



**INTEL<sup>®</sup>  
EXPERIENCE  
DAY**



# ОБЗОР АРХИТЕКТУРЫ ПРОЦЕССОРОВ INTEL<sup>®</sup> CORE<sup>™</sup> 10-ГО ПОКОЛЕНИЯ

## ДОРОЖНАЯ КАРТА ПО ВЫПУСКУ МОБИЛЬНЫХ ПРОЦЕССОРОВ

НИКОНОВ ВЛАДИСЛАВ  
29 10 2019

# ОТКАЗ ОТ ОТВЕТСТВЕННОСТИ

МАТЕРИАЛЫ ПРЕДОСТАВЛЯЮТСЯ ПО ПРИНЦИПУ "КАК ЕСТЬ", БЕЗ КАКИХ-ЛИБО ЯВНЫХ ИЛИ ПОДРАЗУМЕВАЕМЫХ ГАРАНТИЙ, ВКЛЮЧАЯ, В ЧИСЛЕ ПРОЧЕГО, ГАРАНТИЙ В ОТНОШЕНИИ ИХ РЫНОЧНЫХ КАЧЕСТВ, НАРУШЕНИЯ ПРАВ НА ИНТЕЛЛЕКТУАЛЬНУЮ СОБСТВЕННОСТЬ ИЛИ ПРИГОДНОСТИ К ИСПОЛЬЗОВАНИЮ В ТЕХ ИЛИ ИНЫХ КОНКРЕТНЫХ ЦЕЛЯХ. НИ ПРИ КАКИХ ОБСТОЯТЕЛЬСТВАХ КОРПОРАЦИЯ INTEL ИЛИ ЕЕ ПОСТАВЩИКИ НЕ НЕСУТ КАКОЙ-ЛИБО ОТВЕТСТВЕННОСТИ ЗА УЩЕРБ (ВКЛЮЧАЯ, В ЧИСЛЕ ПРОЧЕГО, УПУЩЕННУЮ ВЫГОДУ, ПОСЛЕДСТВИЯ ПРИОСТАНОВКИ ПРЕДПРИНИМАТЕЛЬСКОЙ ДЕЯТЕЛЬНОСТИ ИЛИ ПОТЕРЮ ДАННЫХ), ВЫТЕКАЮЩИЙ ИЗ ФАКТА ИСПОЛЬЗОВАНИЯ МАТЕРИАЛОВ, ЛИБО НЕВОЗМОЖНОСТИ ИХ ИСПОЛЬЗОВАТЬ, ЧТО РАСПРОСТРАНЯЕТСЯ И НА ТЕ СЛУЧАИ, КОГДА КОРПОРАЦИЯ INTEL БЫЛА ПРЕДУПРЕЖДЕНА О ВОЗМОЖНОСТИ НАНЕСЕНИЯ ТАКОГО УЩЕРБА. УЧИТЫВАЯ, ЧТО ЗАКОНОДАТЕЛЬСТВО, ДЕЙСТВУЮЩЕЕ В РЯДЕ ЮРИСДИКЦИЙ, НЕ ДОПУСКАЕТ ОГРАНИЧЕНИЯ ИЛИ ОТКАЗА ОТ ОТВЕТСТВЕННОСТИ ЗА ПОБОЧНЫЙ ИЛИ КОСВЕННЫЙ УЩЕРБ, ИЗЛОЖЕННОЕ ВЫШЕ ПОЛОЖЕНИЕ МОЖЕТ К ВАМ НЕ ОТНОСИТЬСЯ.

Корпорация Intel и ее поставщики не гарантируют точности или полноты текстовой или графической информации, ссылок и иного содержания материалов. Корпорация Intel вправе в любое время и без предварительного уведомления вносить любые изменения в указанные материалы, а равно и в продукцию, описанием которой они служат. Корпорация Intel не берет на себя каких-либо обязательств по обновлению материалов. Информация о тестах производительности предназначена исключительно для специалистов в области компьютерной техники и программного обеспечения, обладающих соответствующими техническими знаниями. Покупателям при приобретении компьютерных систем или компонентов помимо производительности следует также учитывать и иные характеристики соответствующих систем и компонентов. Тесты производительности и рейтинги измерены на конкретных компьютерных системах и/или компонентах и отражают приблизительную производительность продуктов корпорации Intel в единицах данных тестов. Любое отличие в аппаратных или программных компонентах или конфигурации может повлиять на результаты измерений. Дополнительную информацию по тестам производительности и производительности продуктов корпорации Intel можно узнать по адресу:

[http://www.intel.com/performance/resources/benchmark\\_limitations.htm](http://www.intel.com/performance/resources/benchmark_limitations.htm) Тесты третьих сторон. Корпорация Intel не контролирует и не проверяет проведение и результаты тестов третьих сторон или публикации результатов тестов в интернете на которые есть ссылки в этой презентации. Корпорация Intel предлагает всем заинтересованным посетить указанные интернет-страницы и убедиться в том что данные тестов точно отражают производительность систем предлагаемых на рынке.

# Intel® Mobile Product Roadmap

**Legends:**

Kaby Lake: KBL      Amber Lake: AML  
 Coffee Lake: CFL      Gemini Lake: GLK  
 Whiskey Lake: WHL      Cherry Trail: CHT  
 Comet Lake: CML

	2018				2019
	Q4'18	Q1'19	Q2'19	Q3'19	Q4'19
<b>H Processors</b>	CFL-H 45W "K", up to 6C, Intel® UHD Graphics 8		CFL-H82 (Refresh) 45W "K", up to 8C, 24EU 9		
<b>G Processors</b>	KBL-G <sup>2</sup> 65W/100W, 4C, Radeon * RX Vega M Graphics 8				
<b>U Processors</b>	CFL-U 28W, up to 4C, Intel® Iris™ Plus Graphics 8		ICL-U, 15W, up to 4C, up to 64EU, Supports DDR4 & LPDDR4x, WiFi6, Integrated Thunderbolt™ 3 10		
	WHL-U 15W, Up to 4C, 24EU 8		CML-U v1, DDR4/LP3 15W, up to 6C, up to 24EU, Supports DDR4 & LPDDR3 10		
	KBL-R 15W, 4C/2C, Intel® UHD Graphics 8				
	KBL-U 15W, 2C, Intel® HD Graphics 7				
<b>Y Processors</b>	AML-Y22 5W, 2C, 24EU 8		AML-Y42 ~7W, up to 4C, up to 24EU 10		ICL-Y, 9W, up to 4C, up to 64EU 10
<b>N Processors</b>	GLK 6W, up to 4C				

