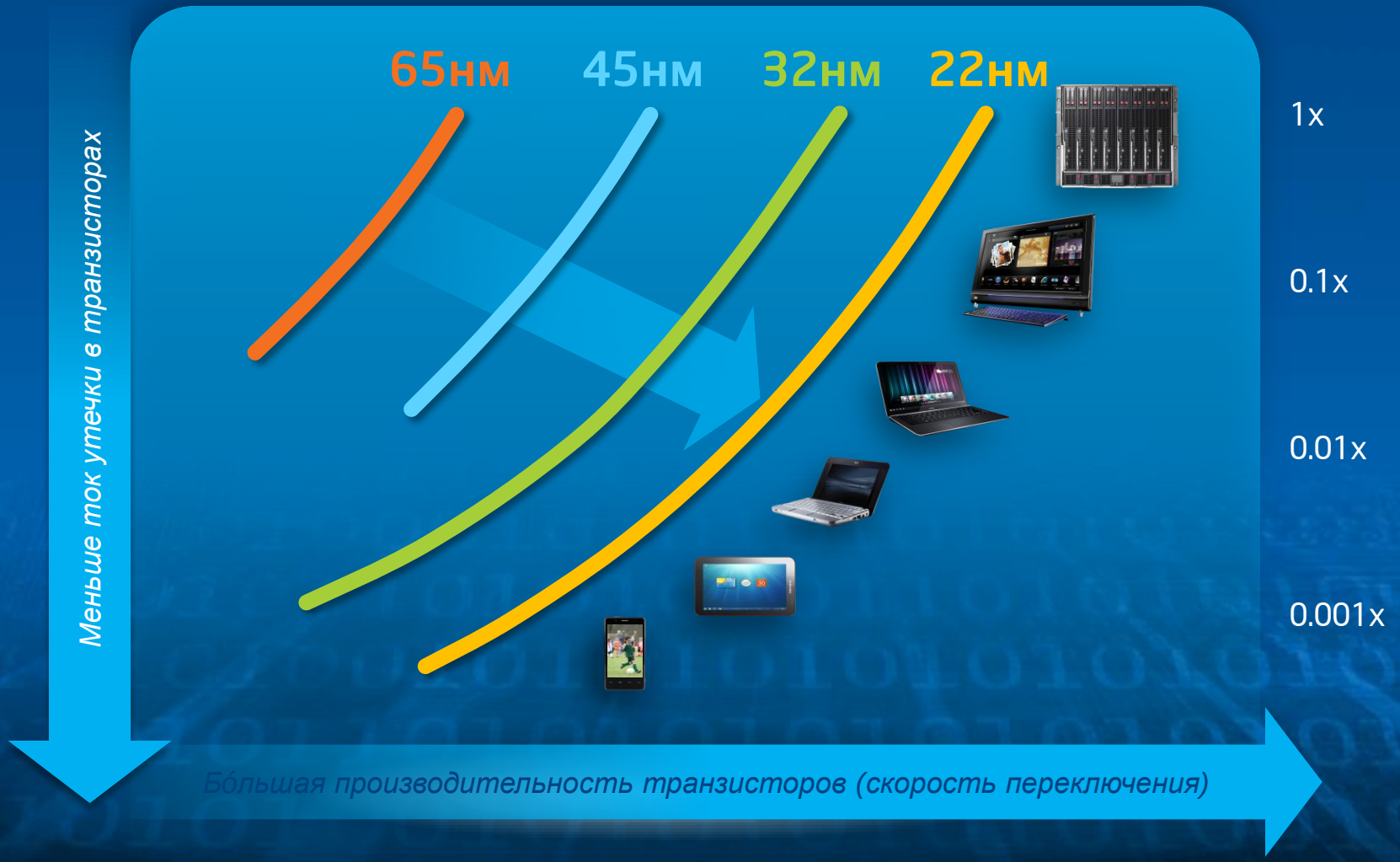
# Самый передовой технологический процесс



