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While Wi-Fi 7 is backward compatible with previous generations, new Wi-Fi 7 features require PCs configured with Intel Wi-Fi 7 solutions, PC OEM enabling, operating system support, and use with appropriate WiFi 7 routers/APs/gateways. 6 GHz Wi-Fi 7 may not be available in all regions. Performance varies by use, configuration, and other factors. For details on performance claims, learn more at www.Intel.com/performance-wireless.

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tour.US
Panther
Lake
Recap
Nish Neelalojanan
Sr Director Product Management
PC Products

Panther Lake

AI PC Excellence at Scale

Built with

intel 18A

x86 power efficiency

scaled performance

INTRODUCING

Panther Lake

Built for scale

More designs	More price points	More experiences

Architectural Learnings for Scalability

Lunar Lake

x86 power efficiency

Leveraging the best of "both"

- IP and partitioning-agnostic fabric
- Mature Foveros-S 2.5D packaging technology
- Separated GPU tile for scaling to segments
- Grouped I/O and platform-based IP

Arrow Lake

scaled performance

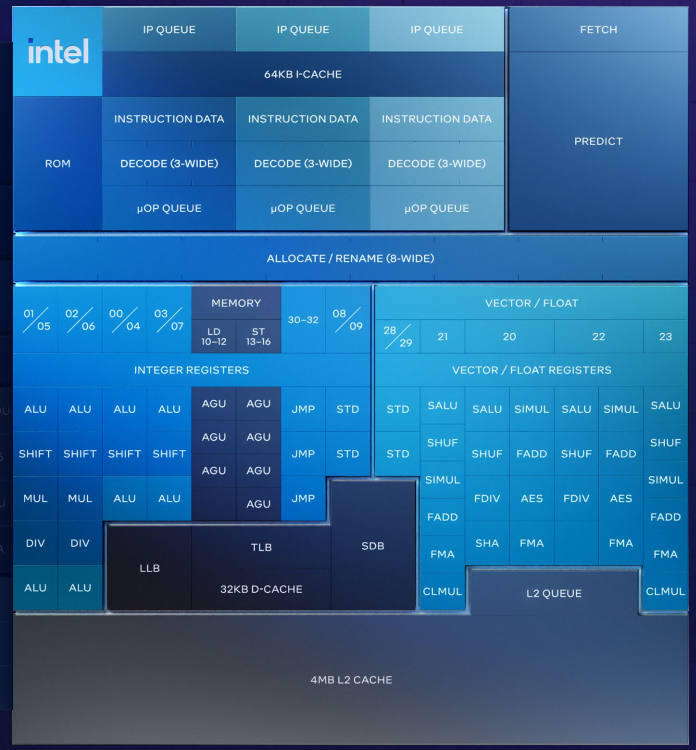
New Core IP

Increasing performance while retaining efficiency

- Designed and optimized for 18A
- Better performance at lower power
- Additional IPC optimization

Cougar Cove
P-core

Darkmont
E-core & LPE-core



Hybrid Core Strategy

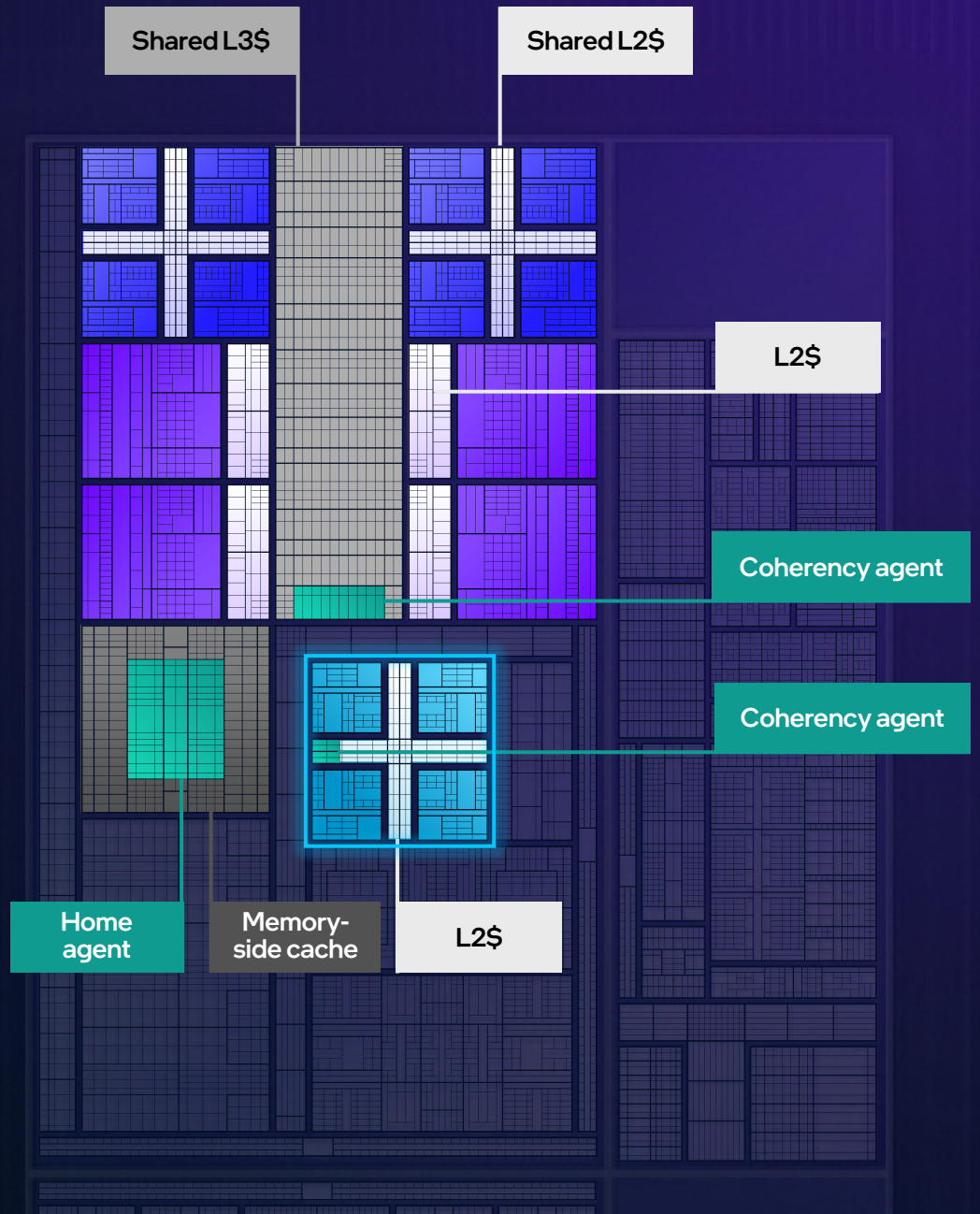
Caches & Compute Cluster Types

Performance cluster
P-Core and E-core modules with a shared last level cache

Efficiency cluster
E-core module with separate resources and memory connection

Home Agent (HA) cross-agents system coherency

Per-cluster Coherency Agent (CA)