# 10<sup>Е</sup> ПОКОЛЕНИЕ ПРОЦЕССОРОВ INTEL® CORE™

## ВСЕ КОДОВЫЕ ИМЕНА

ICL U/Y-series

10th Gen Intel®  
Core™ i3/i5/i7  
processor

AML 4+2 Y-series

10th Gen Intel®  
Core™ i3/i5/i7  
processor

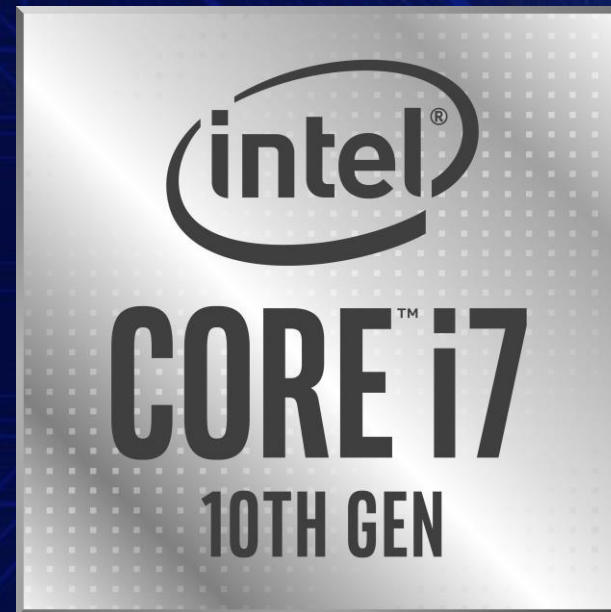
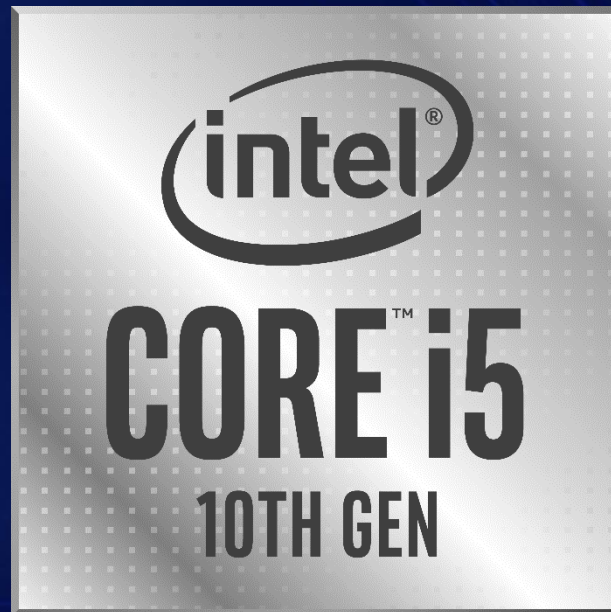
CML U-series

10th Gen Intel®  
Core™ i3/i5/i7  
processor

10th Gen or 10th Generation is approved usage

\*H-series and S-series will continue to offer Intel® Xeon® workstation processors

# ПРОЦЕССОРЫ INTEL CORE 10-ГО ПОКОЛЕНИЯ



**INTELLIGENT PERFORMANCE**

**STUNNING ENTERTAINMENT**

**BEST CONNECTIVITY**

# ПРОЦЕССОРЫ С КОДОВЫМ ИМЕНЕМ ICE LAKE

**НОВЫЕ  
ТРАНЗИСТОРНЫЕ  
ТЕХНОЛОГИИ**

**НОВАЯ  
АРХИТЕКТУРА  
ЯДРА И ГРАФИКИ**

**НОВЫЕ  
ВОЗМОЖНОСТИ  
ИНТЕГРАЦИИ**

**СОВЕРШЕННО НОВАЯ ПЛАТФОРМА ДЛЯ САМЫХ СОВРЕМЕННЫХ В МИРЕ НОУТБУКОВ**

# ЭВОЛЮЦИЯ АРХИТЕКТУРЫ INTEL CORE



2006

**MEROM**

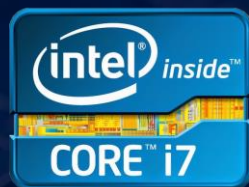
65nm



2008

**NEHALEM**

45nm



2011

**SANDY BRIDGE**

32nm



2013

**HASWELL**

22nm



2015

**SKY LAKE**

14nm



2019

**ICE LAKE**

10nm



# ПРЕДСТАВЛЯЕМ ICE LAKE: 10NM ПРОЦЕССОР

## NEW SUNNYCOVE CORES

Up to 4 Cores / 8 Threads  
Up to 4.1GHz

## NEW CONVERGED CHASSIS FABRIC

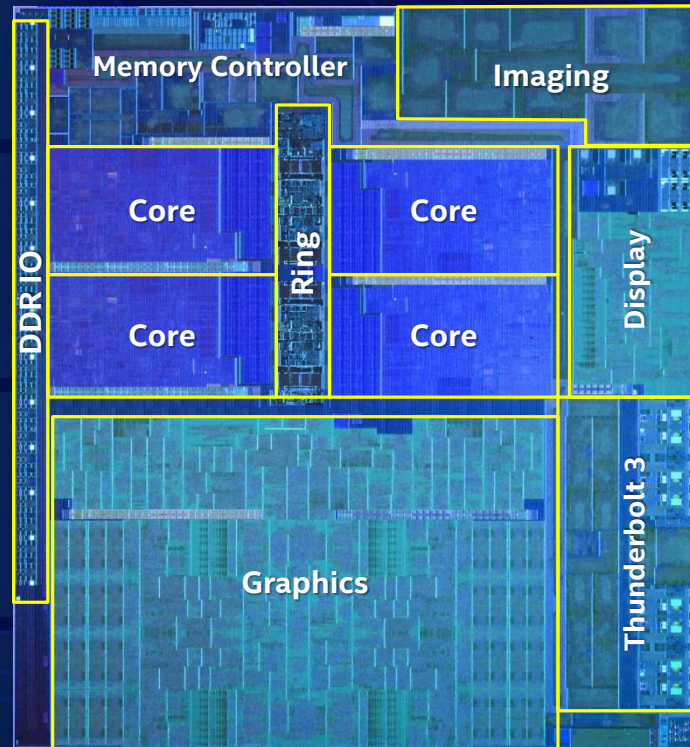
High Bandwidth / Low Latency  
IP and Core Scalable