# Инвестиции Intel в производство

## Модернизация фабрик под 22нм процесс

**D1D/D1C**
Орегон

Фабрика №**32/12**
Аризона

Фабрика №28
Израиль

## *Новые фабрики по* техпроцессу 14нм и менее

**D1X**
Орегон

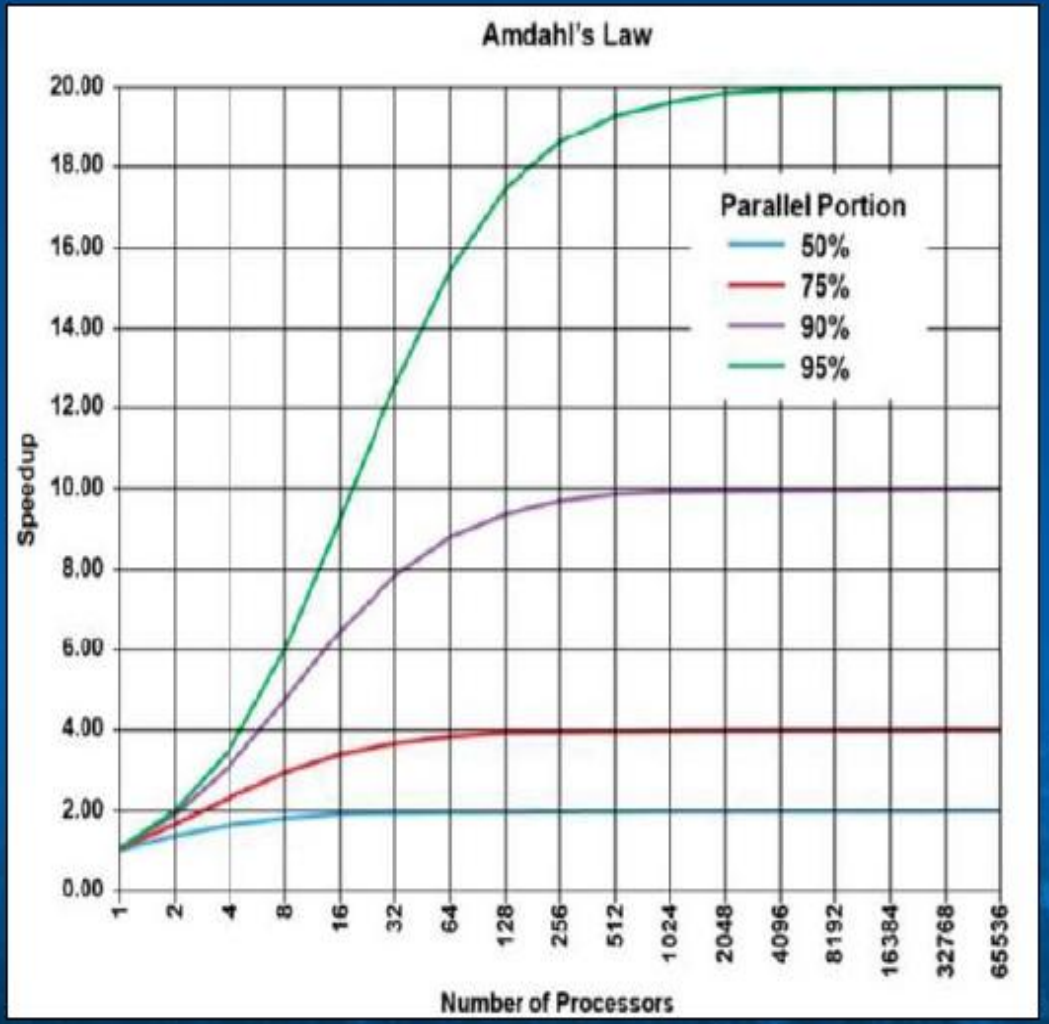
Фабрика №**42**
Аризона

Фабрика №**24**
Израиль

# To Compute ...

# you must have the Right Architecture

"The speedup of a program using multiple processors in parallel computing is limited by the sequential fraction of the program."
*- Gene Amdahl*

