

GRAPHICS & MEDIA DEEP DIVE

Tom Petersen, Intel Fellow

Meteor Lake GPU



2x
perf/watt*

Intel® Iris® Xe Graphics
on 12th Gen Intel® Core™

Modern
graphics features

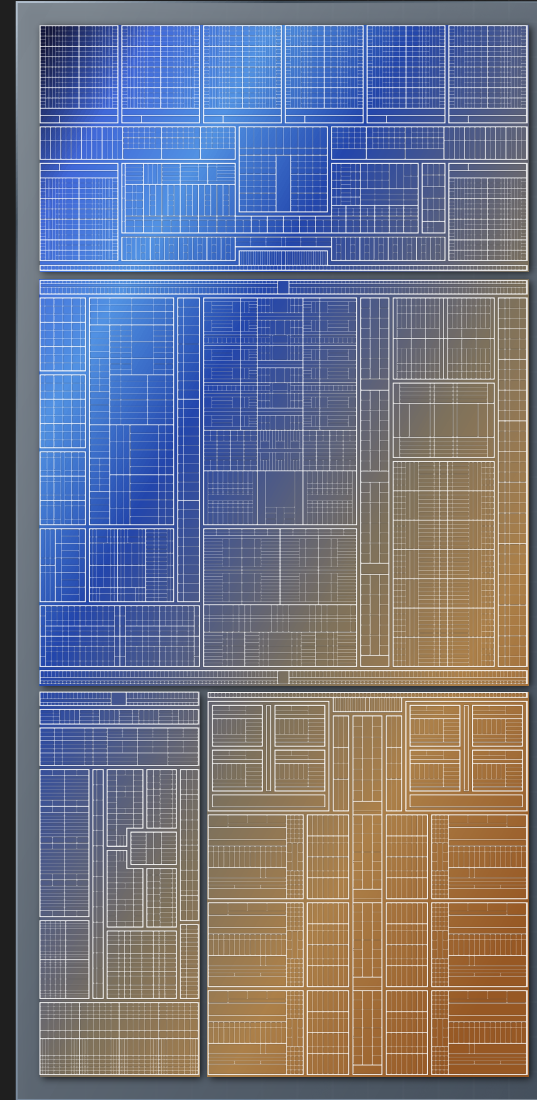
Intel® Arc™
A-Series Graphics**

*Compared to prior generation. See appendix for more information. Results may vary.