## NEW MEMORY CONTROLLER

LP4/x-3733 4x32b up to 32GB  
DDR4-3200 2x64b up to 64GB

## FIRST INTEGRATED THUNDERBOLT™ 3

Full 4x DP/USB/PCIe mux on-die  
Up to 40Gbps bi-directional per port



## NEW GEN11 GRAPHICS

Up to 64EU and 1.1GHz  
>1TFLOP

## NEW 2X MEDIA ENCODERS

Up to 4K60 10b 4:4:4  
Up to 8K30 10b 4:2:0

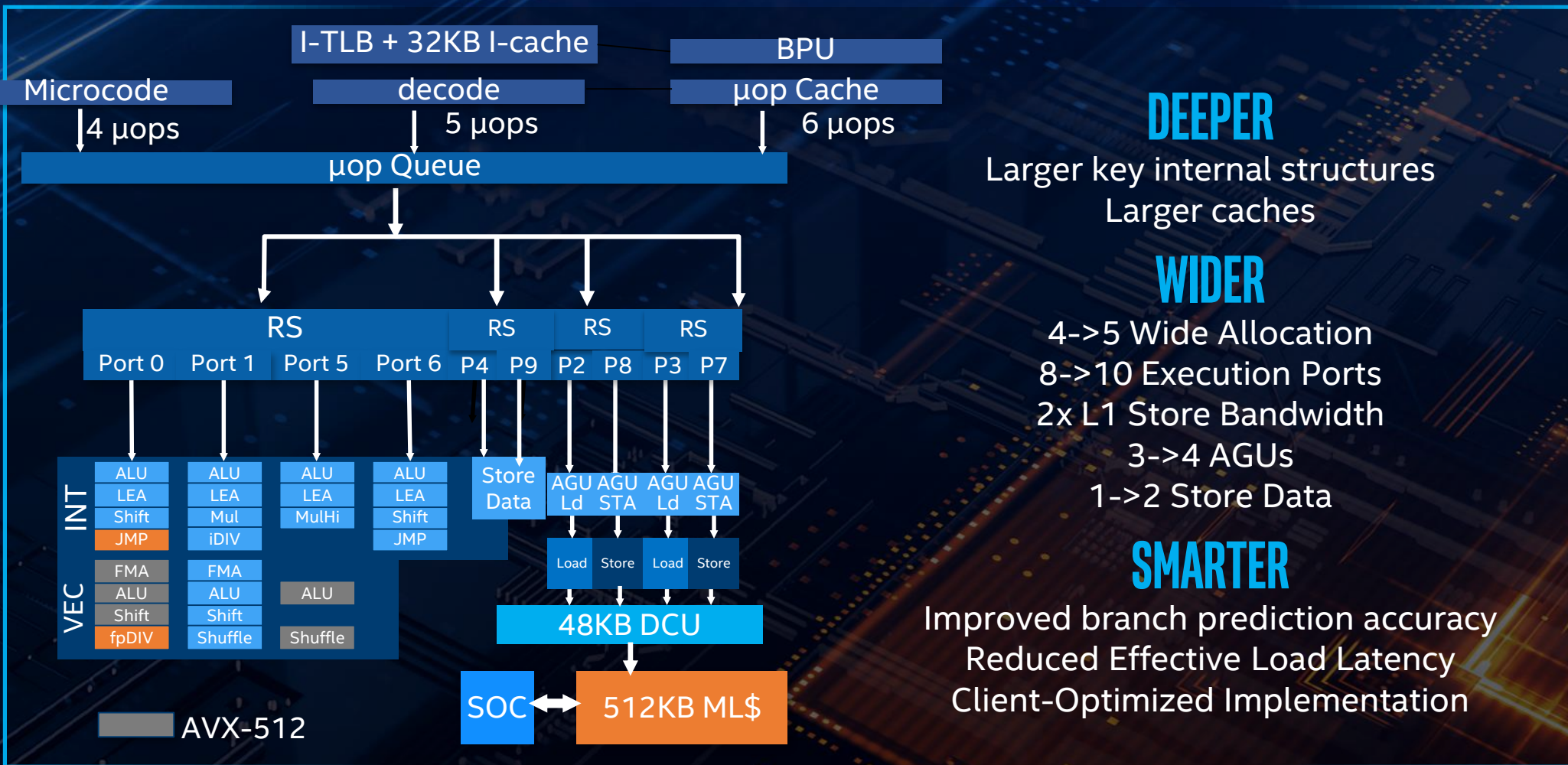
## NEW 3X DISPLAY PIPES

Up to 5K60 or 4K120  
DP1.4, BT.2020

## NEW IMAGE PROCESSING UNIT 4

Up to 16MP  
Up to 1080p120, 4K30

# SUNNYCOVE MICROARCHITECTURE



**DEEPER**

Larger key internal structures  
Larger caches

**WIDER**

4->5 Wide Allocation  
8->10 Execution Ports  
2x L1 Store Bandwidth  
3->4 AGUs  
1->2 Store Data

**SMARTER**

Improved branch prediction accuracy  
Reduced Effective Load Latency  
Client-Optimized Implementation

# SUNNYCOVE MICROARCHITECTURE

	HASWELL	SKY LAKE	ICE LAKE
L1 Data Cache	32KB	32KB	48KB
L2 Cache	256KB	256KB	512KB
L2 TLB	1024	1536 16 (1G)	2048 (4k) Shared 1024 for 2M/4M 1024 for 1G
$\mu$ op Cache	1.5K $\mu$ ops	1.5K $\mu$ ops	2.25K $\mu$ ops
OoO Window	182	224	352
In-Flight Loads	72	72	128
In-Flight Stores	42	56	72

## NEW CAPABILITIES

### New Instructions for Crypto Performance

- Big Number Arithmetic (IFMA)
- Vector AES ✓
- Vector Carryless Multiply
- Galois Field
- SHA