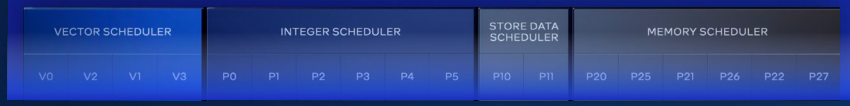
Cougar Cove

P-core

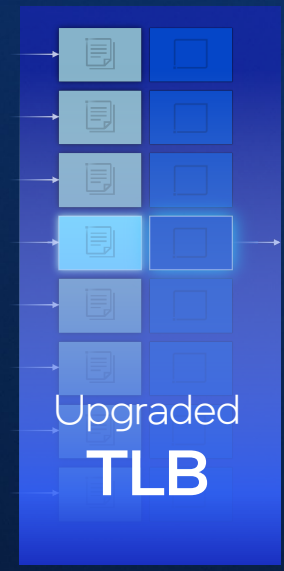
Exceptional throughput on Intel 18A

AI-based
power management

18 Execution ports



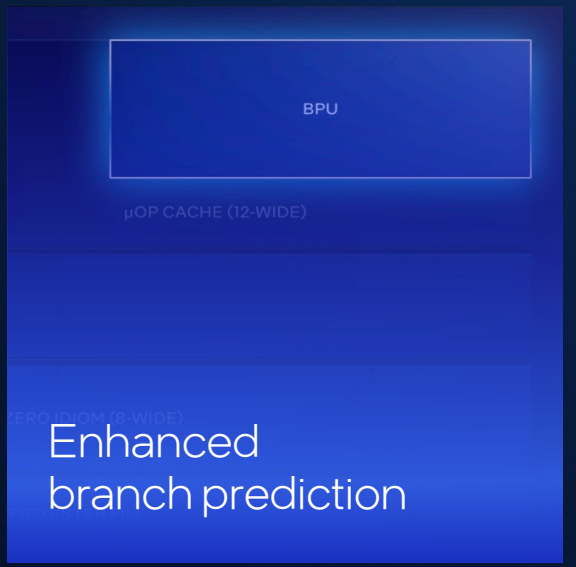
Up to 18MB
shared L3 cache



16.67MHz
Fine clock intervals

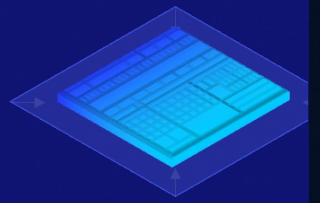
Wide scheduling

across both allocation/rename & retire



Enhanced branch prediction

Optimized for
PPA



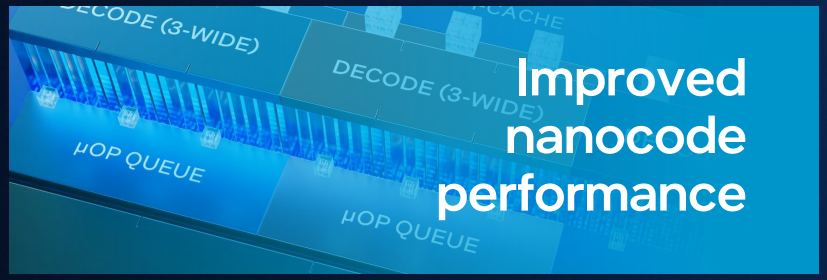
VEC ◀ **Split** out of order engine ▶ **INT**