**Intel® Arc™ graphics only available on select MTL processor-powered systems with dual-channel memory.

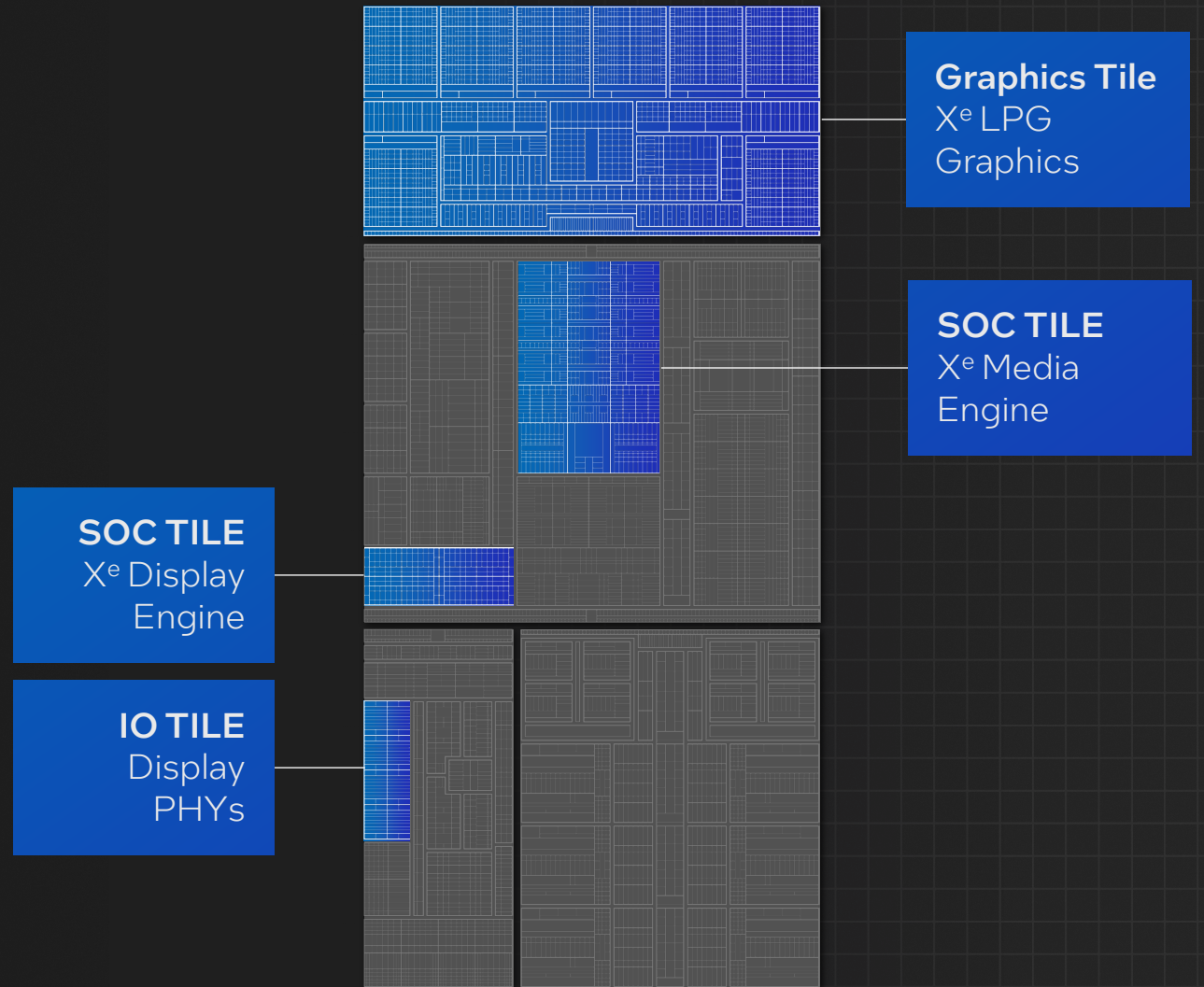
Meteor Lake

Disaggregated Architecture



Meteor Lake

Disaggregated Architecture

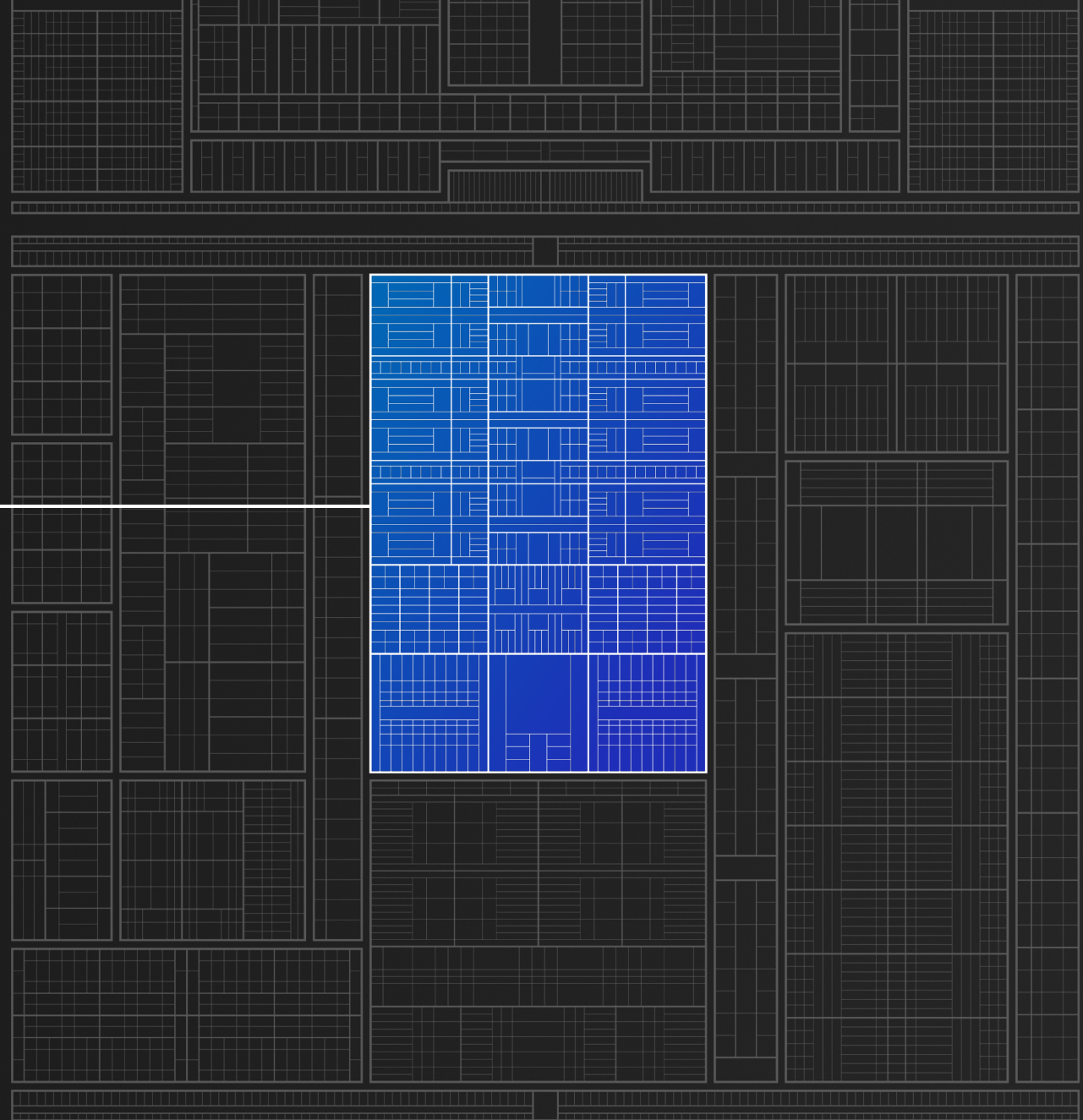


Xe Media Engine

Energy efficient fixed function hardware

Decoupled architecture

AV1 hardware film grain support



Key media workloads and requirements

Video Playback / Streaming

High Performance, Low Power **Decode**

Basic Video Editing and Game Streaming

Encode Throughput and Quality

Productivity and Desktop Sharing

Optimized **Encode/Decode** for
Text and Screen Captures

Advanced Video Editing

Accelerate **Encode/Decode** for
Professional Video Creation

AI Inference

Offload **Decode** pre-processing for
Video Analytics

Key media workloads and requirements

	JPEG/MPEG	AVC	VP9	HEVC	AV1
Video Playback / Streaming High Performance, Low Power Decode	MPEG2	4:2:0 Interlace and Progressive	10b, 12b 4:2:0	10b, 12b 4:2:0	10b 4:2:0 HW Film Grain
Basic Video Editing and Game Streaming Encode Throughput and Quality		8b baseline	10b	10b	
Productivity and Desktop Sharing Optimized Encode/Decode for Text and Screen Captures			4:4:4	4:4:4 Screen Content Coding	Screen Content Coding
Advanced Video Editing Accelerate Encode/Decode for Professional Video Creation				10b 4:2:2	10b 4:2:0
AI Inference Offload Decode pre-processing for Video Analytics	JPEG 4:2:0, 4:4:4	10b 4:2:0		10b 4:2:0, 4:4:4	10b 4:2:0