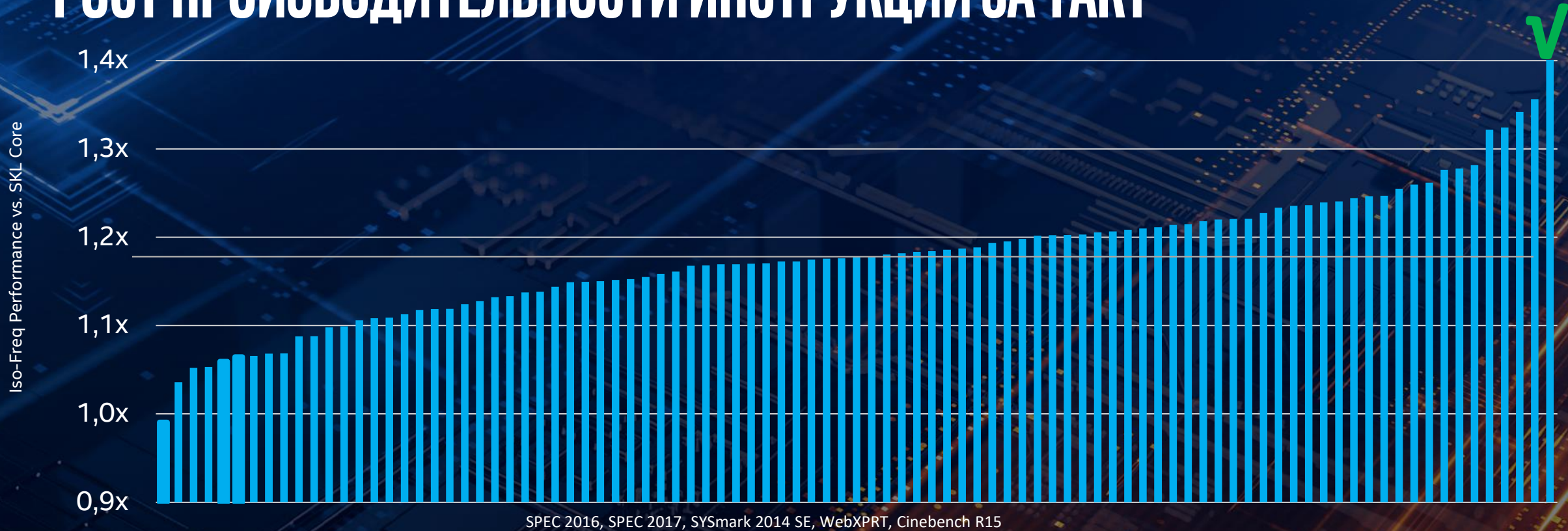
### Additional Vector Capabilities

- DLBoost – Inference Acceleration ✓
- VBMI (Permutates/Shifts)
- VBMI2 (Expand/Compress/Shifts)
- BITALG (POPCNT, Bit Shuffle)

### Security Features

- User Mode Instruction Prevention (UMIP)

# АРХИТЕКТУРА SUNNYCOVE: РОСТ ПРОИЗВОДИТЕЛЬНОСТИ ИНСТРУКЦИЙ ЗА ТАКТ



**18% IPC IMPROVEMENT<sup>1</sup>**

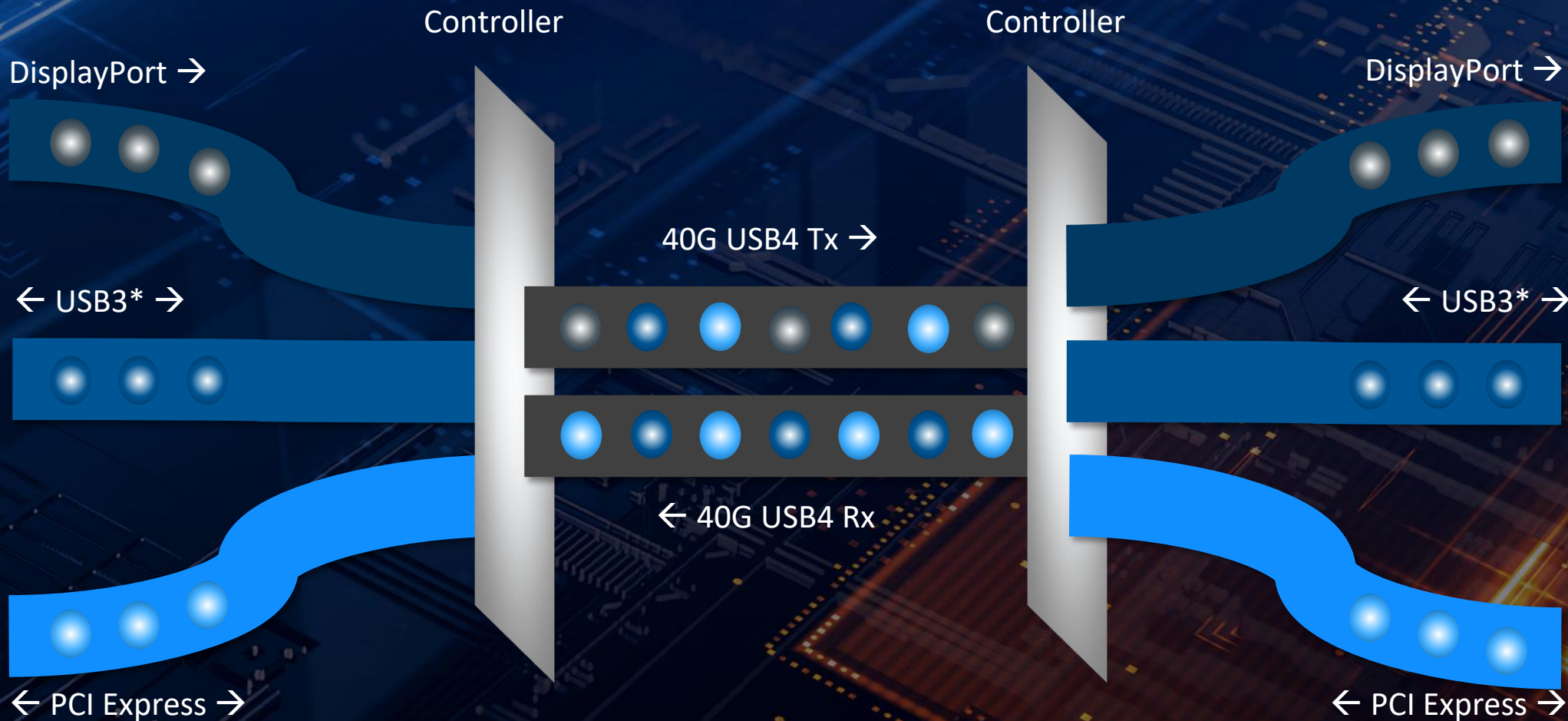
Geomean vs SKL Core

<sup>1</sup>Performance results are based on testing as of dates shown in configuration and may not reflect all publicly available security updates. See configuration disclosure for details. No product or component can be absolutely secure. Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more complete information visit [www.intel.com/benchmarks](http://www.intel.com/benchmarks).