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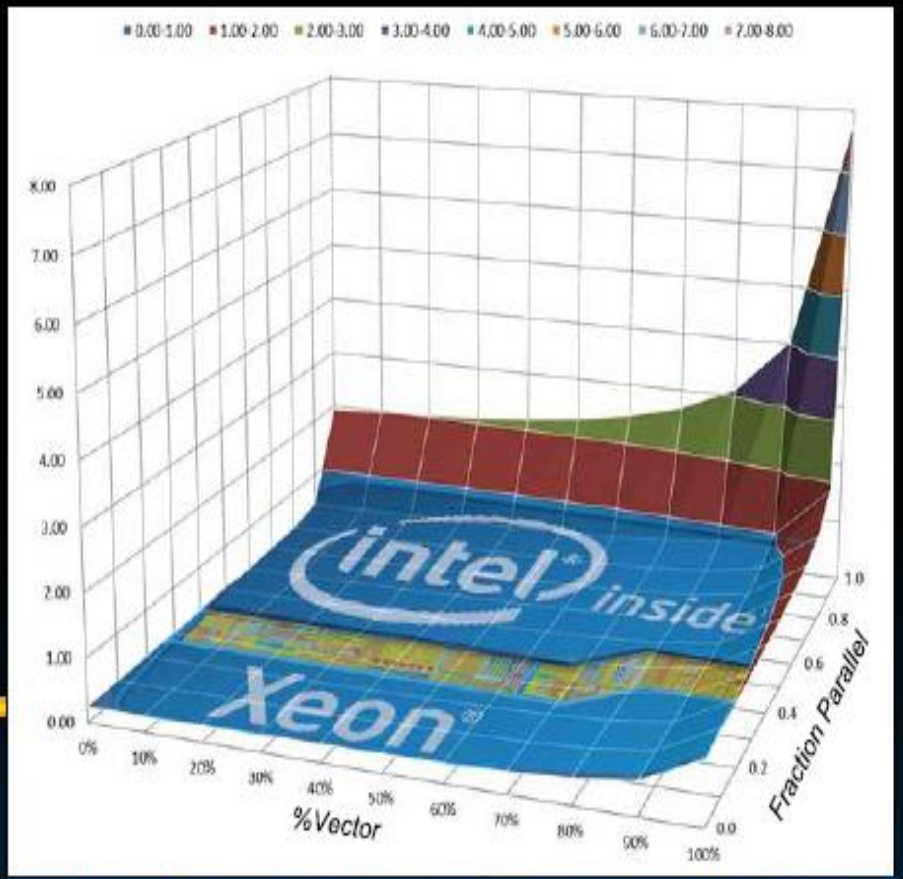
# Xeon: Most Commonly Used Parallel Processor

Parallel, Fast Serial
Multicore & Vector
2X Cadence through Haswell
Leadership Today and Tomorrow

**Intel® Xeon® E5 Processor's**
**Parallel Features**
**Make It Ideal For Most HPC Applications**




Theoretical acceleration of a highly parallel processor over a Intel® Xeon® parallel processor (<1Intel® Xeon® faster)