intel

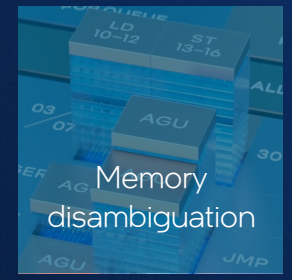
Darkmont E-core

Power-efficient, multi-threaded performance

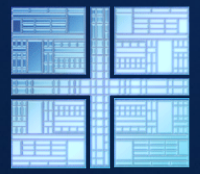
26
dispatch ports



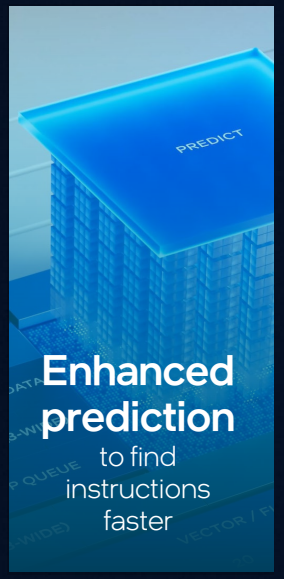
Improved nanocode performance



Memory disambiguation



4MB
shared L2 cache

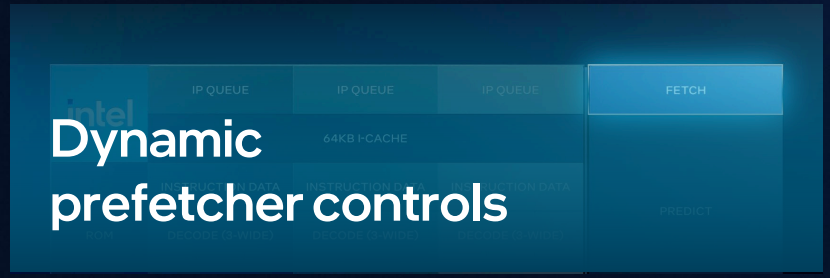


Enhanced prediction
to find instructions faster

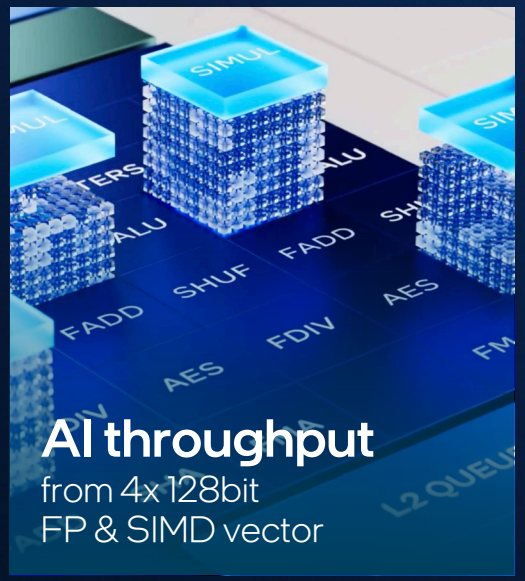
128B/cycle
L2 cache bandwidth

Deep queueing
for better parallelism

Scalable & flexible
across multiple implementations



Dynamic prefetcher controls



AI throughput
from 4x 128bit FP & SIMD vector

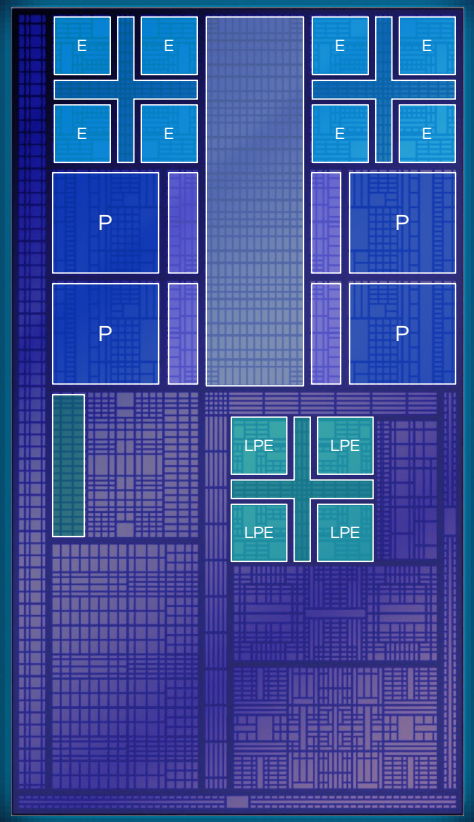
intel

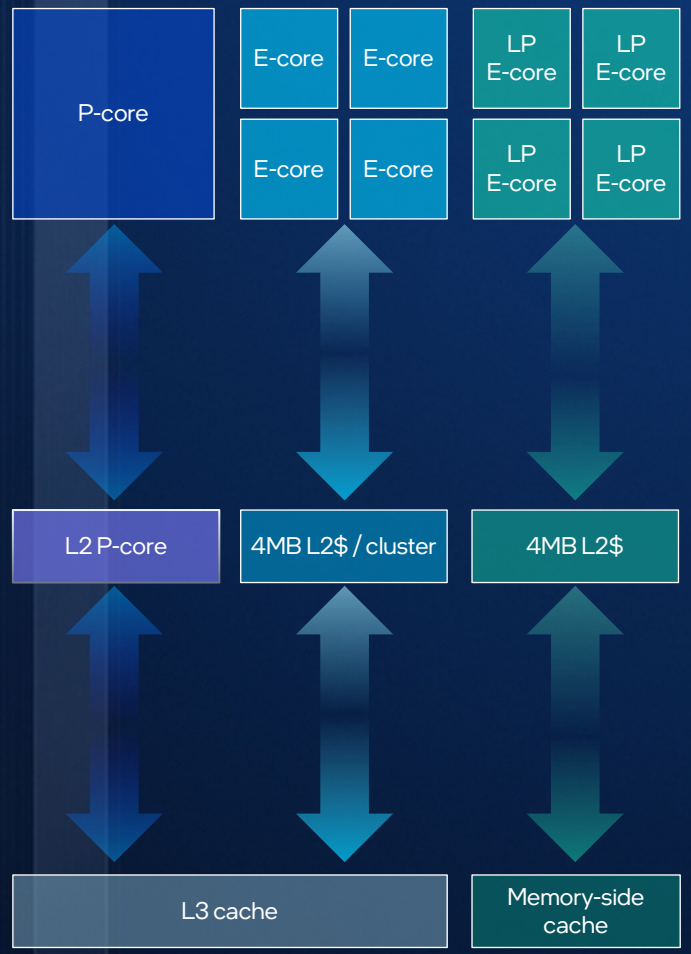
Cache & Memory Subsystem

8 E-cores on L3 cache ring
compared to none on Lunar Lake

Double the L2 cache for LP E-cores
compared to Meteor & Arrow Lake

Memory-side cache & controller on compute tile
vs. no memory-side cache and controller on SOC tile on Arrow Lake



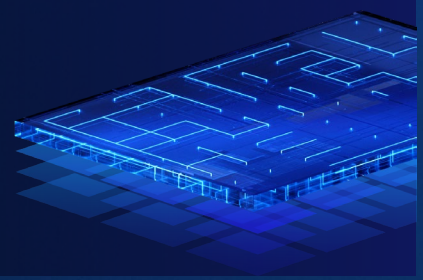


Panther Lake
Thread Director

Enhanced & optimized intelligent thread guidance across a wider set of use cases

Optimized classification models

Improved power management input



Expanded "busy" use case coverage

Simultaneous execution across P-core, E-core and LP E-core

OS containment zones

Efficiency	Hybrid / compute	Zoneless

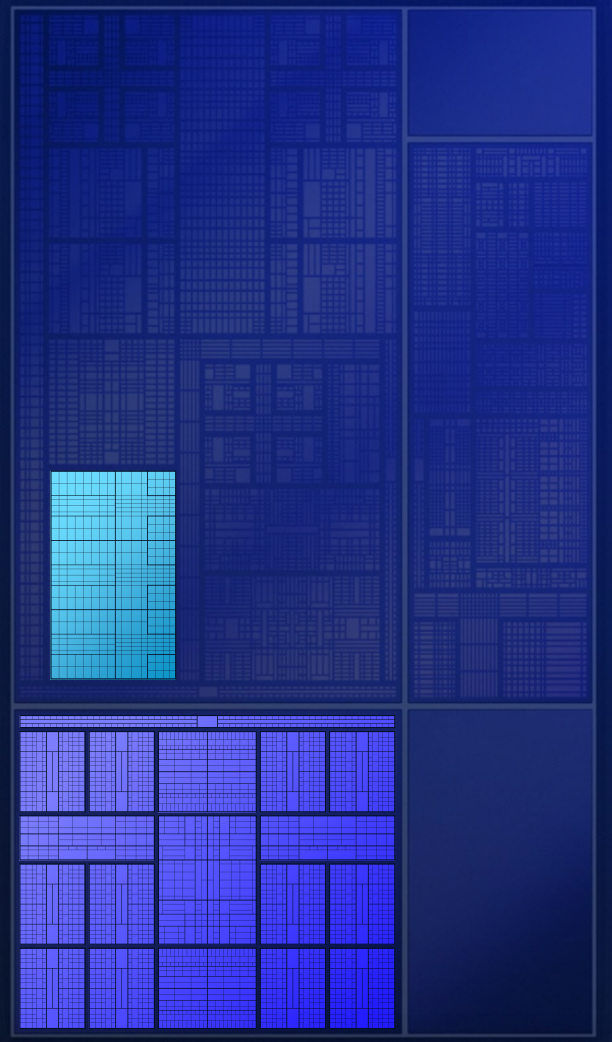
Panther Lake
XPUs

GPU

- Scale to larger configurations
- Throughput optimized

NPU

- Consistency across the stack
- Efficiency optimized

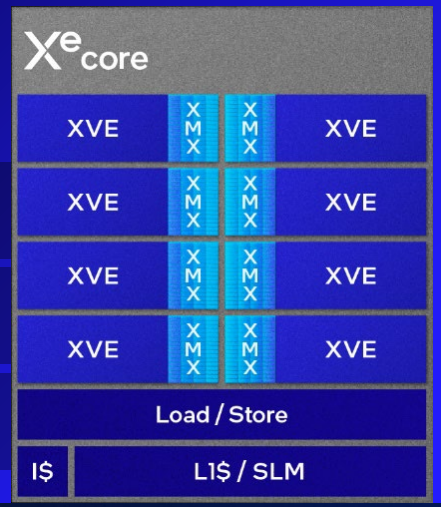


Xe3

Optimized from engine to slice
for a more consistent experience

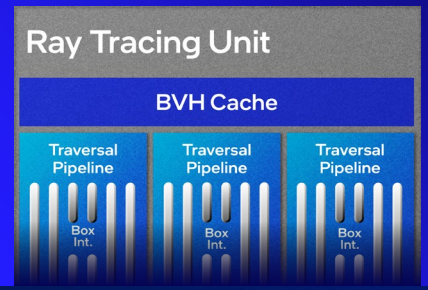
3rd gen Xe-core

- **8** 512-bit Vector engines
- **8** 2048-bit XMX engines
- **+33%** shared L1$/SLM