Xe

Media Engine

Up to
8k60 10-bit
HDR decode

Up to
8k 10-bit
HDR encode

VP9

AVC

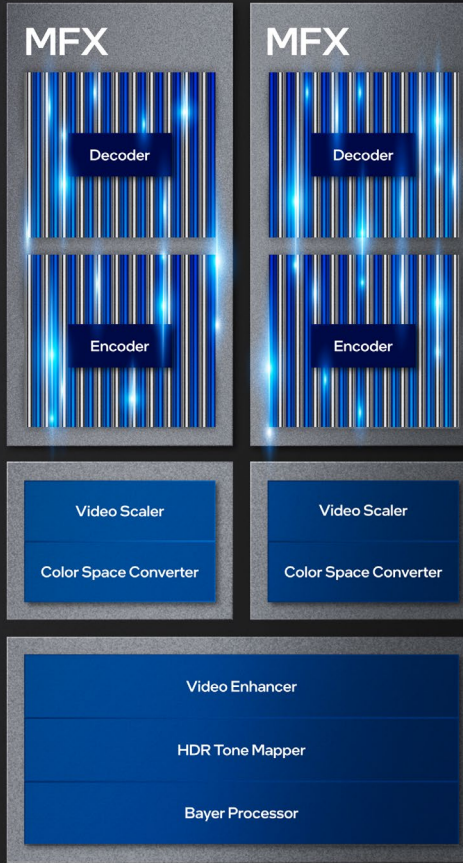
HEVC



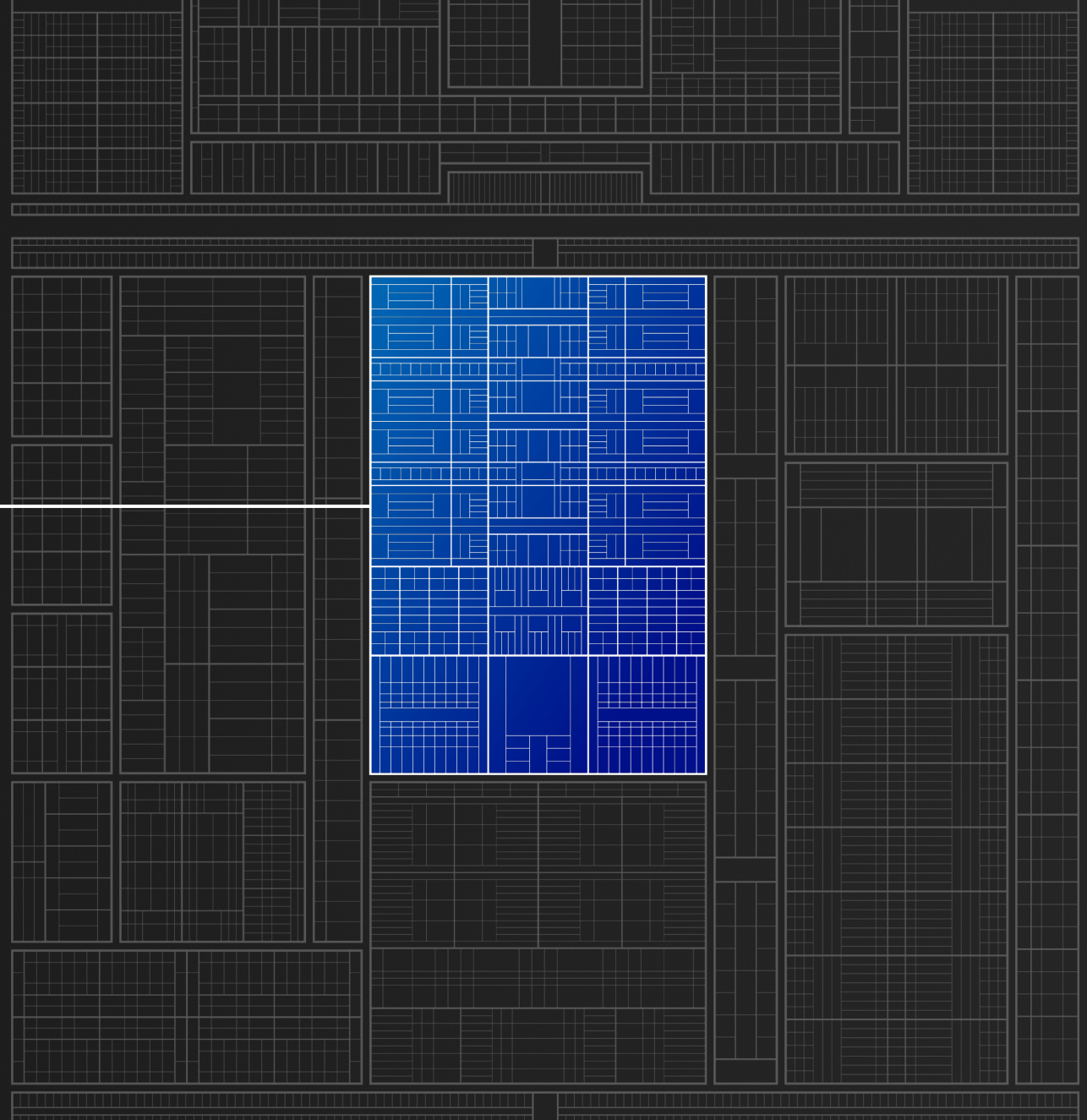
NETFLIX



Xe Media Engine



Xe Media Engine

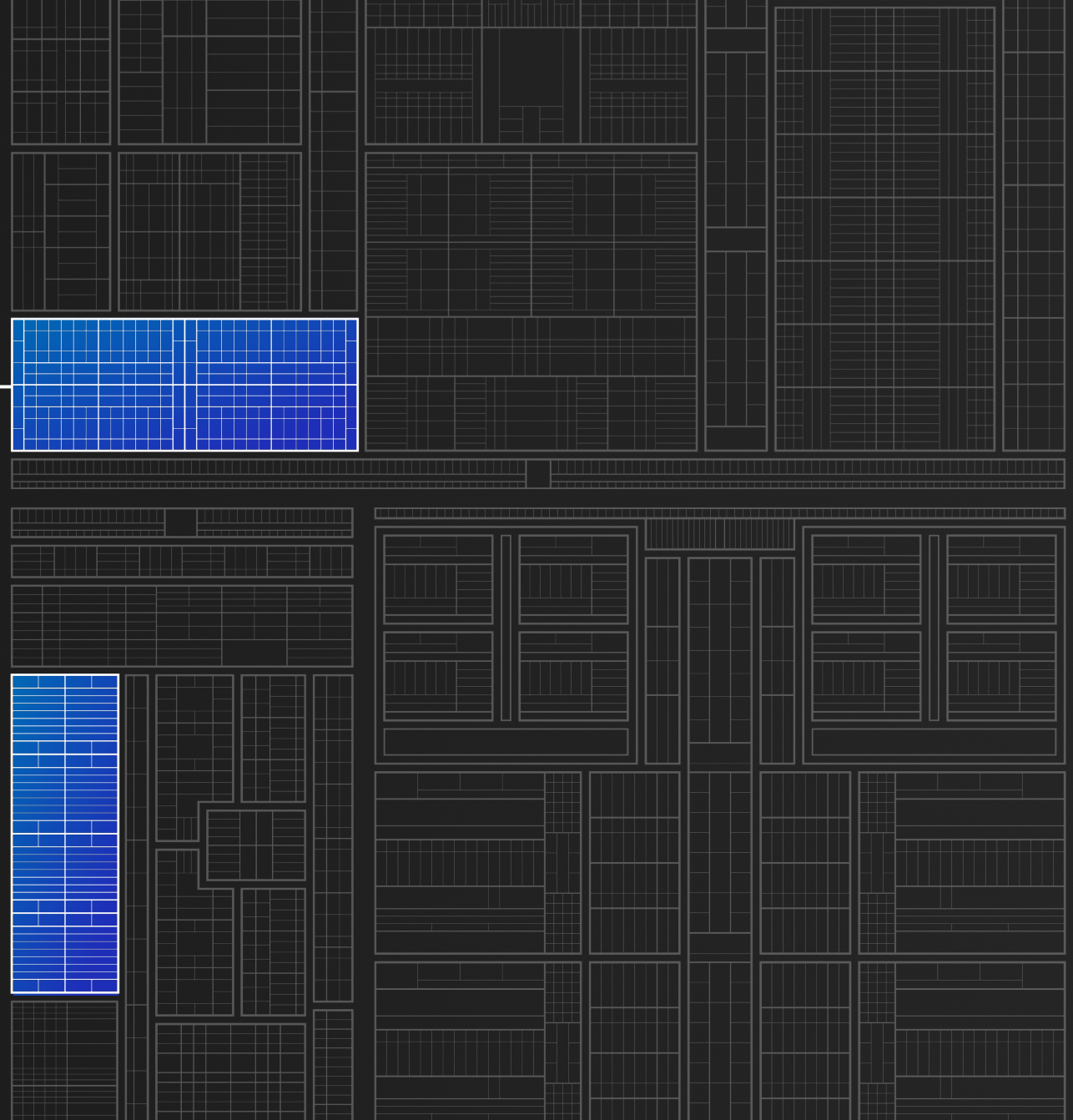


Xe Display Engine

4 display pipes / 2 low power optimized

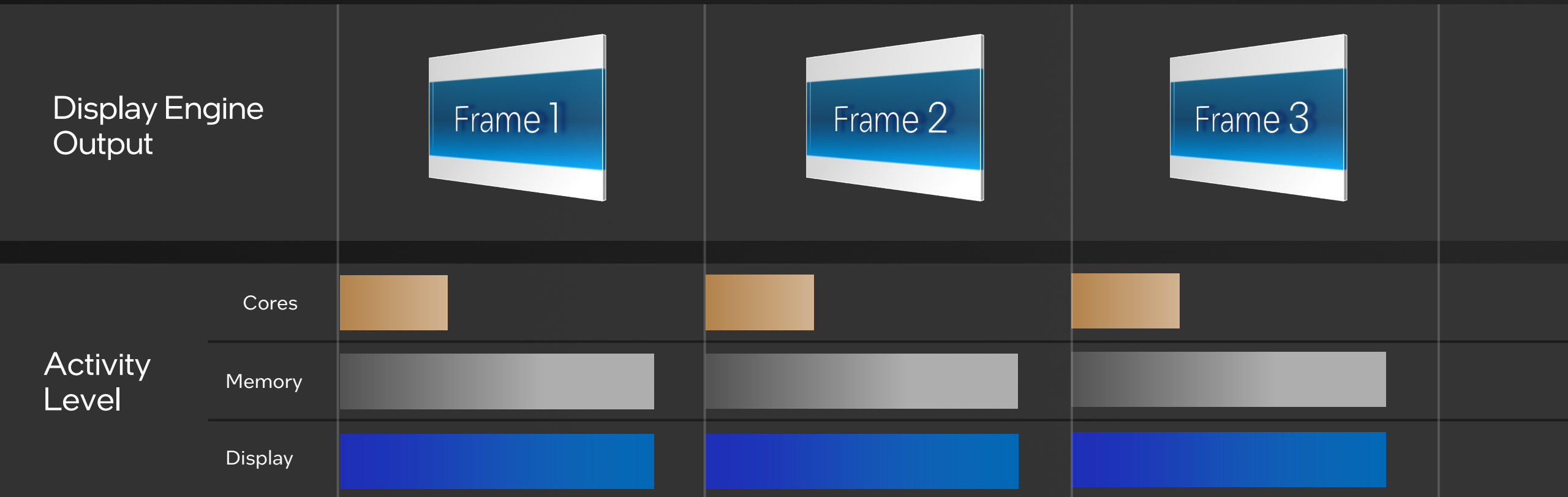
Optimized end to end unified compression