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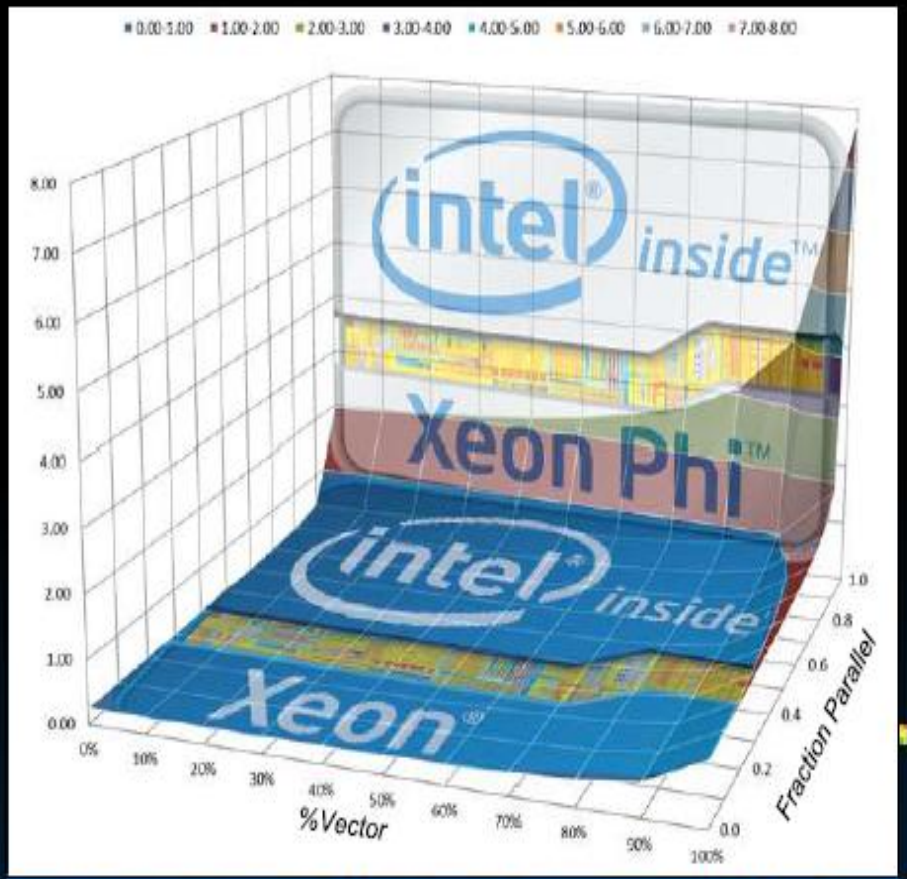
# Highly Parallel Applications and Processors




Theoretical acceleration of a highly parallel processor over a Intel® Xeon® parallel processor (<1Intel® Xeon® faster)

intel inside
Xeon Phi

Many-Core Coprocessor
Wider SIMD16 Vector Instructions
Up to 8X increase in Theoretical Performance
Designed for Reliability In Large Systems