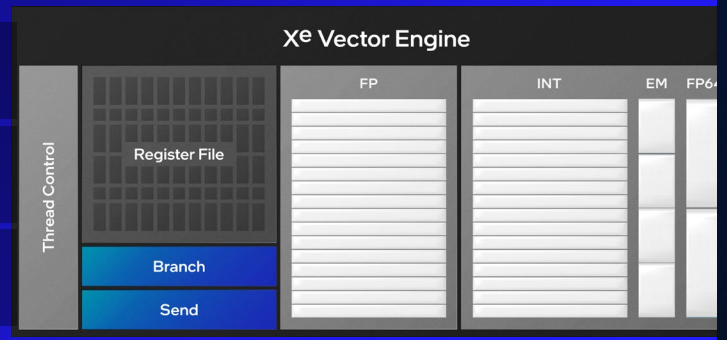
Enhanced ray tracing unit

Dynamic ray management
for async ray tracing



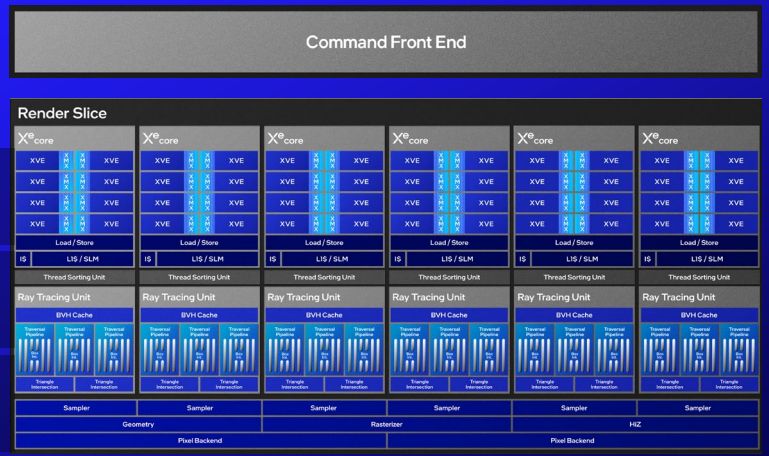
Xe vector engine – increased utilization

- Up to **25%** more threads
- **Variable** register allocation
- **FP8** dequantization support



Enhanced GFX fixed function

- **NEW** URB manager
- Up to **2x** anisotropic filtering
- Up to **2x** stencil test rate



Panther Lake

Xe3

Performance

>50% **Performance**
vs. Lunar Lake

Based on geomean power consumption across measured benchmark and game testing. Details at intel.com/performanceindex

Panther Lake

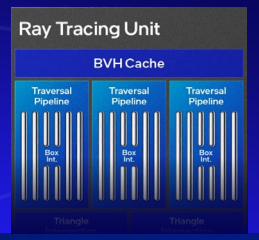
GPU

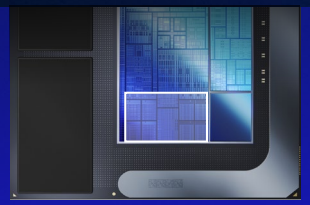
Better, faster and more efficient on all fronts

Latest features

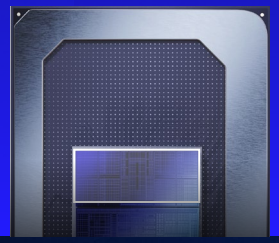
DirectX XII ULTIMATE

Up to **12** **enhanced** ray tracing units





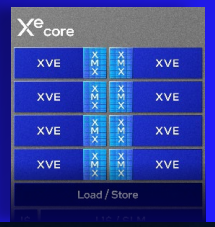
>40% **better graphics perf/watt** vs. Arrow Lake H



>50% **faster graphics performance** vs. Lunar Lake GPU

Up to **120** TOPS

Up to **12** **3rd gen** Xe-cores



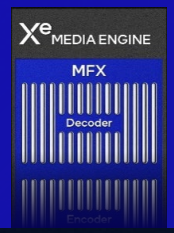
Xe matrix extensions

AV1 Encode & decode

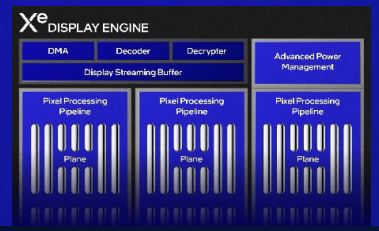
VVC Decode

eDP 1.5

16MB L2 cache



Efficiency-optimized media & display engines

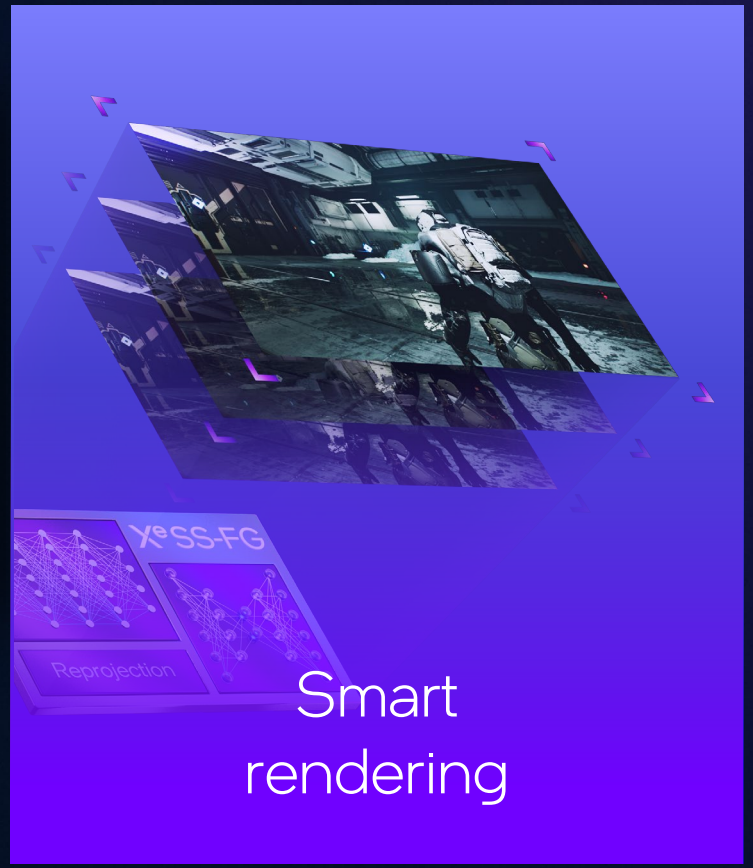


intel

Details at intel.com/performanceindex

Gaming at Low Power

High-performance GPU IP



Smart rendering

Platform tuning

Next-Gen NPU5

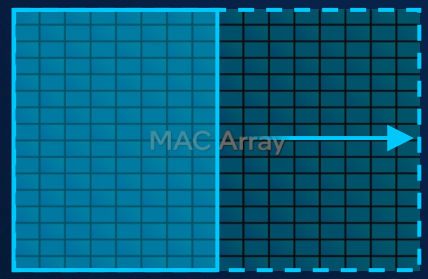
Major leap in efficiency and performance, powering next-gen AI accelerators