New lower power mode for media playback



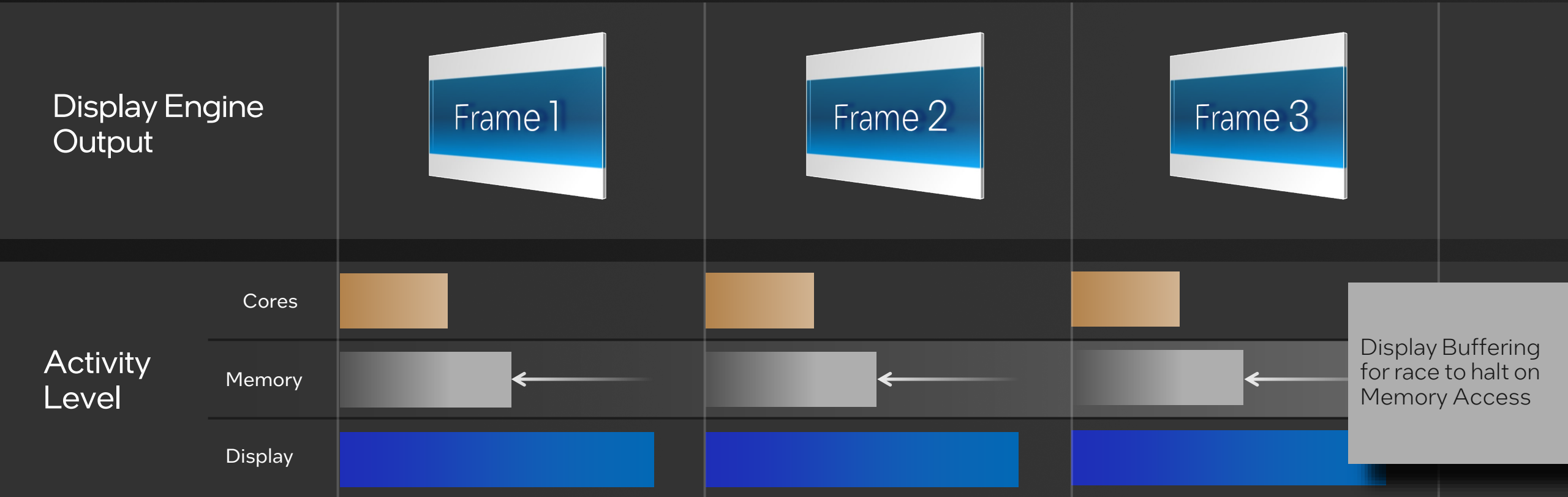
Display Engine Power Optimizations

Legacy



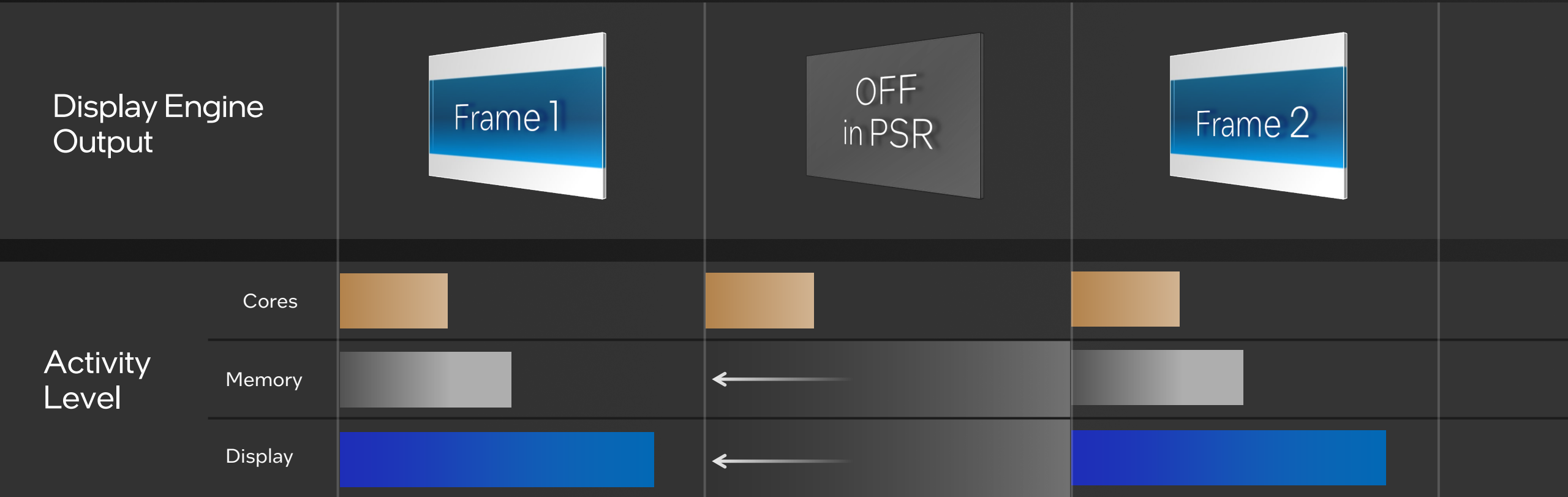
Display Engine Power Optimizations

Burst Fill



Display Engine Power Optimizations

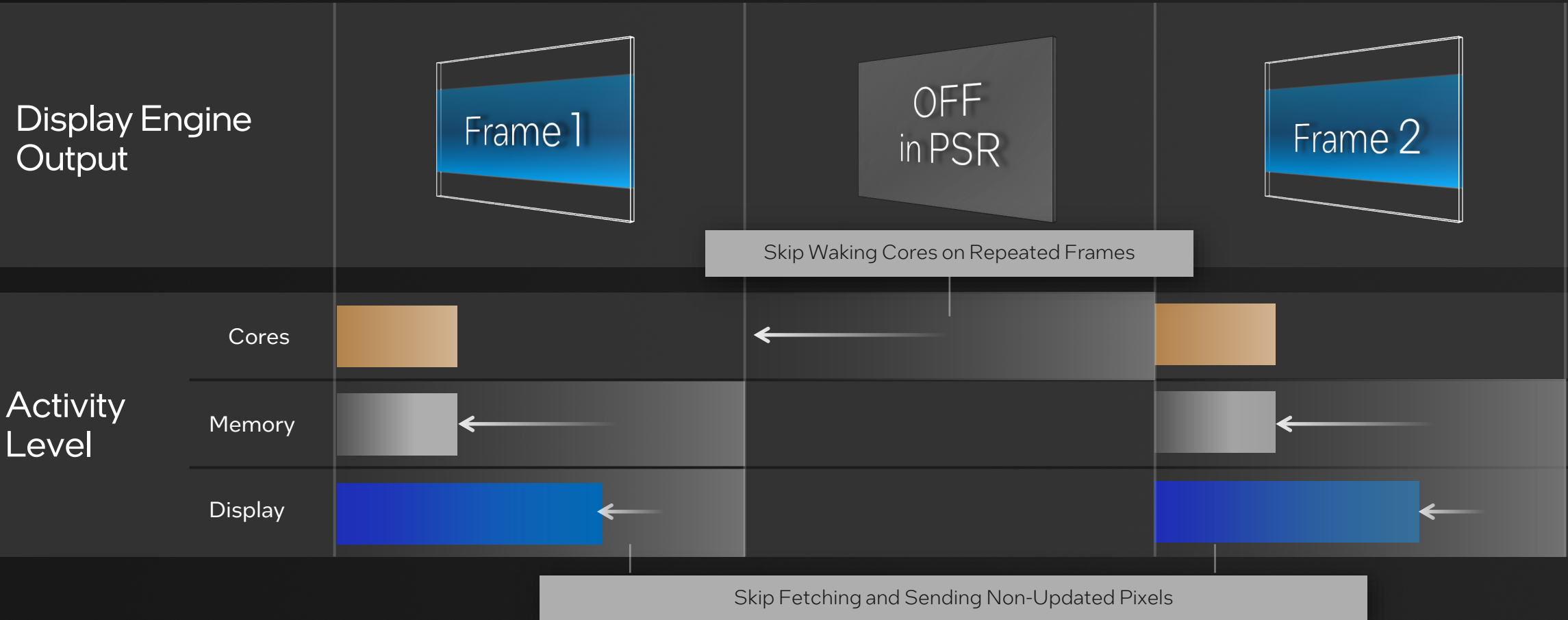
Panel Self Refresh



Skip Fetching and Transmitting Repeated Frames

Display Engine Power Optimizations

Selective Update and Optimized Vertical Blanking Interrupts

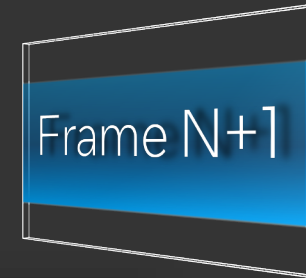
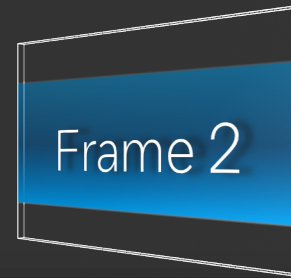
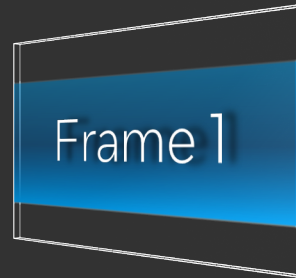