# THUNDERBOLT™ 3

## САМЫЙ БЫСТРЫЙ И УНИВЕРСАЛЬНЫЙ ПРОТОКОЛ В МИРЕ

# 3В1



# НОВАЯ ГРАФИКА INTEL



Gaming &  
Community



Day Zero  
Game Support



Higher Mainstream  
and Enthusiast  
Performance



Immersive  
Entertainment



Content  
Creation



Artificial  
Intelligence



# ПРЕДСТАВЛЯЕМ ICE LAKE: 10НМ ПРОЦЕССОР

## New Sunnycove Cores

Up to 4 Cores / 8 Threads  
Up to 4.1GHz

## New Converged Chassis Fabric

High Bandwidth / Low Latency  
IP and Core Scalable

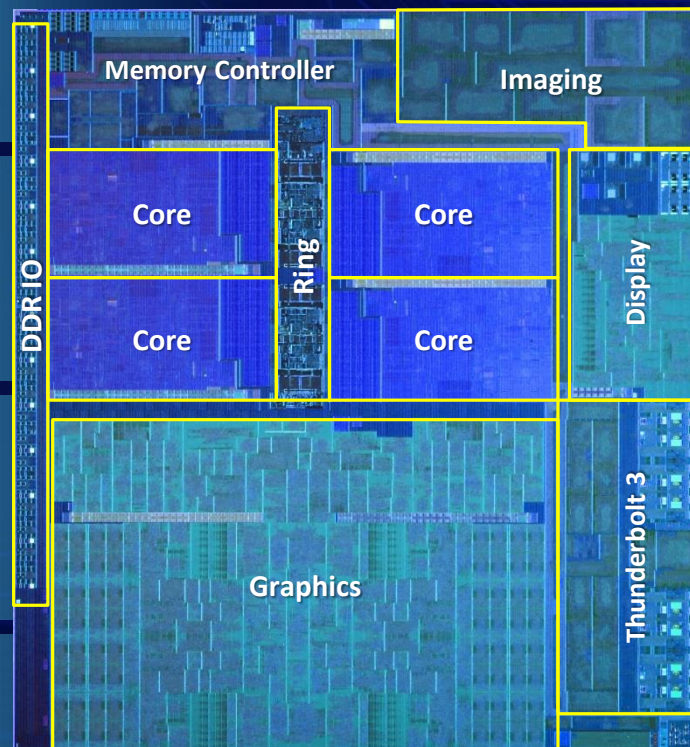
## New Memory Controller

LP4/x-3733 4x32b up to 32GB  
DDR4-3200 2x64b up to 64GB

## First Integrated Thunderbolt™

3

Full 4x DP/USB/PCIe mux on-die  
Up to 40Gbps bi-directional per port



## New Gen11 Graphics

Up to 64EU and 1.1GHz  
>1TFLOP

## New 2x MEDIA Encoders

Up to 4K60 10b 4:4:4  
Up to 8K30 10b 4:2:0

## New 3x Display Pipes

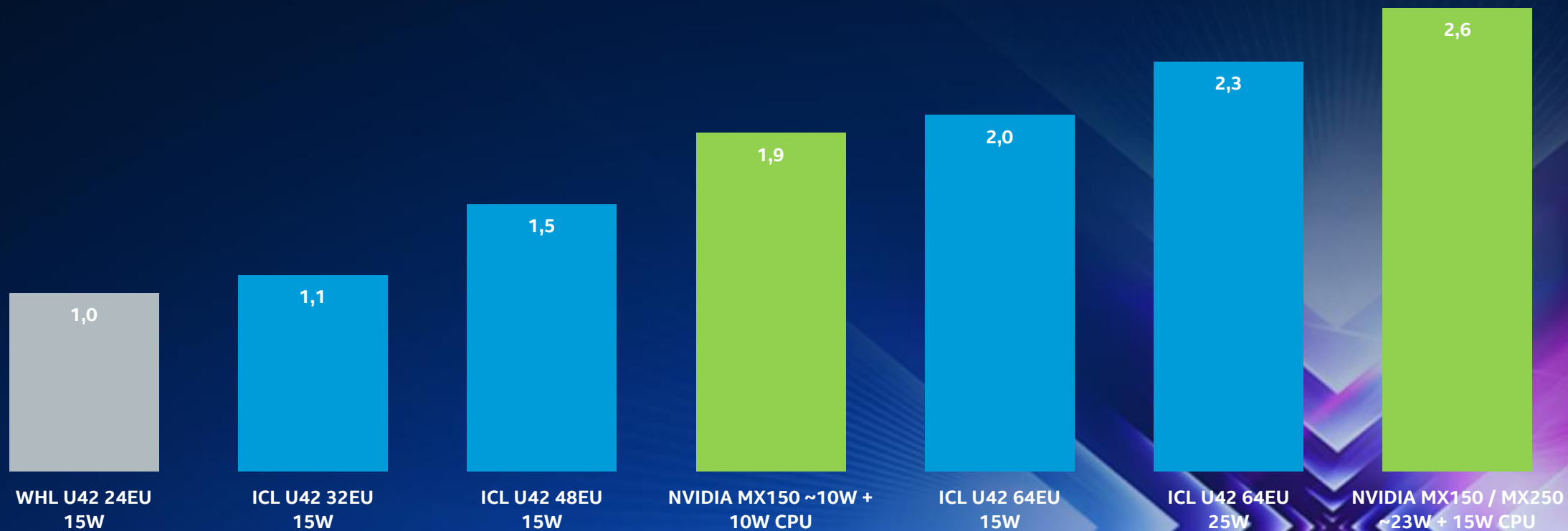
Up to 5K60 or 4K120  
DP1.4, BT.2020

## New Image Processing Unit 4

Up to 16MP  
Up to 1080p120, 4K30

# ЭВОЛЮЦИЯ ПРОИЗВОДИТЕЛЬНОСТИ ГРАФИКИ INTEL

Average 3DMark11 / Fire Strike (TGP)



128bit Memory Bus is Needed to Achieve Maximum Performance



# ПОТРЯСАЮЩИЕ ОСОБЕННОСТИ НОВОЙ ГРАФИКИ

Технология	Gen9	Gen11
Adaptive Sync	No	Yes
Decode / Encode	4K60	8K30
4K HEVC Encode Speed	1x	Up to 2x
Encode Quality / Compression	1.0x	Up to 1.3x
Codec Support	HEVC / AVC / VP9	HEVC / AVC / VP9
Color Compression / Bit Depth	4:2:0 10-bit	4:2:2 / 4:4:4 10-bit
HDR Support	Yes	Power Optimized
Display Pipes	3	3
Single Pipe Resolution	Up to 4K60	Up to 5K60 or 4K120

1.QSV HEVC performance expected to be 2x on Gen 11 vs KBL-R (Gen 9). Projections only.  
All ICL performance projections are preliminary and subject to change.

Software and workloads used in performance tests may have been optimized for performance only on Intel microprocessors. Performance tests, such as SYSmark and MobileMark, are measured using specific computer systems, components, software, operations and functions. Any change to any of those factors may cause the results to vary. You should consult other information and performance tests to assist you in fully evaluating your contemplated purchases, including the performance of that product when combined with other products. For more information go to [www.intel.com/benchmarks](http://www.intel.com/benchmarks)

Results have been simulated and are provided for informational purposes only. Results were derived using simulations run on an architecture simulator. Any difference in system hardware or software design or configuration may affect actual performance.