**It's the Highly Vectorizable Applications that Benefit from Highly Parallel Architecture**

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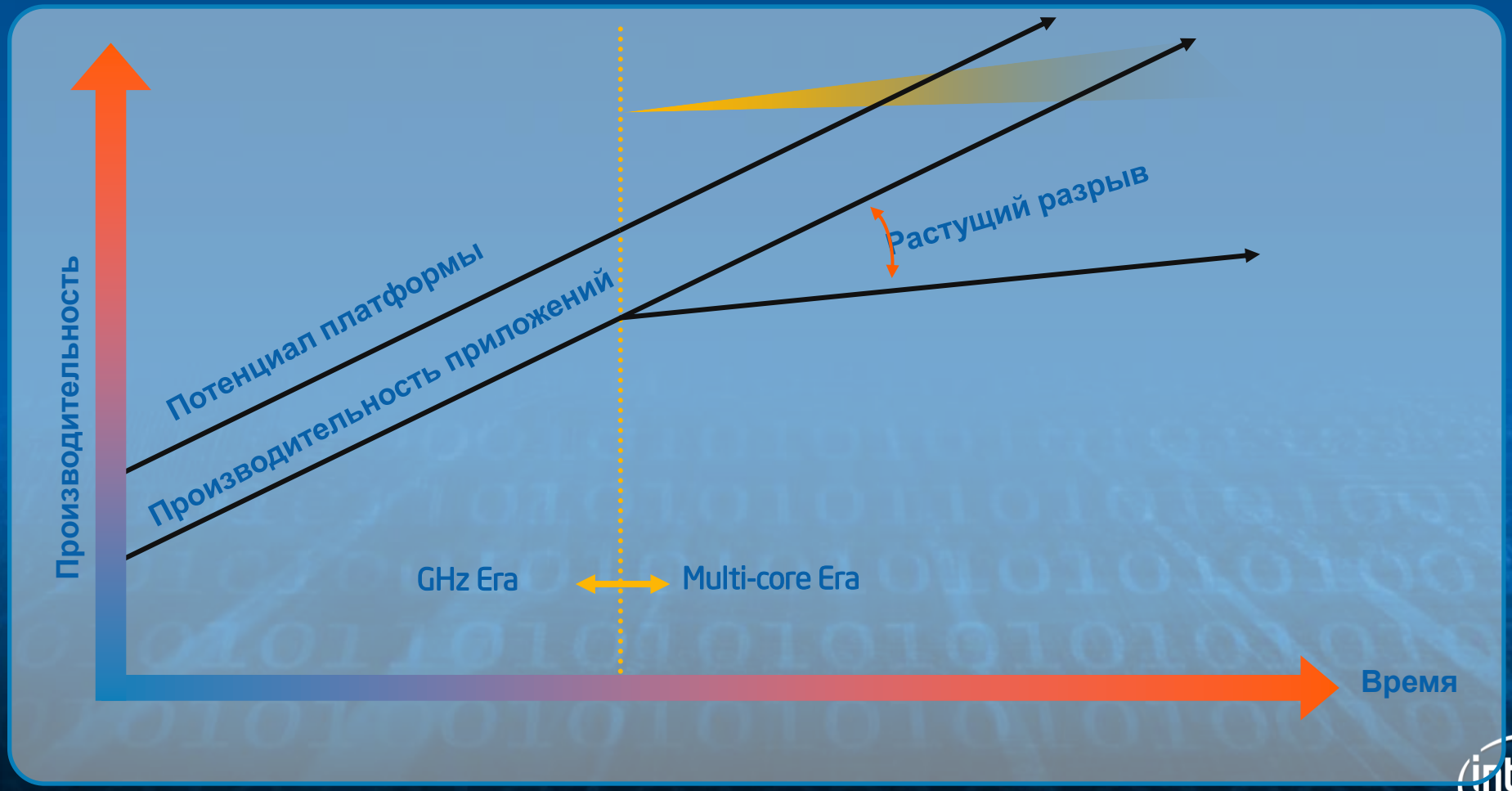
# Многоядерные процессоры нуждаются в параллельных приложениях



# Intel's Assets for HPC

## Processors
*Intel® Xeon® Processor*

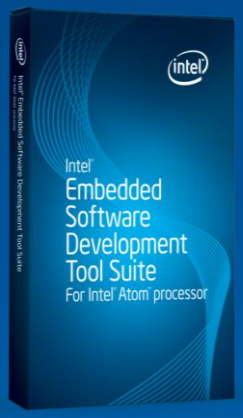
## Co-Processor
*Intel® Many Integrated Core*