New activation function support

1.0

0.0

MAC array **doubled in size**

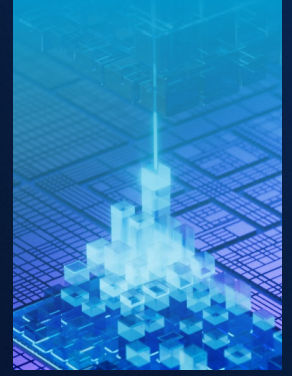


Up to

50

TOPS

Enhanced datatype conversion

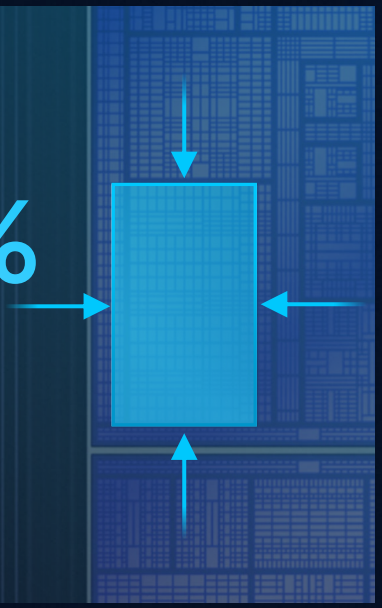


Native FP8

datatype support

>40%

improvement in TOPS per area



Copilot+PC

3

Neural compute engines

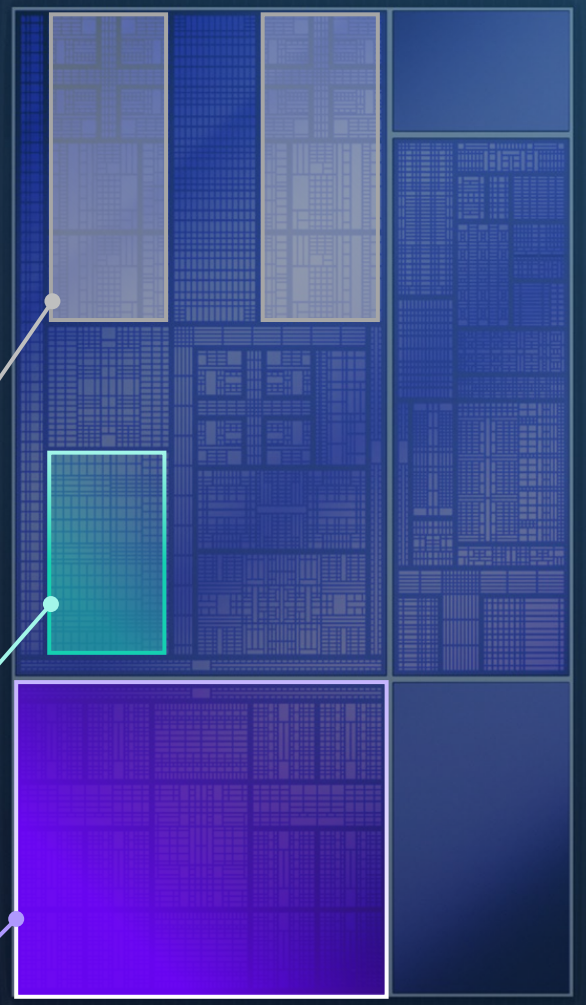
intel.

Details at intel.com/performanceindex

AI Engines in Panther Lake

Up to **180** platform TOPS

CPU	Up to **10** TOPS	VNNI & AVX	Light AI workloads
NPU	Up to **50** TOPS	NPU5 MAC arrays	AI assistants
GPU	Up to **120** TOPS	Xe3 XMX engines	Gaming & creator AI



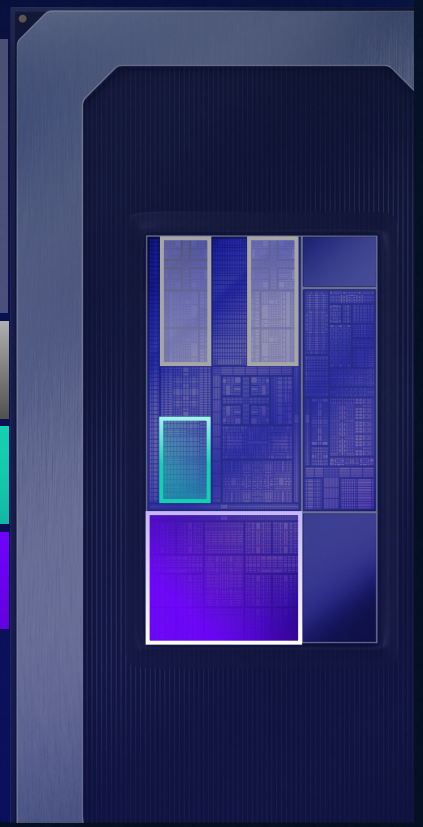
Panther Lake
Built for Agentic AI

Up to
180
platform
TOPS

CPU

NPU

GPU



AI engines

Software optimization

Microsoft

PyTorch | ONNX | TensorFlow

Hugging Face | OpenVINO | ONNX RUNTIME

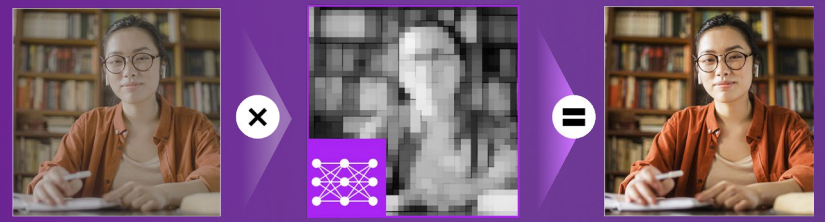
TensorFlow Lite | Keras | W3C

Ecosystem engagement

Next-Gen IPU 7.5

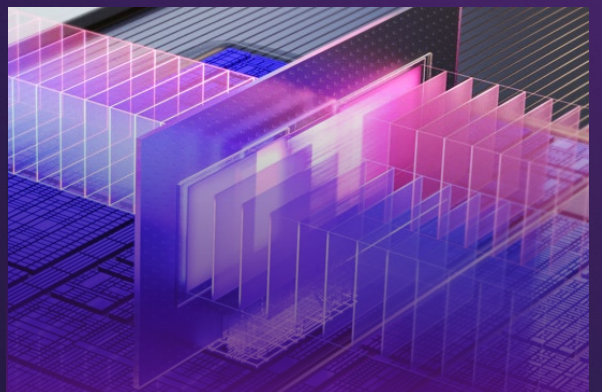
Vivid and lifelike visuals across a wide spectrum of lighting conditions on Panther Lake