Display Engine Power Optimizations

Selective Update and Hardware Queuing

Repeat N-1 times

Display Engine Output



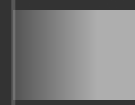
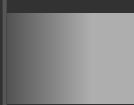
Queueing Frame into Display to reduce core wakeups

Activity Level

Cores



Memory



Display





Display Engine

Display
Connectivity
Standards

HDMI[™]
HIGH DEFINITION MULTIMEDIA INTERFACE

2.1

DisplayPort

2.1 20G

eDP 1.4

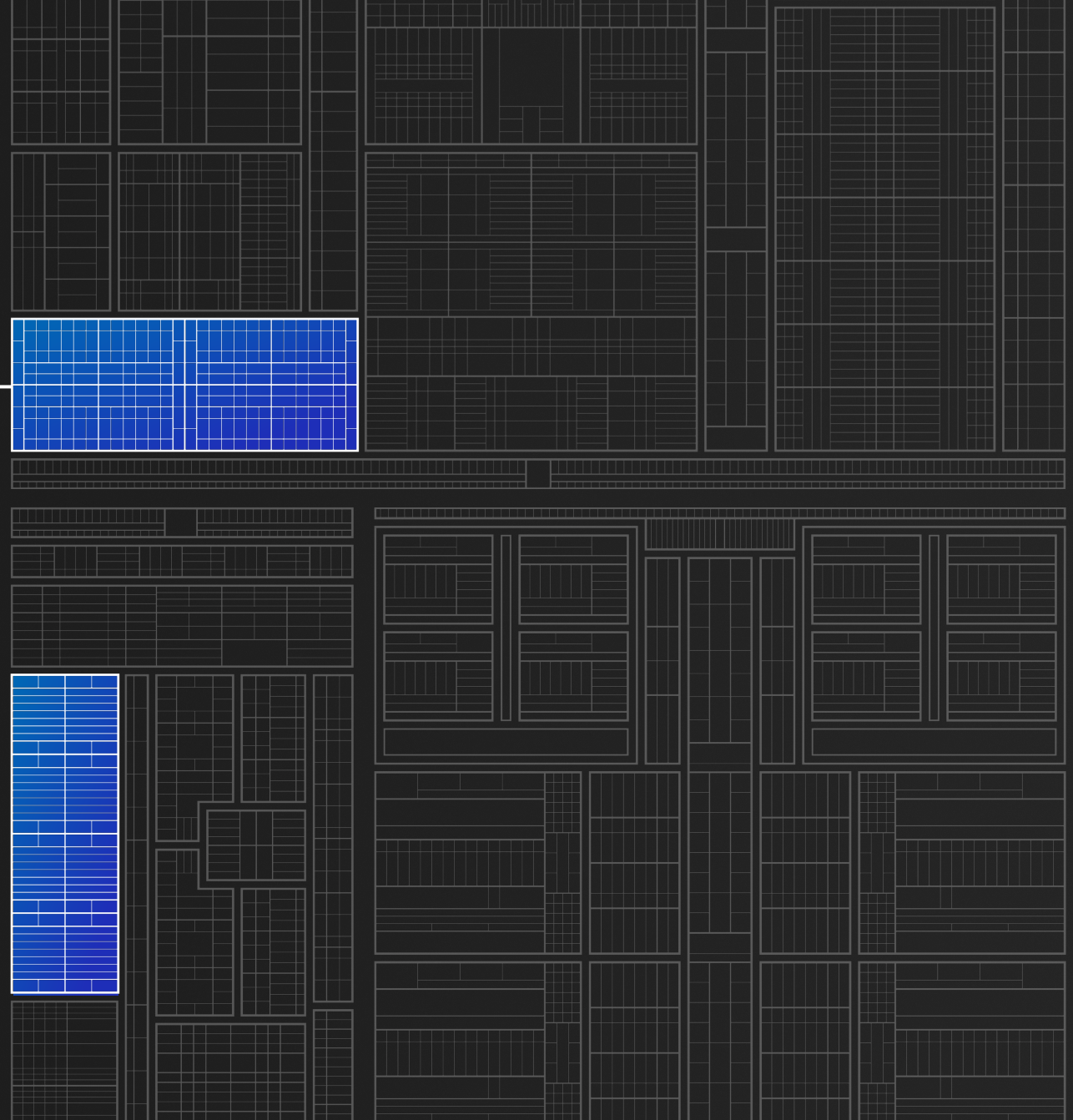
High
Resolution
Support

Up to
8k60
HDR

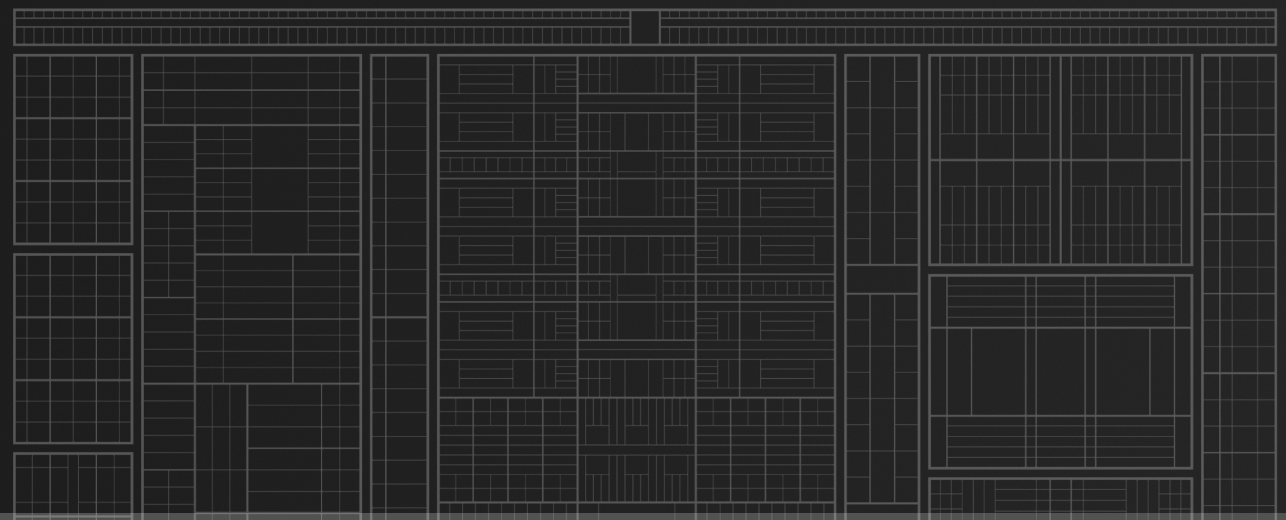
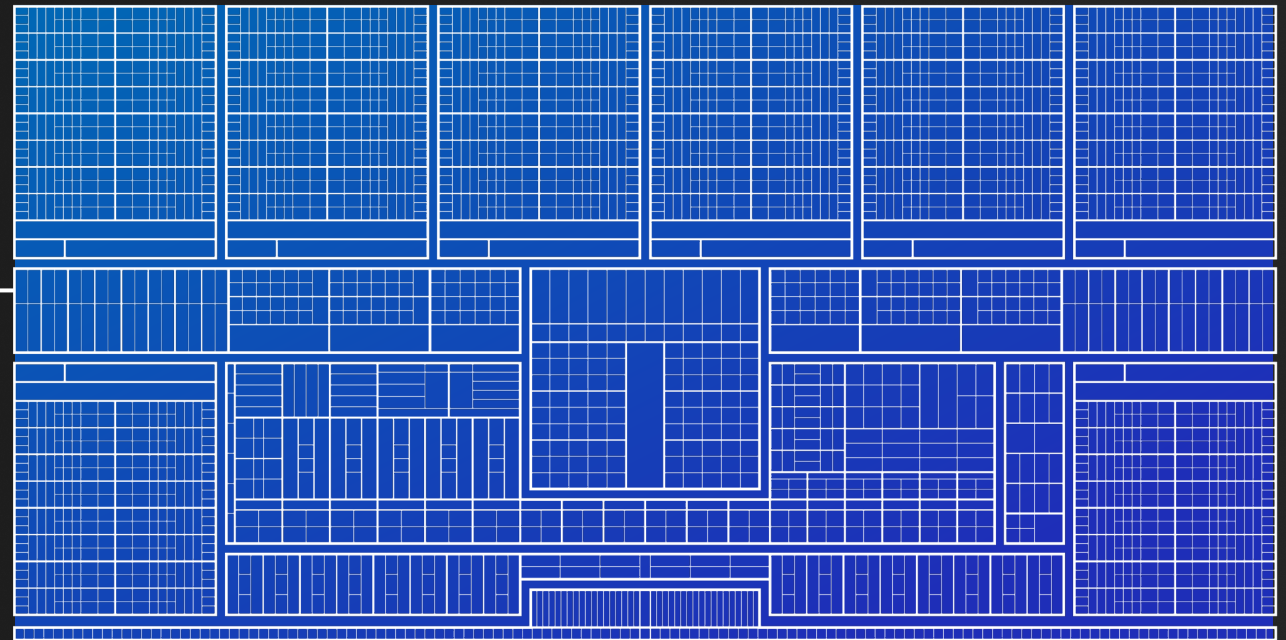
Up to
4x 4k60
HDR