## Fabrics

## Software & Services

## Storage

# Intel Development Tools for Diverse Needs



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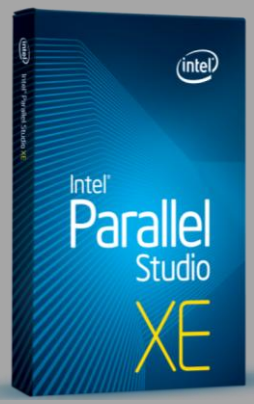
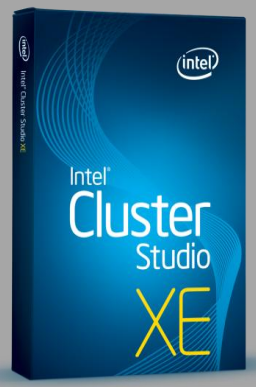
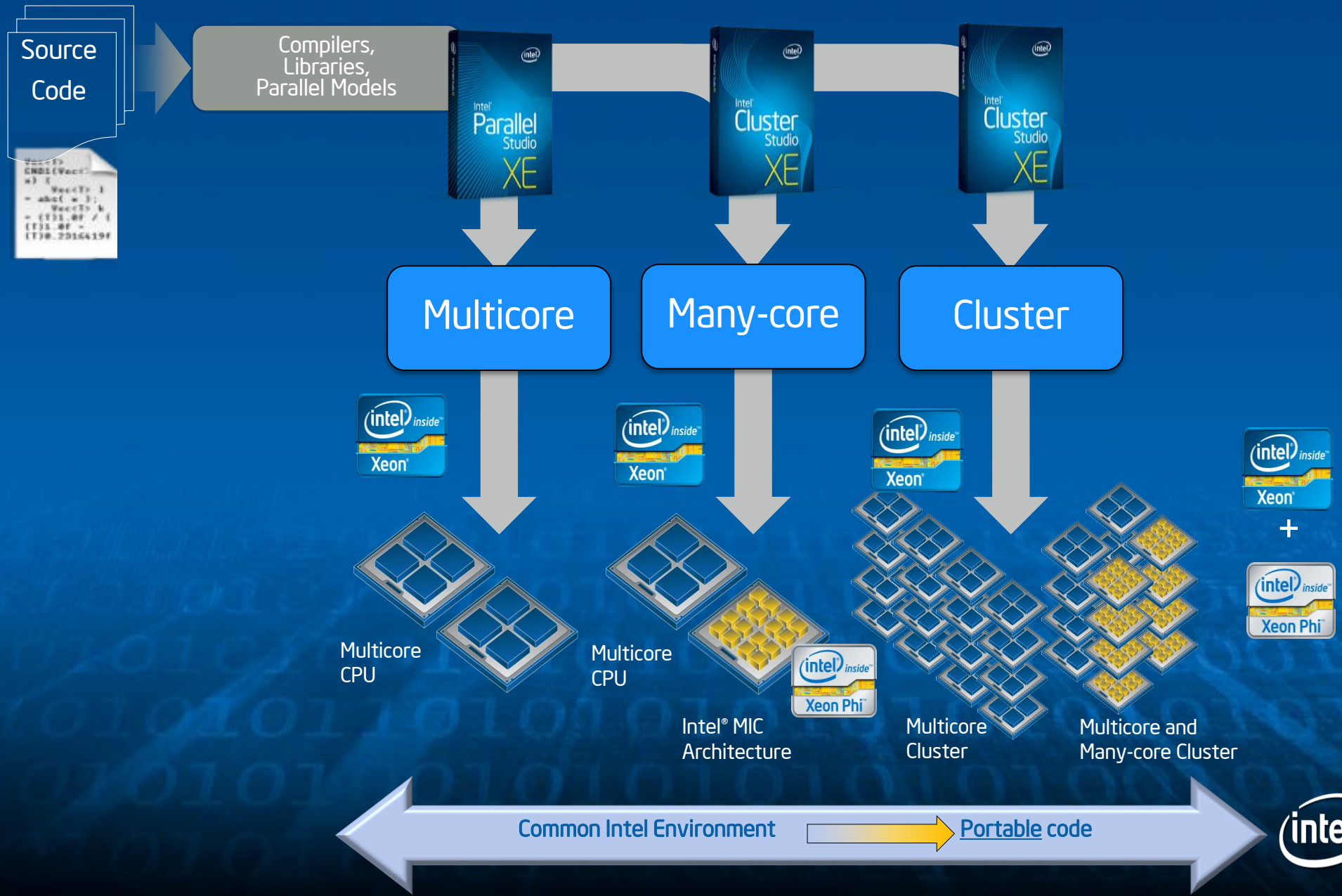