System Configurations: ICL Media performance is based on projections and subject to change. Gen 9 performance is based on KBL-R U42 system

# ВАРИАНТЫ ГРАФИКИ В ПРОЦЕССОРАХ ICE LAKE U/Y

Segment	CPU Brand	EU Count	Media Encoders	Graphics Brand
U 15W	i7-1065G7	64EU	2x	Intel® Iris® Plus Graphics
	i5-1035G7	64EU	2x	Intel® Iris® Plus Graphics
	i5-1035G4	48EU	2x	Intel® Iris® Plus Graphics
	i5-1035G1	32EU	1x	Intel® UHD Graphics
	i3-1005G1	32EU	1x	Intel® UHD Graphics
Y 9W	i7-1060G7	64EU	2x	Intel® Iris® Plus Graphics
	i5-1030G7	64EU	2x	Intel® Iris® Plus Graphics
	i5-1030G4	48EU	2x	Intel® Iris® Plus Graphics
	i3-1000G4	48EU	2x	Intel® Iris® Plus Graphics



# 10<sup>Е</sup> ПОКОЛЕНИЕ ПРОЦЕССОРОВ INTEL® CORE™ ВСЕ КОДОВЫЕ ИМЕНА

ICL U/Y-series

10th Gen Intel®  
Core™ i3/i5/i7  
processor

CML U-series

10th Gen Intel®  
Core™ i3/i5/i7  
processor







10th Gen or 10th Generation is approved usage

\*H-series and S-series will continue to offer Intel® Xeon® workstation processors

# CML U PROCESSOR KEY FEATURE ADVANCEMENTS

	Whiskey Lake (15W)		Comet Lake (CMLv1 and CMLv2) (15W)	
CPU	<ul style="list-style-type: none"> <li>14nm CPU / 14nm PCH</li> <li>SYSmark'14 SE: targeting 1.10x vs. KBL-R<sup>1</sup></li> </ul>	4 ядра	<ul style="list-style-type: none"> <li>14nm CPU / 14nm PCH</li> <li>targeting significant performance improvement over WHL U42</li> </ul>	6 ядер
GFX	<ul style="list-style-type: none"> <li>Gen 9 Intel Graphics; up to 24EU</li> <li>3DMark'11: parity with KBL-R U42<sup>1</sup></li> </ul>		<ul style="list-style-type: none"> <li>Gen 9 Intel Graphics; up to 24EU</li> <li>3DMark'11: parity with WHL U42<sup>1</sup></li> </ul>	
Memory	<ul style="list-style-type: none"> <li>DDR4 up to 2400, LP3 up to 2133</li> </ul>		<ul style="list-style-type: none"> <li>DDR4 up to 2667, LP3 up to 2133</li> <li>DDR4 up to 2667, LPDDR4x up to 2933 (only on CMLv2 U)</li> </ul>	✓
Imaging	<ul style="list-style-type: none"> <li>None – need to use USB camera</li> </ul>		<ul style="list-style-type: none"> <li>None – need to use USB camera</li> </ul>	
Media, Display, Audio	<ul style="list-style-type: none"> <li>HDMI1.4/HDCP2.2, DP 1.2</li> <li>Quad-Core Audio DSP for high fidelity, low power audio and multi-personal assistant supported Wake on Voice</li> </ul>		<ul style="list-style-type: none"> <li>HDMI1.4/HDCP2.3, DP 1.2</li> <li>Quad-Core Audio DSP for high fidelity, low power audio and multi-personal assistant supported Wake on Voice</li> </ul>	
I/O & Connectivity	<ul style="list-style-type: none"> <li>CNVi (integrated 802.11ac and BT5.0)</li> <li>Integrated USB 3.1 Gen 2 (10 Gbps)</li> <li>Thunderbolt™ 3: Titan Ridge w/ USB 3.1 &amp; DP1.4<sup>3</sup> or Alpine Ridge</li> </ul>		<ul style="list-style-type: none"> <li>CNVi (integrated 802.11ax and BT5.0)</li> <li>Integrated USB 3.1 Gen 2 (10 Gbps)</li> <li>Thunderbolt™ 3 : Titan Ridge w/ USB 3.1 &amp; DP1.4<sup>3</sup> or Alpine Ridge (Alpine Ridge support on CMLv1 U only)</li> </ul>	✓
WWAN	<ul style="list-style-type: none"> <li>XMM 7560 M.2</li> </ul>		<ul style="list-style-type: none"> <li>XMM 7560 M.2</li> </ul>	
Storage	<ul style="list-style-type: none"> <li>Intel® Optane™ SSDs/Memory, QLC PCIe Intel® SSD 6 Series, Teton Glacier (Intel® Optane™ Memory M10 series + Neptune Harbor QLC SSD on a single M.2 module)</li> <li>PCIe 3.0, SATA, SD 3.0, eMMC 5.1<sup>4</sup></li> </ul>		<ul style="list-style-type: none"> <li>Intel® Optane™ SSDs/Memory, QLC PCIe Intel® SSD 6 Series, Teton Glacier (Intel® Optane™ Memory M10 series + Neptune Harbor QLC SSD on a single M.2 module)</li> <li>PCIe 3.0, SATA, SD 3.0, eMMC 5.1<sup>4</sup></li> </ul>	
Security	<ul style="list-style-type: none"> <li>SGX 1.0 • Secure biometrics</li> <li>Corporate: Intel® Authenticate hardened MFA, Intel® Runtime BIOS Resilience (IRBR) with attestation via Nifty Rock 1.0 + Intel® TXT (starting Windows* 10 RS6/19H1) for Intel® vPro™ clients</li> </ul>		<ul style="list-style-type: none"> <li>WHL features +</li> <li>“Devils Gate Rock” extending IRBR SMM HW access protection capability to other platform areas (CPU registers, IO, etc.) on Intel® vPro™ clients,</li> <li>Intel® PTT (integrated TPM) option with FIPS 140-2 L2 certification and Intel® TXT support for Intel® vPro™ clients</li> <li>RPMC support in SPI Flash for PTT</li> </ul>	
Manageability	<ul style="list-style-type: none"> <li>Intel® AMT for remote out-of-band manageability of Intel® vPro clients</li> <li>Intel® Endpoint Management Assistant for cloud-based management of Intel® AMT capabilities</li> </ul>		<ul style="list-style-type: none"> <li>WHL features +</li> <li>Intel® AMT over Thunderbolt™ 3 dock and Foxville 2.5GbE Wired LAN,</li> <li>Intel® Trusted Device Setup (for more secure Drop Ship capability)</li> </ul>	

# Mobile U-Processor Line (15W) Roadmap

		Q2'19	Q3'19	Q4'19
     				
				U-MS3'
				U-T4'
	U-T4+	i7-8557U	i7-10710U <sup>1</sup>	i7-10710U <sup>1</sup>
	U-MS3	i7-8665U	i7-1065G7	i7-1065G7
	U-T4	i7-8650U	i7-8665U	i7-8665U
		i7-8565U	i7-10510U	i7-10510U
			U-T3a+	
	U-T3+	i5-8257U	i5-1035G7	i5-1035G7
	U-MS1	i5-8365U	i5-1035G4	i5-1035G4
i5-8350U		i5-8365U	i5-8365U	
U-T3	i5-8265U	i5-1035G1	i5-1035G1	
		i5-10210U	i5-10210U	



New Badges for 10<sup>th</sup> Gen Intel® Core™ processors - ICL and CML

**KBL-R**  
**WHL-U** 8<sup>th</sup> Gen Intel® Core™ processors

**CML-U**  
**ICL-U** 10<sup>th</sup> Gen Intel® Core™ processors

<sup>1</sup> This sku will be offered with 6-cores.