AI-powered
local tone mapping

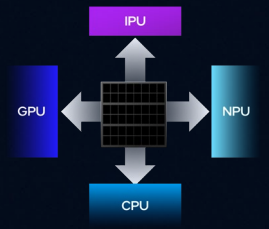


Up to
16MP stills
with zero shutter lag

Full-stack IP solution



Hardware-based
staggered HDR

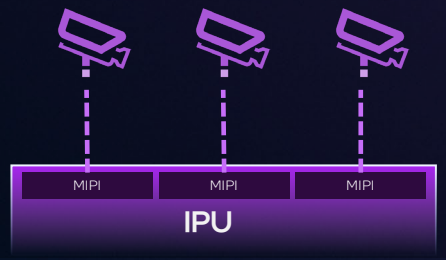


Seamless workloads
with other accelerators

AI-powered Bayer
noise reduction

Improved
power efficiency

Up to
3
concurrent cameras



1080p120
slow motion

intel

OEM enablement may be required. See intel.com/performanceindex

Best-in-class Wireless for AI PCs

Powered by Panther Lake

Breadth of innovations

Platform integration

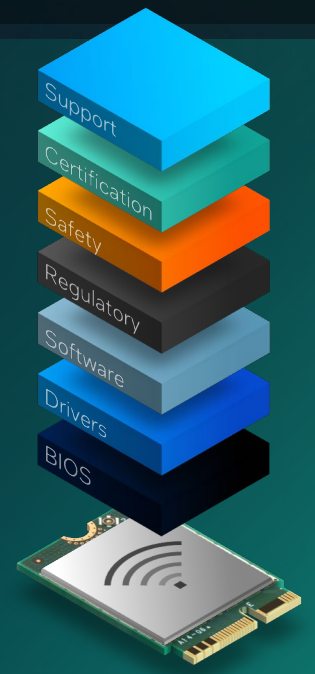
Coordinated development in tandem with Intel AI PC platforms

Maximized standards support

Wi-Fi 4 · Wi-Fi 5 · Wi-Fi 6 · Wi-Fi 7 R1 · Wi-Fi 7 R2

Bluetooth 3 · Bluetooth 4 · Bluetooth 5 · Bluetooth LE · Bluetooth 6

The only full-service PC wireless vendor



Testing

Platform level validation & performance testing

Manageability

SIPP with vPro manageability

Security

Highest level security protocols supported (WPA3, FIPS)

20+ years

Delivering PC platform wireless solutions

120+ positions

Leadership positions across wireless technology industry groups

Wi-Fi Alliance · USB · IEEE · VESA · Bluetooth · Wireless Broadband Alliance

Expansive ecosystem

Across OSVs, ISVs, OEMs & IHVs

Nearly 2B units of lifetime volume

For unmatched PC connectivity footprint

Details at intel.com/performanceindex

"...the benchmark for industry engagement by Wi-Fi client-side chipset vendors is Intel." Claus Hetting, Wi-Fi NOW , Sep'25

Panther Lake

Scaling platform performance & efficiency

vs. Lunar Lake

>10%

more **ST performance** at similar power

CPU

vs. Lunar Lake

>50%

more **MT performance** at similar power

CPU

vs. Arrow Lake

>30%

lower power at similar MT performance

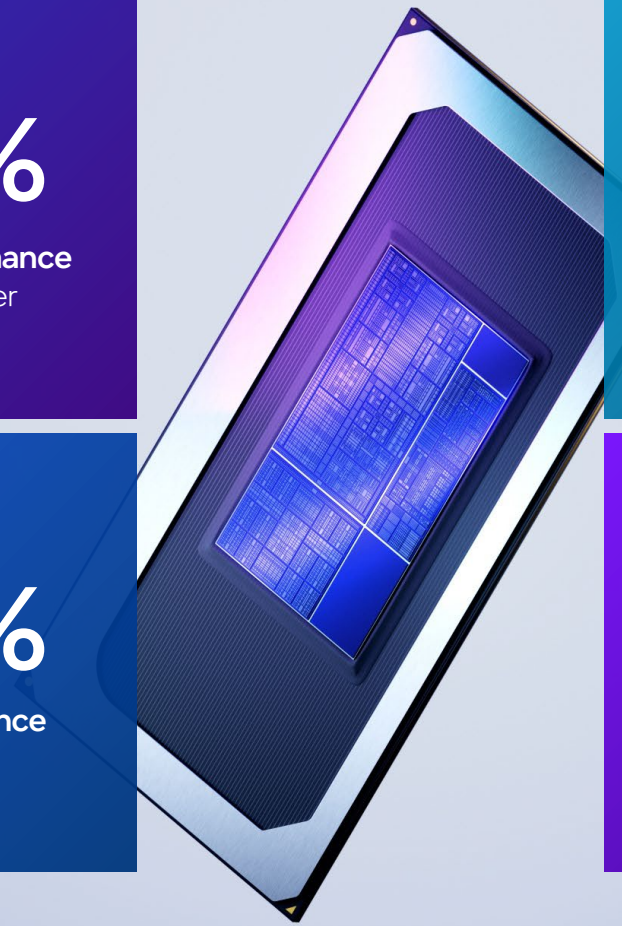
CPU

vs. Lunar Lake & Arrow Lake

>50%

more performance

GPU



vs. Lunar Lake

>40%

more **TOPS/area**

NPU

vs. Lunar Lake

1.5W

reduction in power with HW staggered HDR

IPU

vs. Lunar Lake

Up to

10%

lower power

SoC

vs. Arrow Lake

40%

lower power

SoC

Details at intel.com/performanceindex

Panther Lake

Architecture **Scalability**

- Majority of compute engines on compute tile
- All I/O IP on PCD tile
- Separated GPU tile
- Foveros 2.5D packaging
- Same package across all designs

Panther Lake
8 core

Compute tile

Built on intel 18A

CPU

up to **8** cores

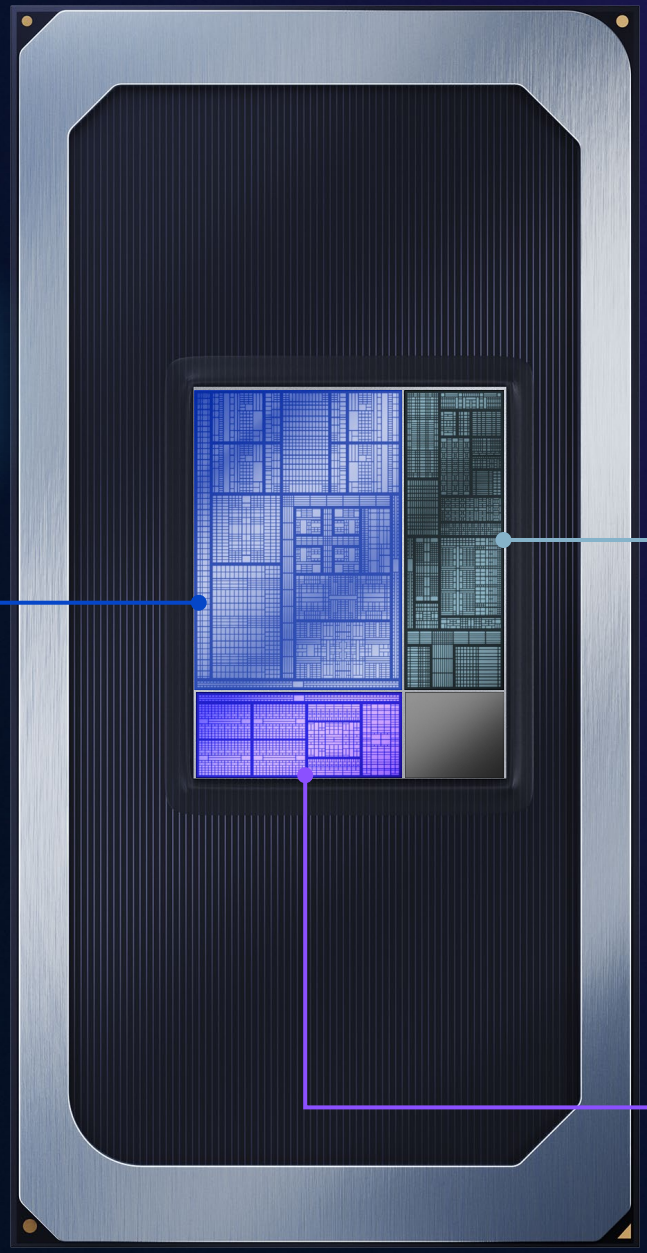
P-cores	LP E-cores
4 Cougar Cove	4 Darkmont