**Shared Memory**



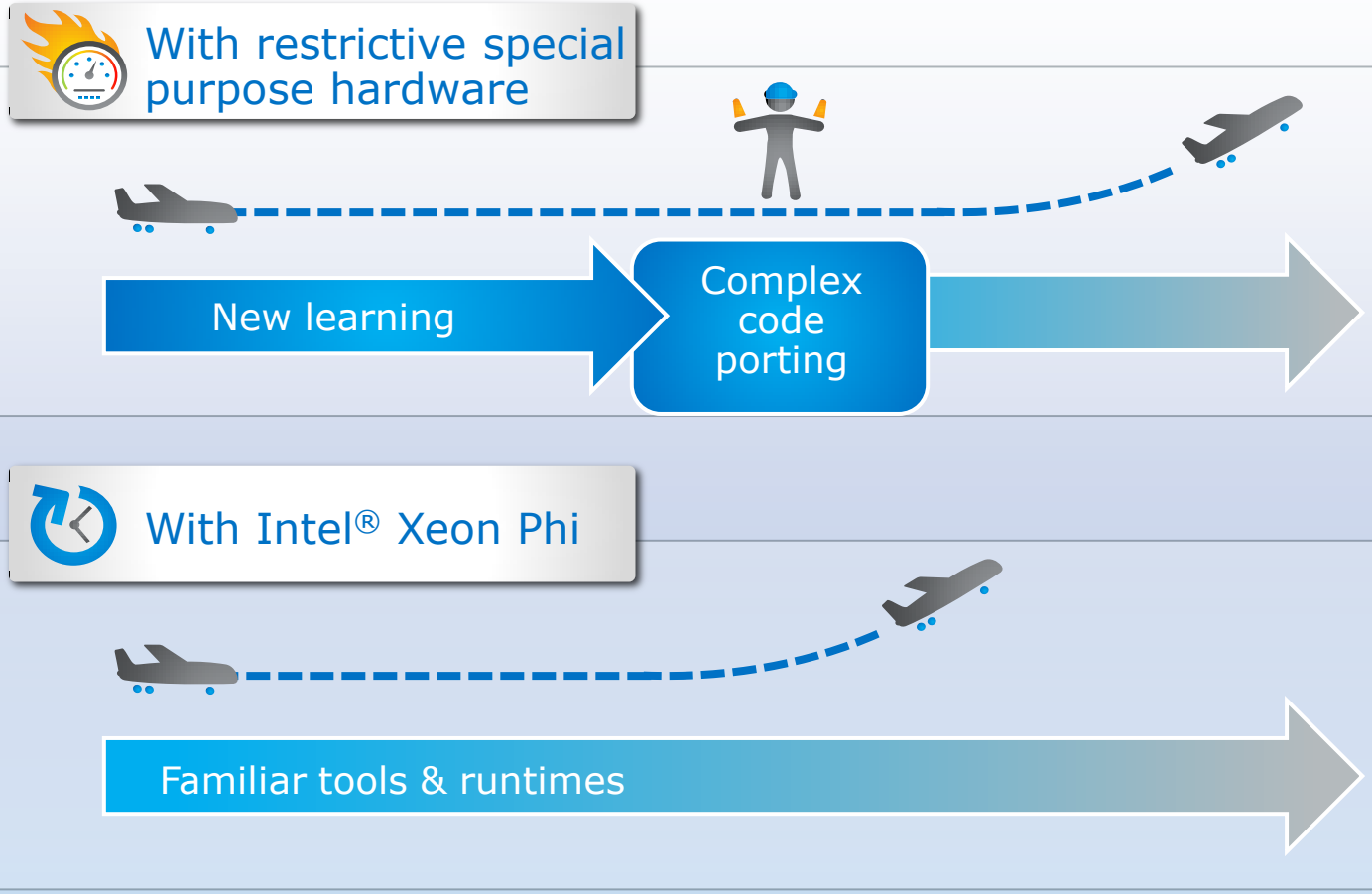
**MPI HPC-Cluster**

# One Source Base ---- Tuned to many Targets



# Intel® Xeon Phi™ - Game Changer for HPC

*Build your applications on a known compute platform…*
*and watch them take off sooner.*