# Mobile U-Processor Line (New 15W) Roadmap

		Q2'19	Q3'19	Q4'19
	U-T1	i3-8145U	i3-1005G1	i3-1005G1
		i3-8130U	i3-10110U	i3-10110U
	U-L1	5405U	5405U	6405U
		4417U	4417U	5405U
4415U		4415U	4417U	
	U-V2	4305U	4305U	4305U
		3965U	3965U	3965U
	U-V1	4205U	4205U	5205U
		3867U	3867U	4205U
		3865U	3865U	3867U

**KBL-R**  
**WHL-U** 8<sup>th</sup> Gen Intel® Core™ processors

**CML-U**  
**ICL-U** 10<sup>th</sup> Gen Intel® Core™ processors

**НА ЭТОМ ПОКА ВСЁ)**

The background features a complex, symmetrical geometric pattern. It consists of multiple overlapping, nested shapes that resemble stylized arrows or chevrons pointing towards the center. The color palette is dominated by deep blues, purples, and magentas, with bright white and cyan highlights. A prominent light flare or lens flare effect is visible in the upper right quadrant, adding a sense of depth and energy to the composition. The overall aesthetic is futuristic and dynamic.



# Introducing Intel<sup>®</sup> Tremont Microarchitecture

Stephen Robinson | Senior Principal Engineer | Intel<sup>®</sup>  
Linley Fall Processor Conference 2019 – October 24, 2019

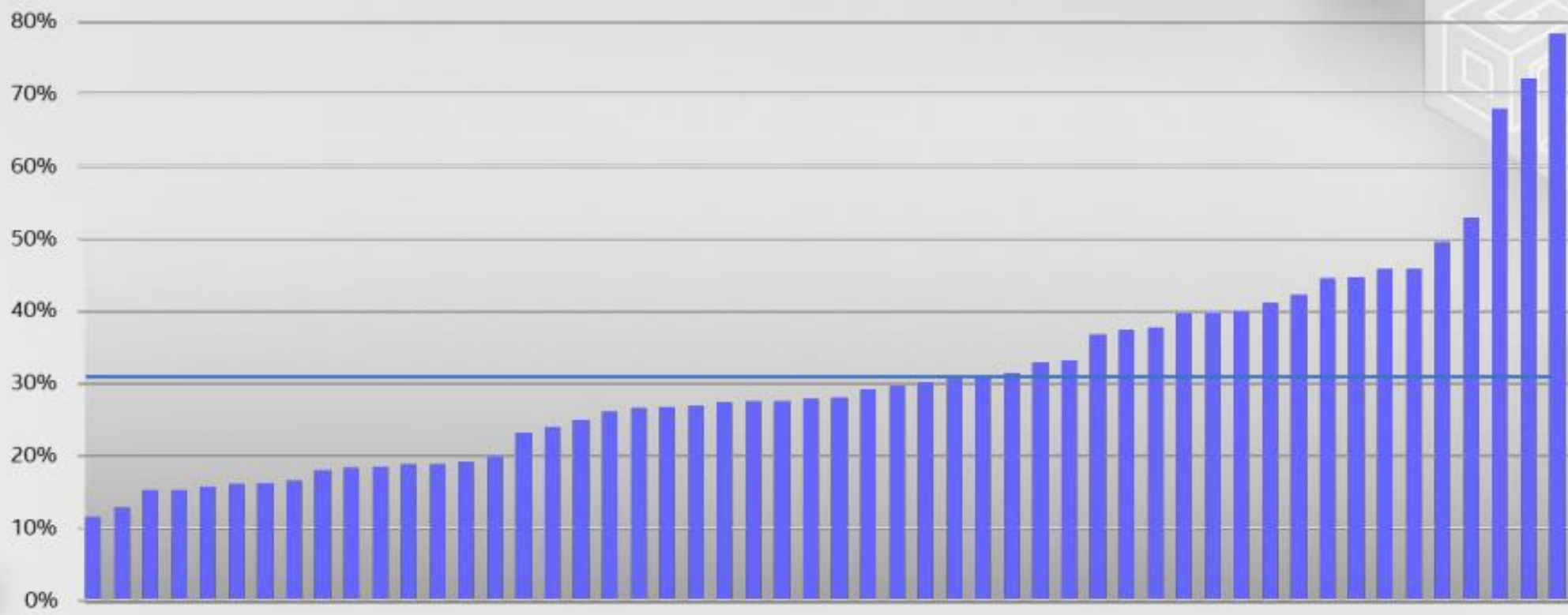


# Design Target: Single Thread Performance



- Intel® Core™ class branch prediction
- 6 wide out of order instruction decode
- 4 wide allocation
- 10 execution ports
- Dual load/store pipelines
- Quad-core module
- L2 cache up to 4.5MB
  - Size is product dependent