xPU

IPU 7.5	NPU 5	Xe
Image signal processor		Media & display engines

Memory

Up to 6800 MT/s	Up to 6400 MT/s	8MB
LPDDR5x	DDR5	Memory-side cache



Platform controller tile

Built on External

I/O

12 PCIe lanes	8x PCIe gen 4	4x PCIe gen 5

Up to 4x Thunderbolt™ 4	2x USB 3.2 8x USB 2.0

Connectivity

Intel® Wi-Fi 7 (R2)	Intel® Bluetooth® Core 6.0

GPU tile

Built on intel 3

Xe3 Architecture	4 Xe-cores	4 Ray tracing units

Panther Lake
16 core

Compute tile

Built on intel 18A

CPU

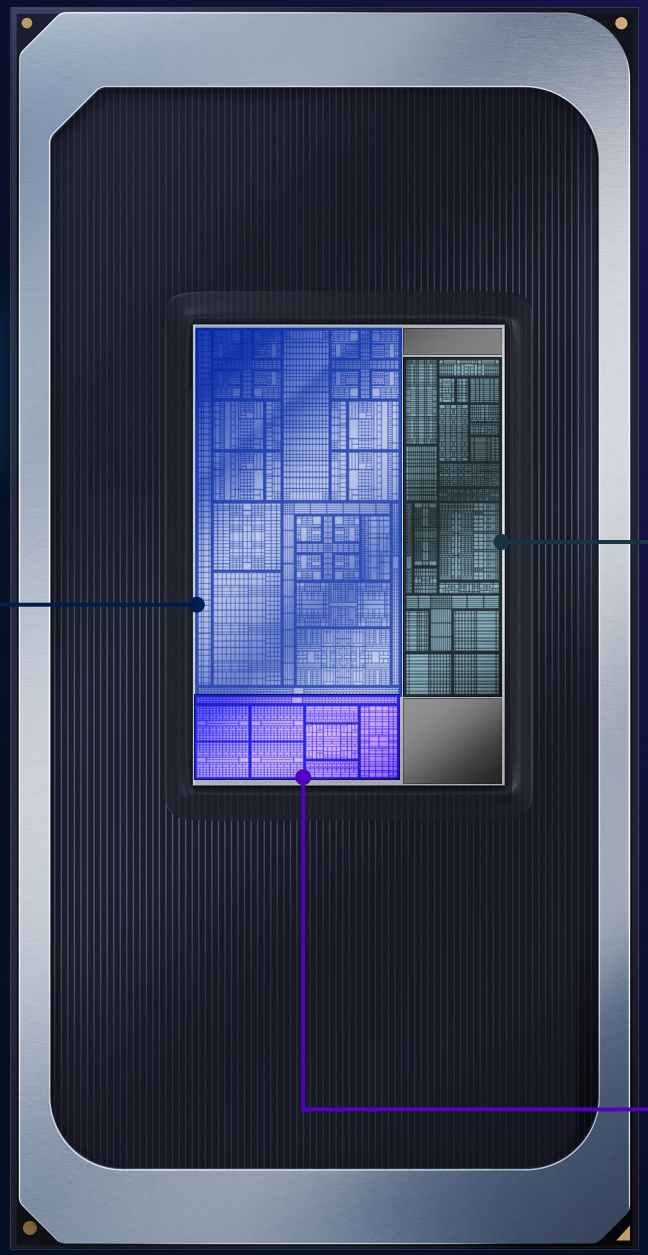
up to 16 cores	P-cores	E-cores	LP E-cores
	4 Cougar Cove	8 Darkmont	4 Darkmont

xPU

IPU 7.5	NPU 5	Xe
Image signal processor		Media & display engines

Memory

Up to 8533 MT/s LPDDR5x	Up to 7200 MT/s DDR5	8MB
		Memory-side cache



Platform controller tile

Built on External

I/O

20 PCIe lanes	8x PCIe gen 4	12x PCIe gen 5

Up to 4x Thunderbolt™ 4	2x USB 3.2 8x USB 2.0

Connectivity

Intel® Wi-Fi 7 (R2)	Intel® Bluetooth® Core 6.0

GPU tile

Built on intel 3

Xe3 Architecture	4 Xe-cores	4 Ray tracing units

Panther Lake
16 core 12Xe

Compute tile
Built on intel 18A

CPU

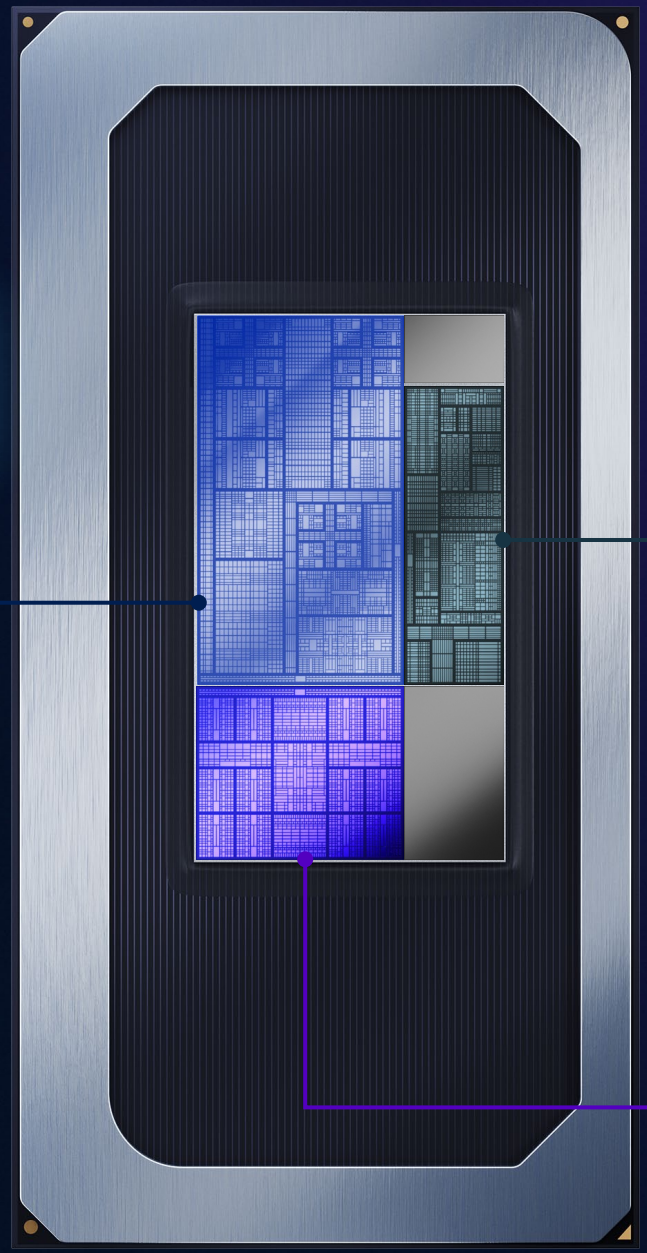
up to 16 cores	P-cores	E-cores	LE E-cores
	4 Cougar Cove	8 Darkmont	4 Darkmont