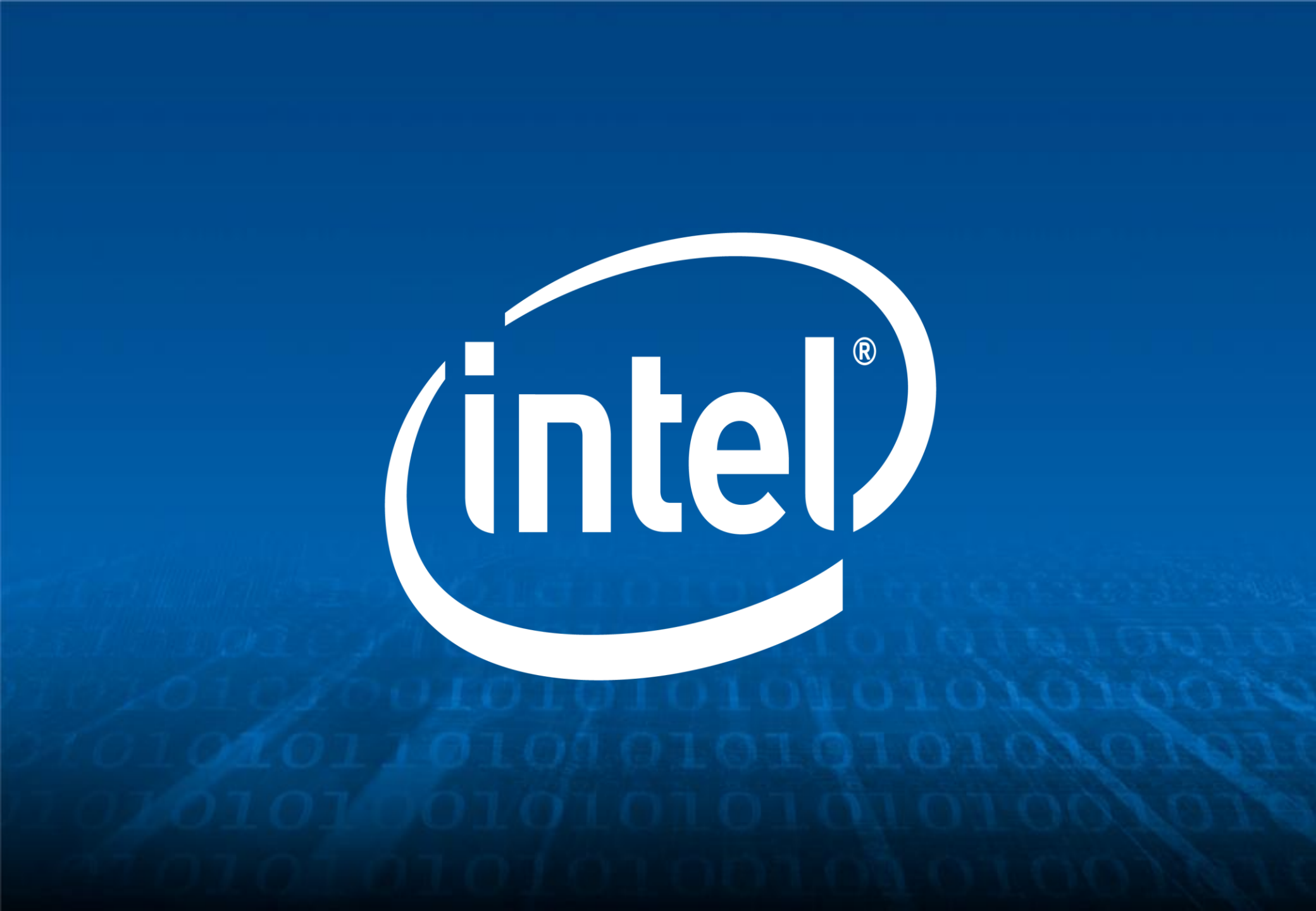



**"We ported millions of lines of code in only days and completed accurate runs. Unparalleled productivity…
most of this software does not run on a GPU and never will".**

*— Robert Harrison,*
*National Institute for Computational Sciences, Oak Ridge National Laboratory*

[7] Harrison, Robert. "Opportunities and Challenges Posed by Exascale Computing—ORNL's Plans and Perspectives." National Institute of Computational Sciences (NICS), 2011.

# План сегодняшнего тренинга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