Up to
1080p360
1440p360

Xe Display Engine



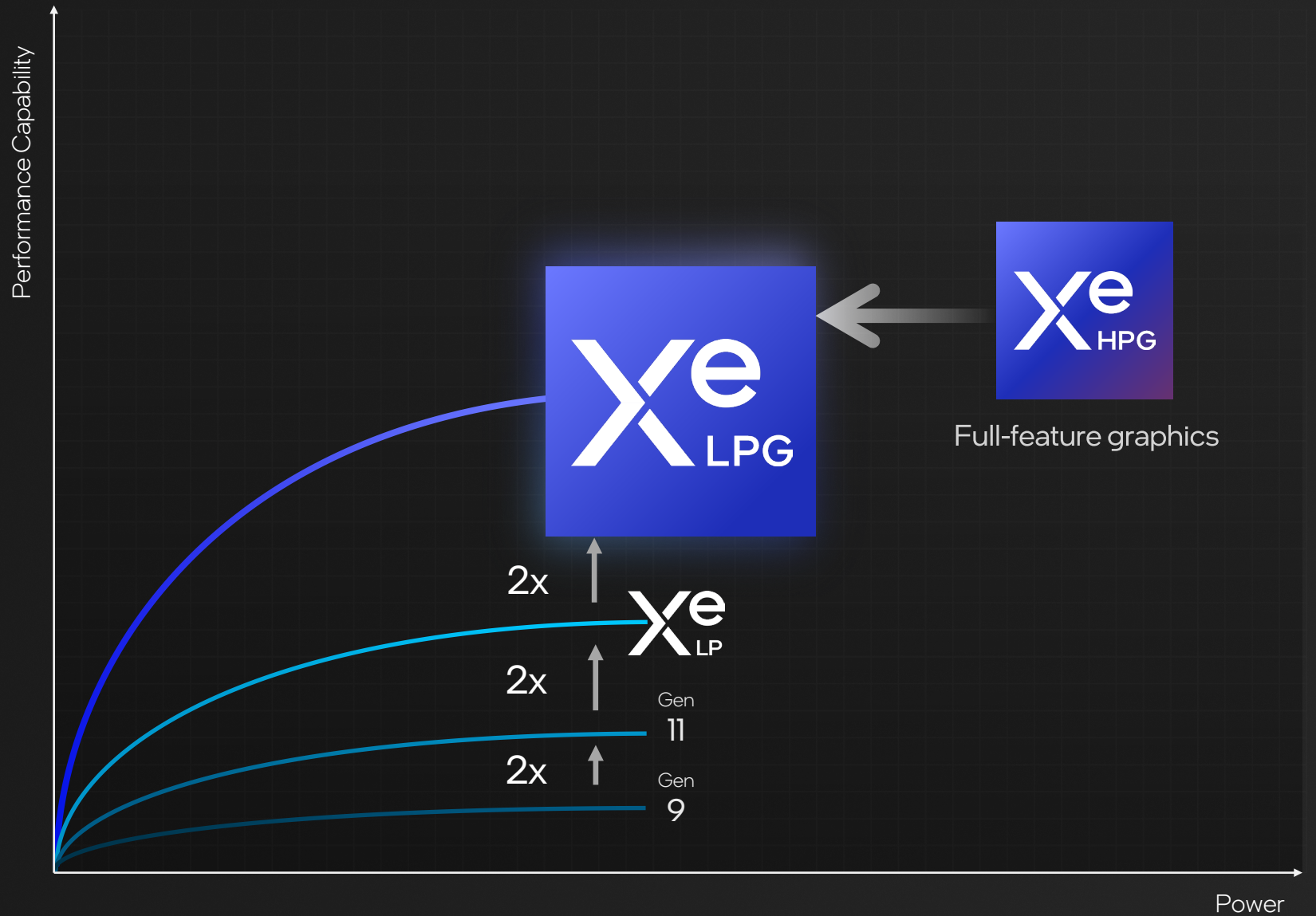
Xe Graphics Tile



Xe LPG

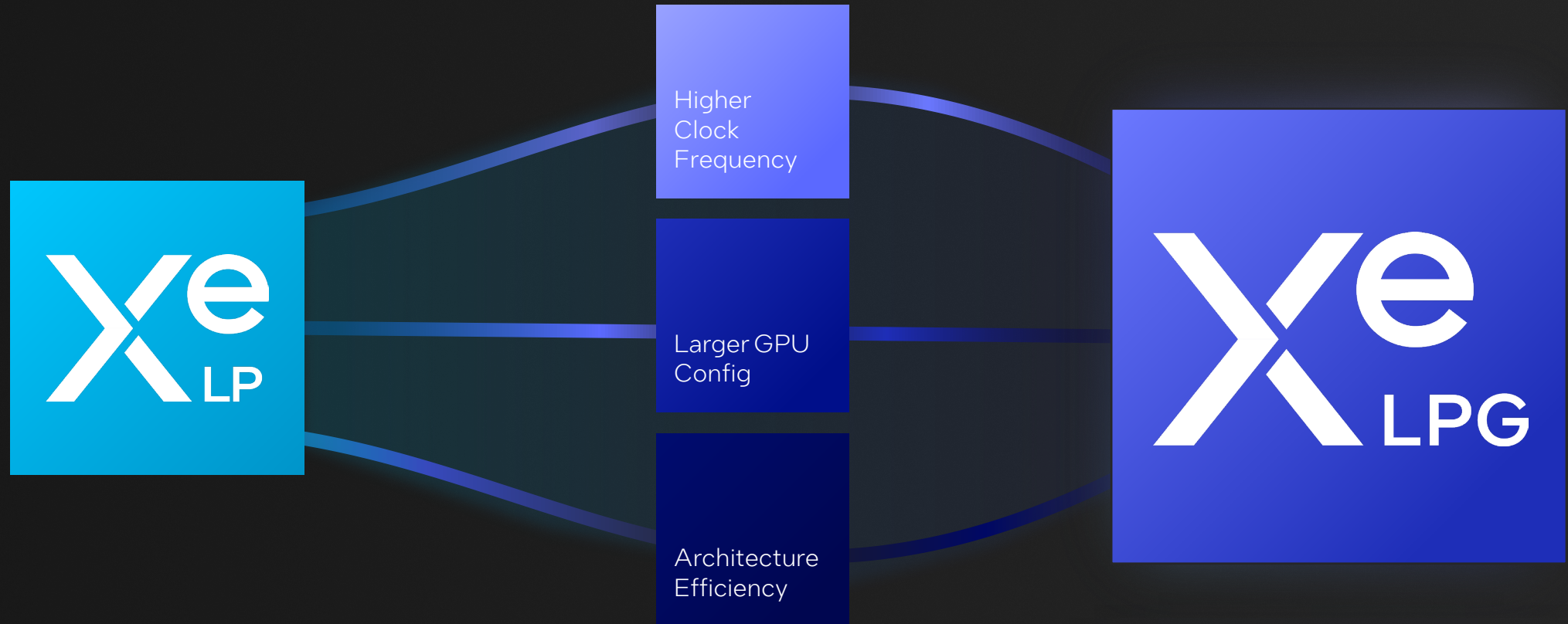
Graphics IP

Scaling the graphics engine

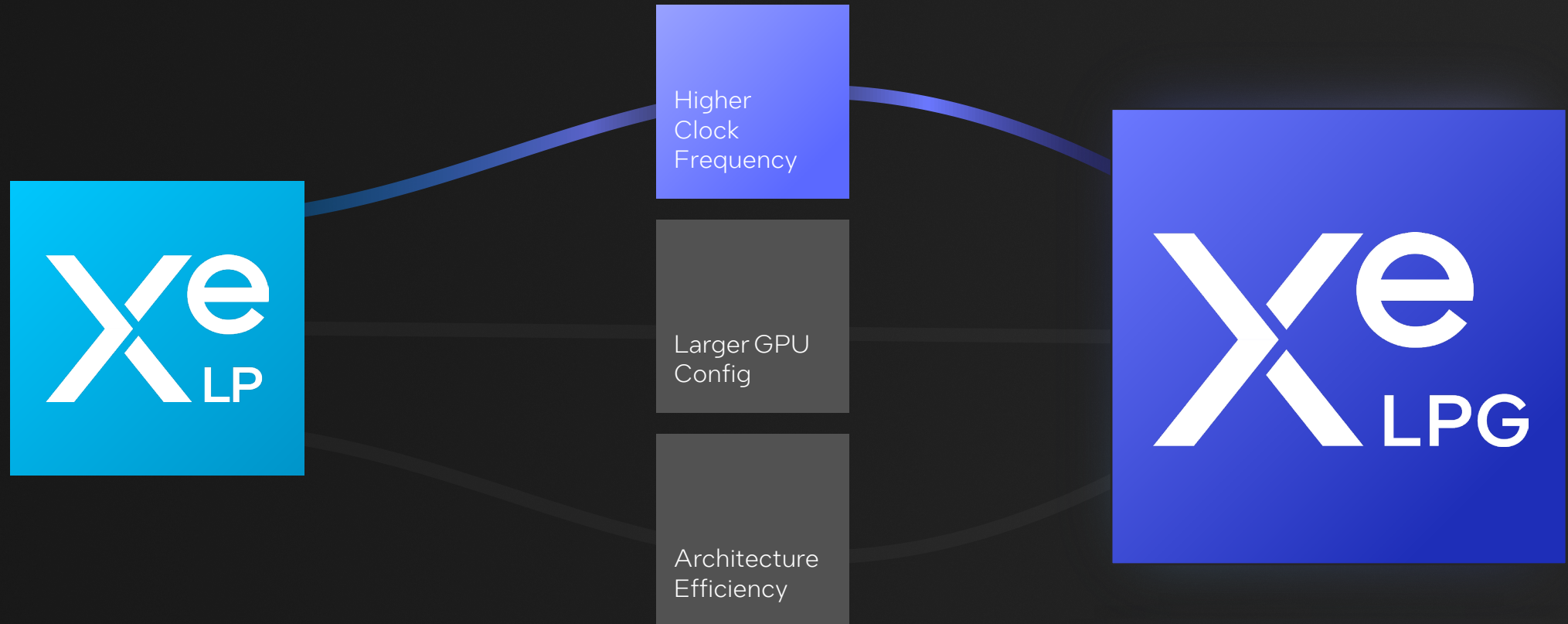


*See appendix for workloads and configurations. Results may vary.