xPU

IPU 7.5	NPU 5	Xe
Image signal processor		Media & display engines

Memory

Up to 9600 MT/s LPDDR5x	8MB
	Memory-side cache



Platform controller tile
Built on External

I/O

12 PCIe Lanes	8x PCIe gen 4	4x PCIe gen 5

Up to 4x Thunderbolt™ 4	2x USB 3.2 8x USB 2.0

Connectivity

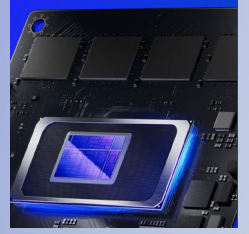
Intel® Wi-Fi 7 (R2)	Intel® Bluetooth® Core 6.0

GPU tile
Built on External

Xe3 Architecture	12 Xe-cores	12 Ray tracing units

Up to
16
CPU cores

Up to
96GB
LPDDR5



Next-gen
IPU 7.5

Up to 180 TOPS
Across the total platform

Next-gen
NPU 5

New
Xe3 GPU

XeSS
Multi-Frame Generation

Integrated
Thunderbolt™ 4

Panther Lake
Built for scale

Enhanced Intel Thread Director
& power management

Integrated Intel® Wi-Fi 7 (R2) &
Dual Intel® Bluetooth® Core 6

Up to
12
Xe-cores

E-core
Darkmont

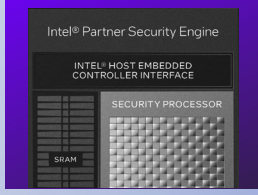
P-core
Cougar Cove

8c
4Xe

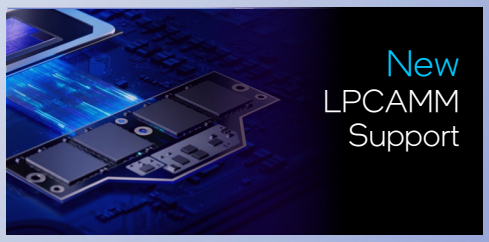
16c
4Xe

16c
12Xe

Up to
12 lanes
PCIe gen 5



Intel®
Total
Storage
Encryption



New
LPCAMM
Support

intel

Panther Lake

AI PC Excellence at Scale

vs. Lunar Lake & Arrow Lake

>50%

more performance

GPU

vs. Lunar Lake

>50%

more **MT performance** at similar power

CPU

Core performance

Game-changing graphics

Leading AI experiences

Power efficiency

See intel.com/performanceindex for details. Results may vary.


intel
TECH
tour.US
Thank
you

Appendix

Claim	Claim Details/Citation
>50% more CPU & GPU performance vs. Lunar Lake & Arrow Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake & Arrow Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (n-copy) for long-term expected steady state processor power consumption. Data based on Panther Lake reference validation platform measurement vs Lunar Lake and Arrow Lake-H reference validation platforms as measured by 3Dmark Solar Bay, Cyberpunk 2077 and Borderlands 3.
Best-in-class Wireless for AI PCs	The Intel® Wi-Fi 7 (5 Gig) wireless solution available for the new Intel® Core® Ultra (series 3) AI PC platforms is best-in-class based on: support for optional performance-enhancing features of the latest unlicensed wireless standards (Wi-Fi 7 R2, Bluetooth® Core 6.0); PC-first focused wireless solution design, technology integration, and coordinated development in tandem with Intel AI PCs; extensive end-to-end platform-level wireless validation and performance testing; breadth of Intel platform connectivity innovations: new features, software applications, telemetry, analytics, and power savings; support for the highest levels of industry standards-based security protocols (WPA3, FIPS), and support for SIPP with vPro manageability (Active Management Technology); Intel is the only full-service PC WLAN card vendor (Silicon, M.2 cards, BIOS, drivers, software, world-wide regulatory services, safety testing, standards certification, supply-chain, logistics, and OEM & end-user customer support); expansive connectivity ecosystem enabling and interoperability testing (OSV/ISV/PC OEM/IHV); wireless Industry leadership as measured by a history of more than 20 years of delivering wireless solutions for Intel PC platforms and more than 120 leadership positions across wireless technology industry groups; and the nearly 2 billion unit global lifetime footprint of Intel® processor-based PC clients with Intel® WLAN since the initial launch of the Intel® Centrino® platform in 2003. Learn more at intel.com/wireless.
Dual Bluetooth Superior Range - Nearly 2x better vs previous gen - Increasing range by an additional 1.5-2x	Intel Taiwan Wireless Test Facility; Clients: (Intel) PTL RVP - Intel Whale Peak, BE200, AX211 – 23.90.24304 - Windows 11 24H2, (QCOM) Asus Vivobook S 15 – Qualcomm Snapdragon X Elite – FC7800 – 1.0.404.8300 - Windows 11 24H2; Speaker - Harmon Kardon Luna Speaker; Playback Application – Microsoft Media Player
IPU 7.5	IPU 7.5 is available on select systems. OEM enablement required. Check with OEM or retailer for system configuration.
>10% more ST performance at similar power vs. Lunar Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake & Arrow Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (1-copy) for long-term expected steady state processor power consumption.
>50% more MT performance at similar power vs. Lunar Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (n-copy) for long-term expected steady state processor power consumption.
>30% lower power at similar MT performance vs. Arrow Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake & Arrow Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (n-copy) for long-term expected steady state processor power consumption.
>50% more performance vs. Lunar Lake & Arrow Lake	Testing by Intel as of Sept 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake and Arrow Lake-H reference validation platforms as measured by 3Dmark Solar Bay, Cyberpunk 2077 and Borderlands 3.
>40% more TOPS/area vs. Lunar Lake	As measured by comparing peak TOPS to measured die area.
1.5W reduction in power with HDR staggered HDR vs. Lunar Lake	Power reduction is dependent on resolution.
Up to 10% lower power vs. Lunar Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake & Arrow Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (1-copy) for long-term expected steady state processor power consumption.
40% lower power vs. Arrow Lake	Testing by Intel as of September 2025. Data based on Panther Lake reference validation platform measurement vs Lunar Lake & Arrow Lake reference validation platform(s) as estimated by SPECrate®2017_int_base (1-copy) for long-term expected steady state processor power consumption.