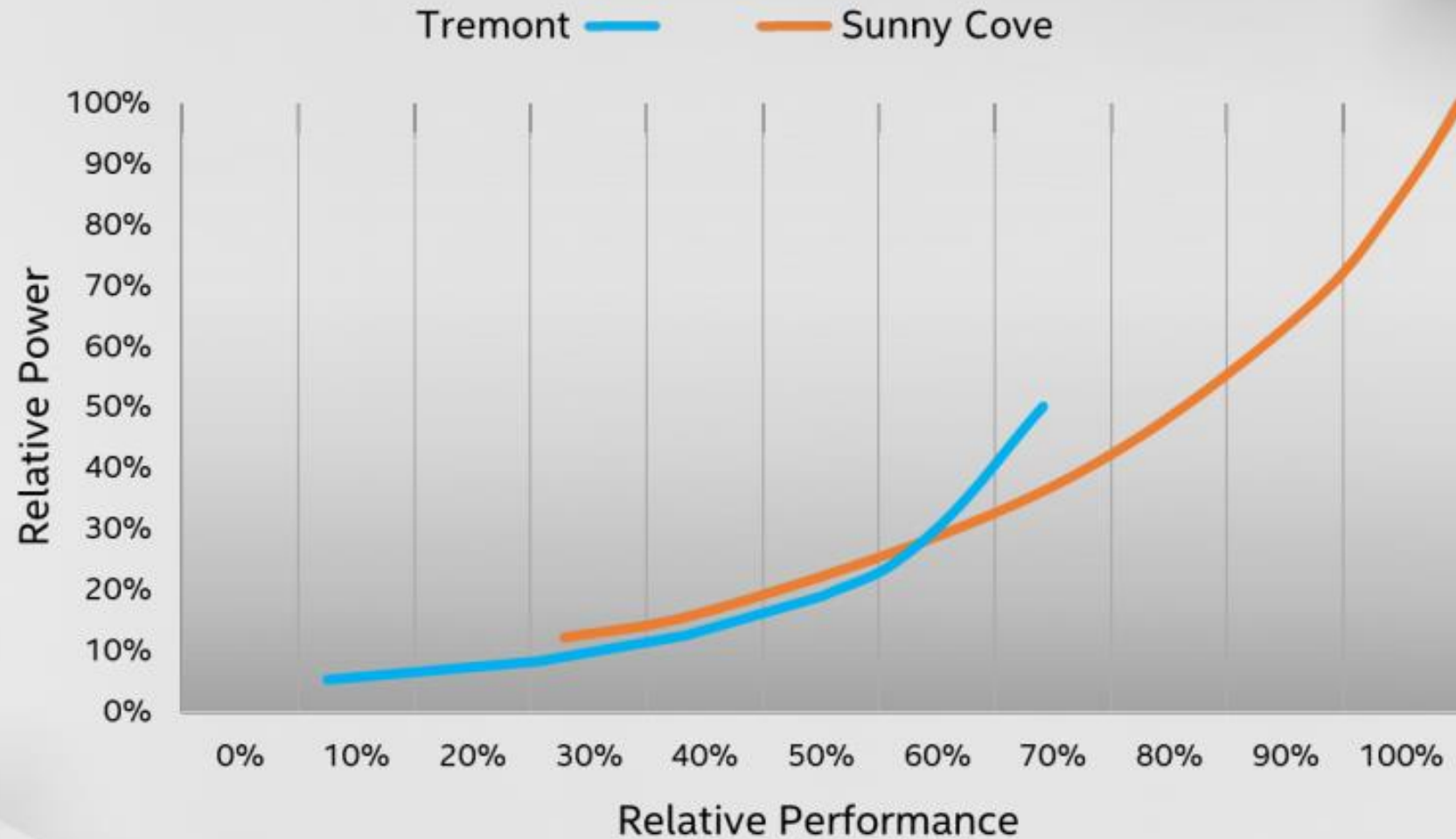
# ISO-Frequency Single Thread Performance Improvement (Relative to Goldmont Plus)



Single Thread Performance – Components of SPECint\* Rate Base 2006/2017 & SPECfp\* Rate Base 2006/2017

# Performance - Hybrid

## Lakefield Hybrid Single Thread Power/Performance



# DRAM INTEGRATION IN 1MMZ HEIGHT

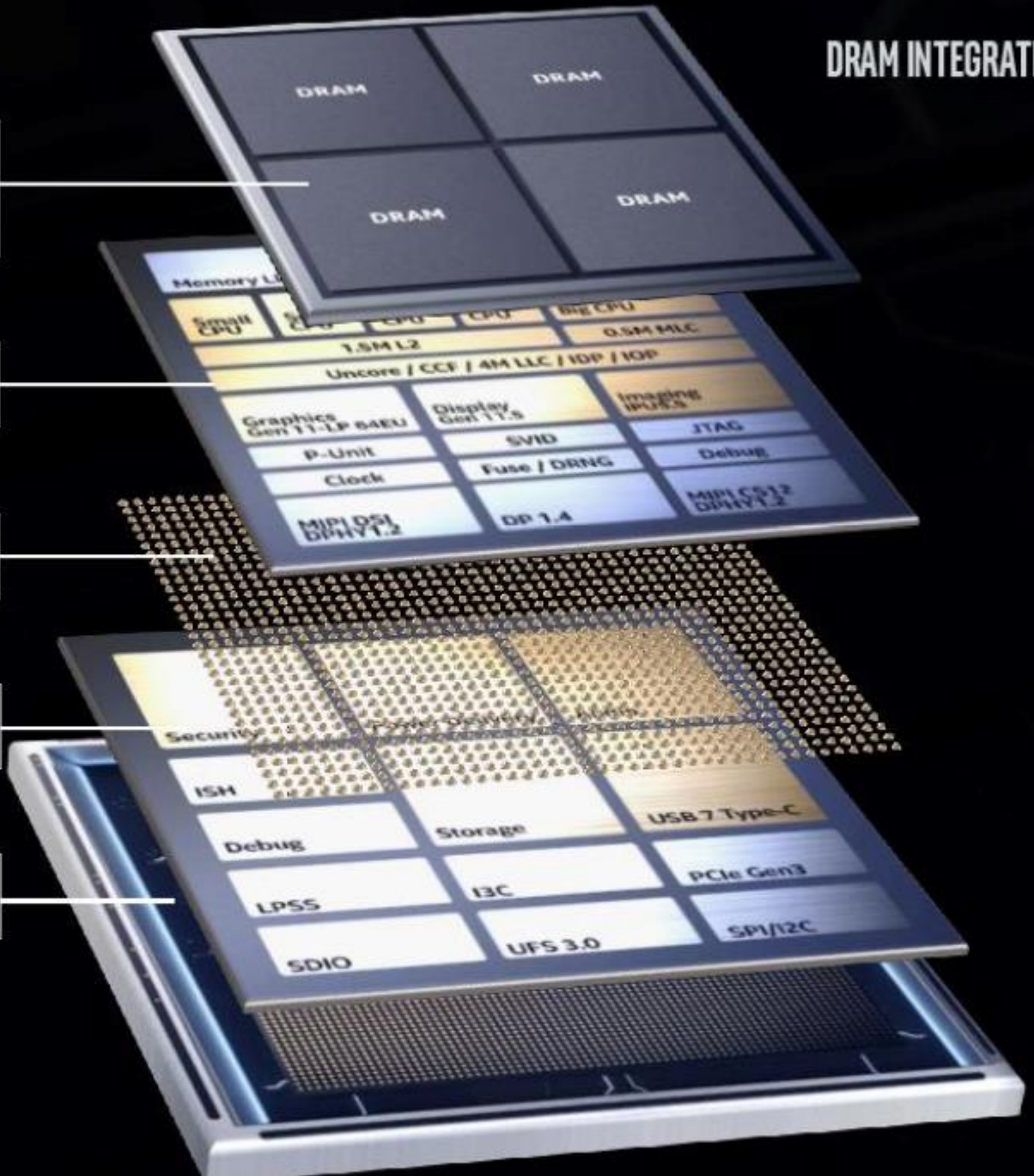
IN-PACKAGE  
DRAM

COMPUTE

FOVEROS

BASE

PACKAGE



**ТОЧНО ВСЁ!**

The background is a complex, abstract geometric pattern. It features a central point from which numerous light rays emanate, creating a sense of depth and movement. The color palette is dominated by deep blues, purples, and magentas, with a bright white and yellow light source at the center-right. The rays form a series of overlapping, diamond-like shapes that create a tunnel-like effect, drawing the viewer's eye towards the center.