Scaling the Graphics Engine



Scaling the Graphics Engine



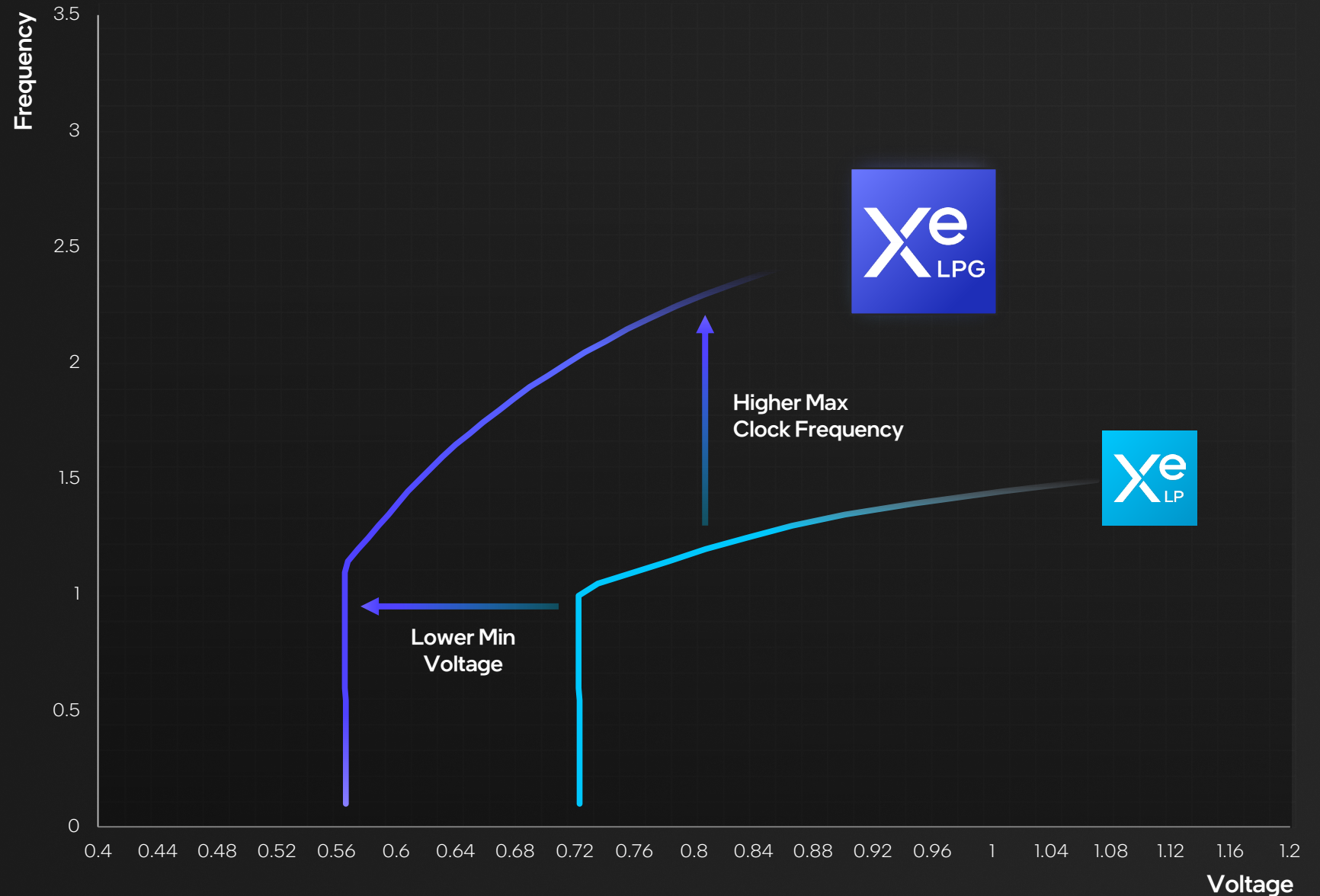
Higher Clock Frequency

Architecture

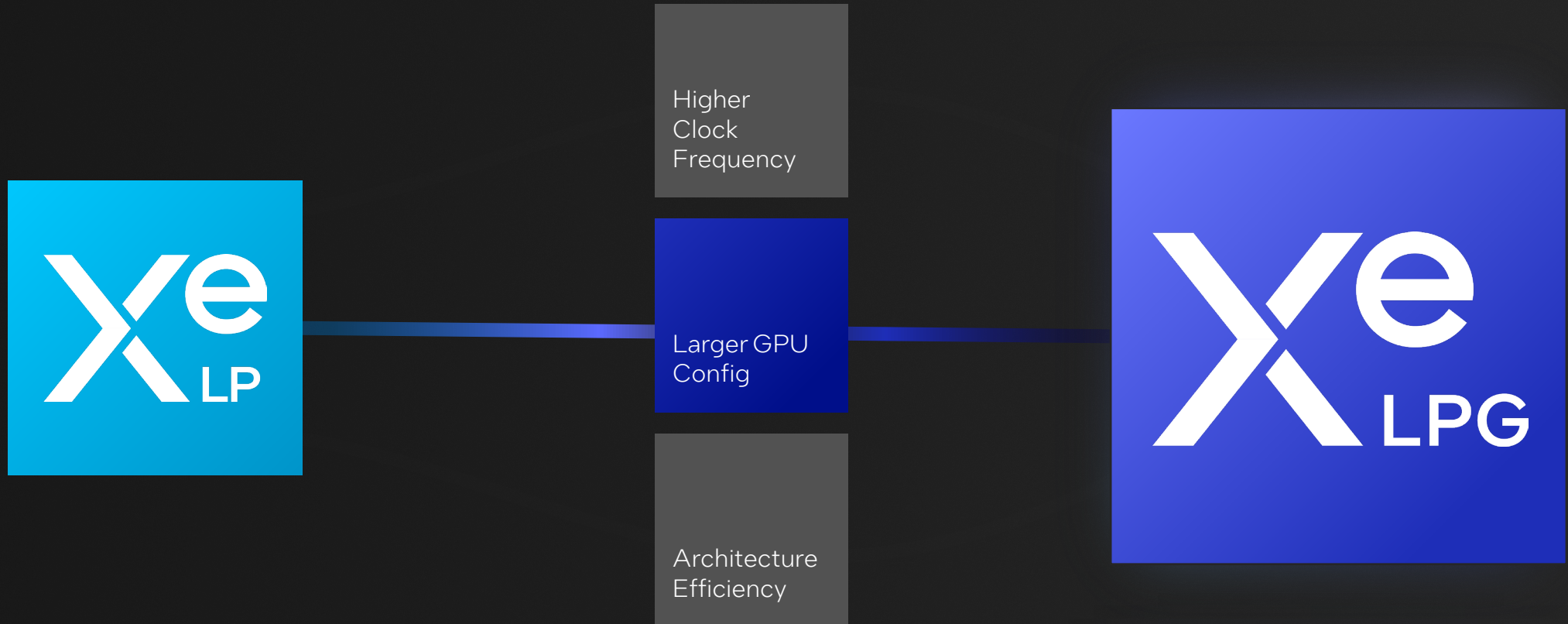
Logic Design

Circuit Design

Process Technology



Scaling the Graphics Engine



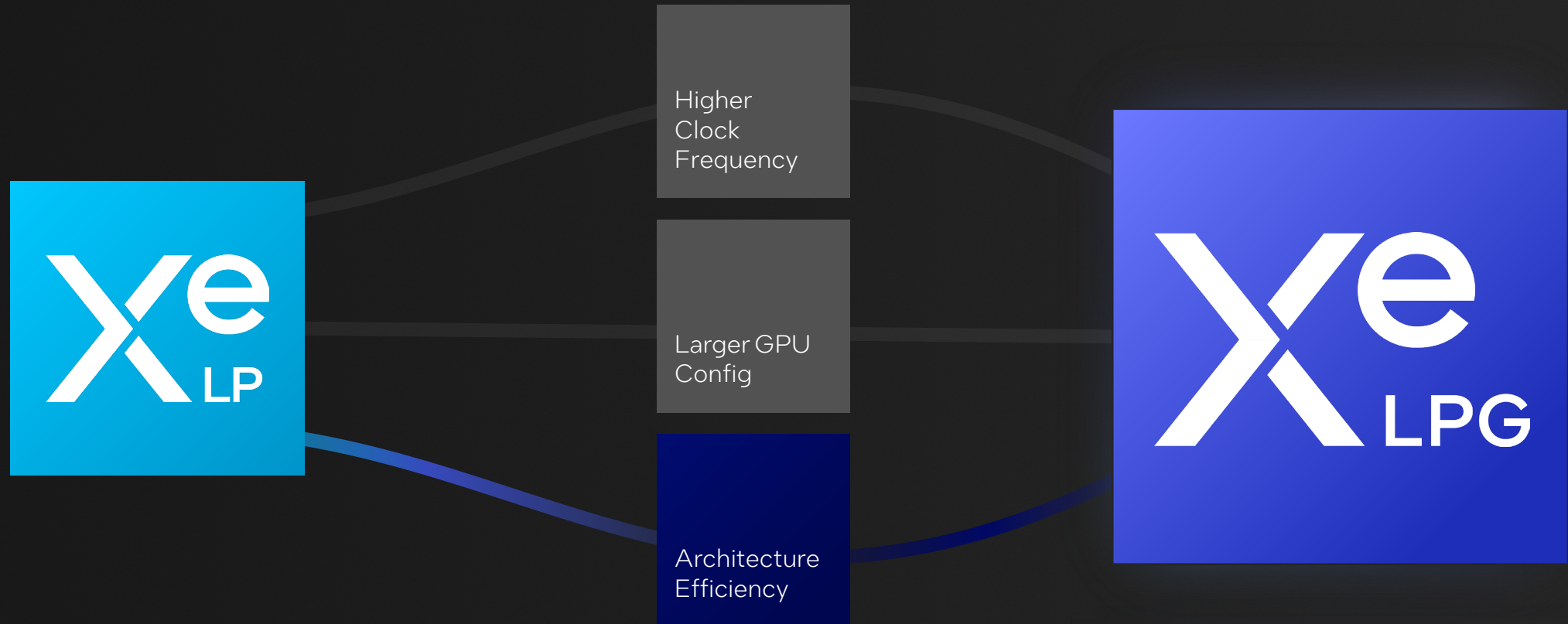
Wider GPU Configuration

8 X ^e -cores	NEW
128 Vector Engines	1.33x
2 Geometry Pipelines	2x
8 Samplers	1.33x
4 Pixel Backends	1.33x
8 Ray Tracing Units	NEW

vs X^e LP



Scaling the Graphics Engine



Xe - core



Xe^e - core

Compute block of Xe^e microarchitecture

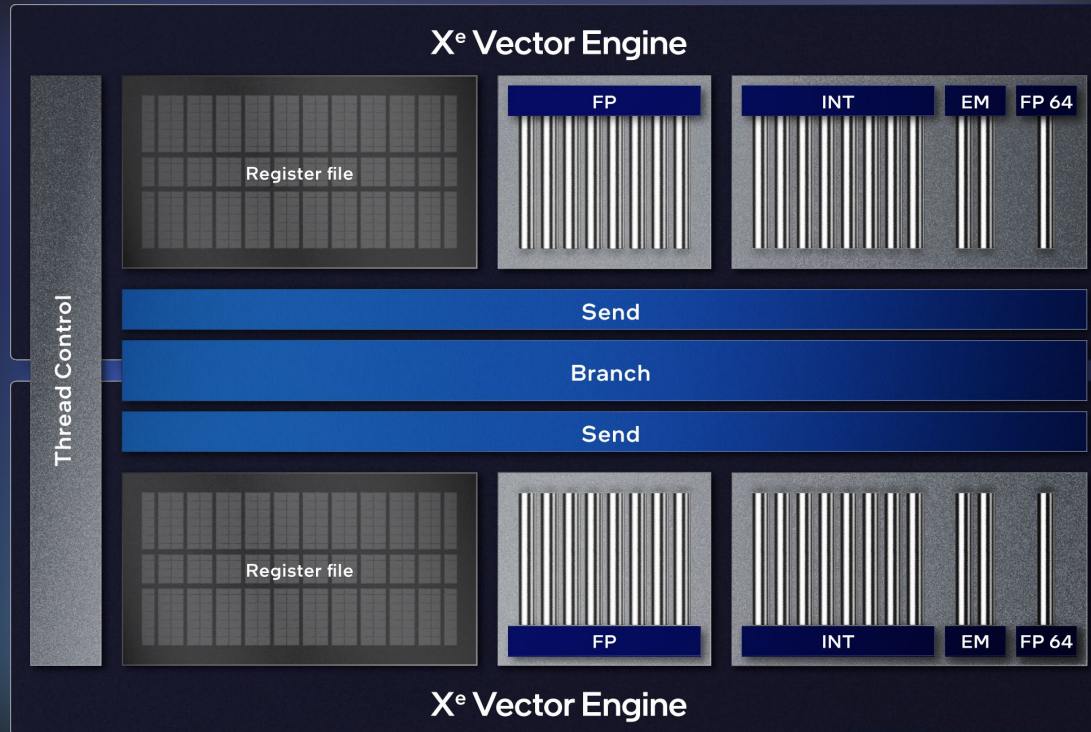
Xe^eLPG configuration

16 256-bit Vector Engines

192KB Shared L1\$/SLM



Xe Vector Engine



Xe-core



Xe Vector Engine

Dedicated FP execution

16 FP32 ops/clock

32 FP16 ops/clock

Shared INT/EM/FP64 execution port

64 INT8 ops/clock

2 Extended Math instructions/clock

1 FP64 ops/clock

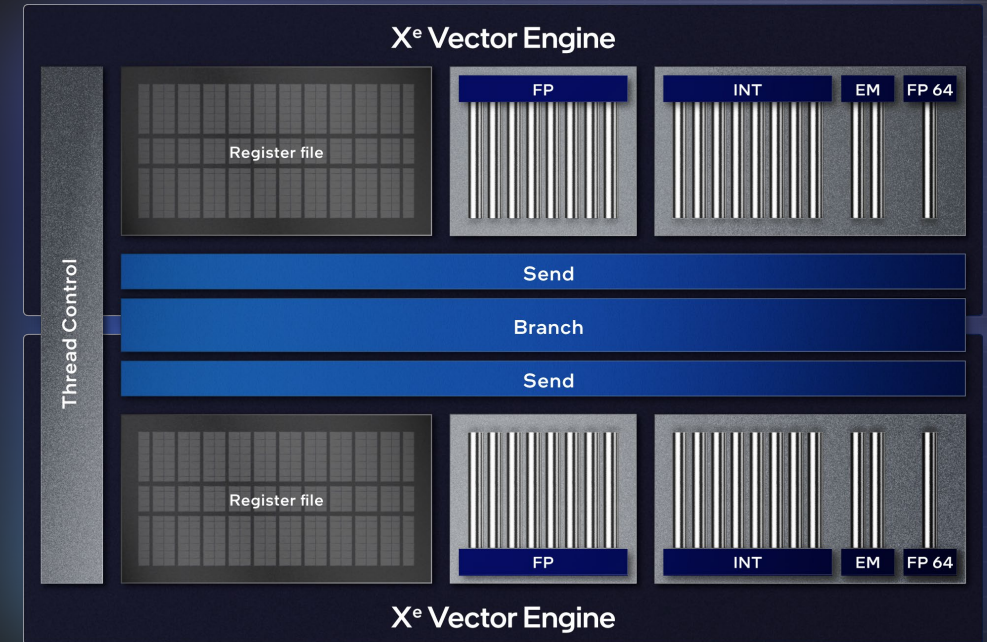
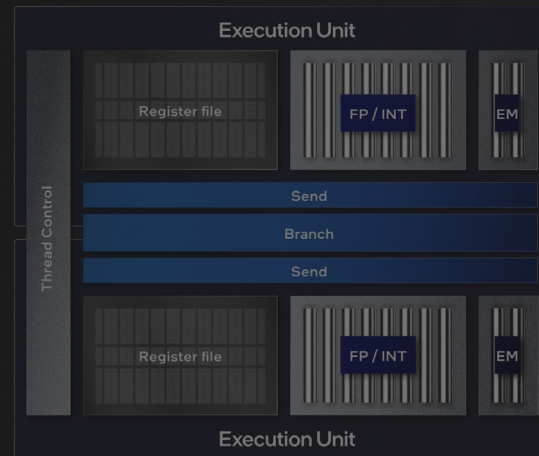
NEW

High Efficiency Thread Control

Pairs of Vector Engines run in lockstep

FP + INT/EM co-issue

NEW



High-Performance Graphics Acceleration Hardware



High-Performance Graphics Acceleration Hardware

X^e HPG Inherited Features

DX12 Ultimate Optimized

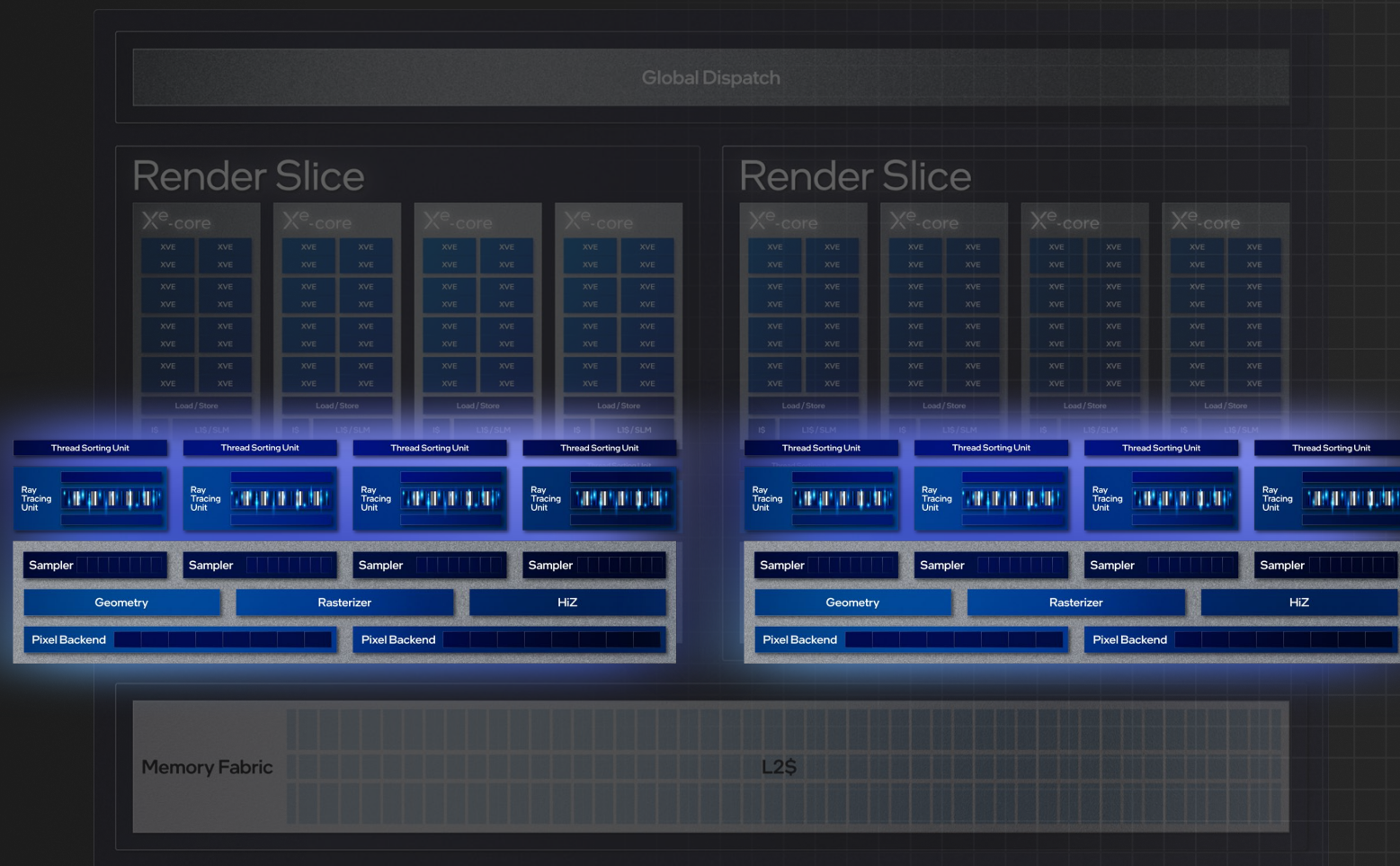
8x Ray Tracing Units

Double Rate HiZ

Async Copies

New with X^e LPG

Out of Order Sampling

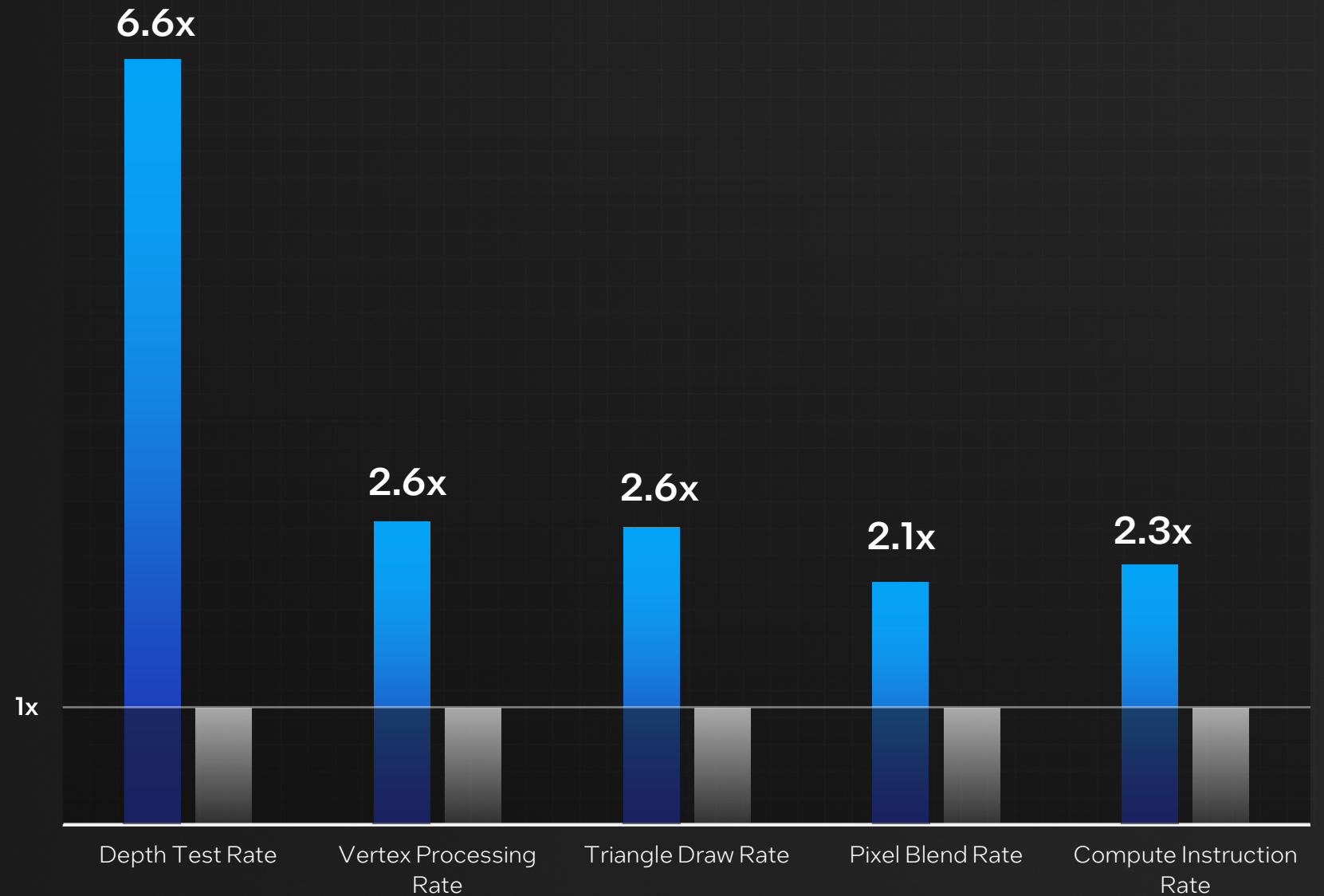


Xe LPG

Graphics IP

Scaling the graphics engine

- Xe LPG – Meteor Lake
- Xe LP – Raptor Lake



See appendix for workloads and configurations. Results may vary.

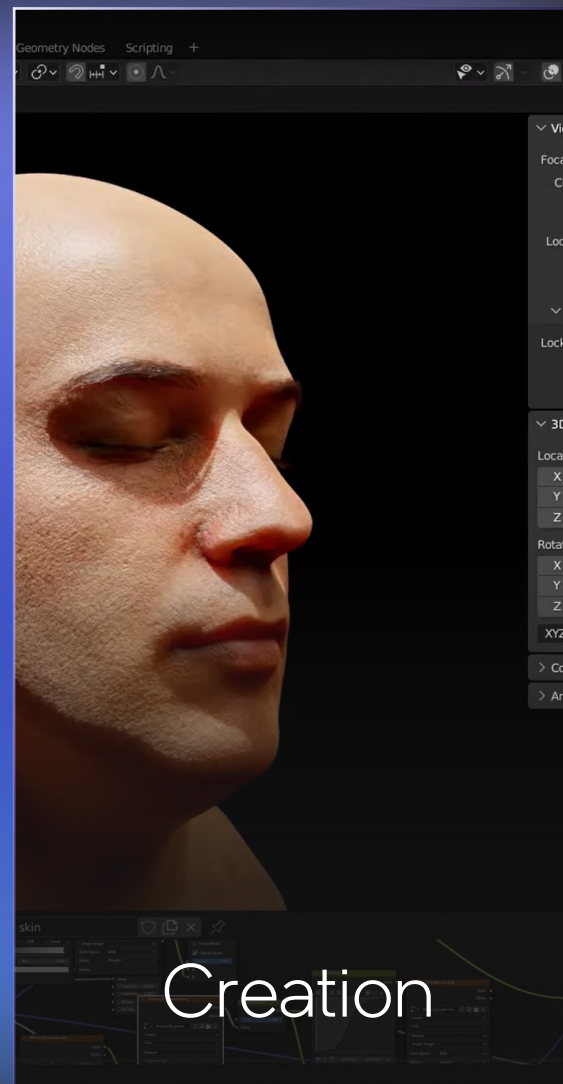
Relative Performance (Higher is better)

Ray Tracing Use Cases



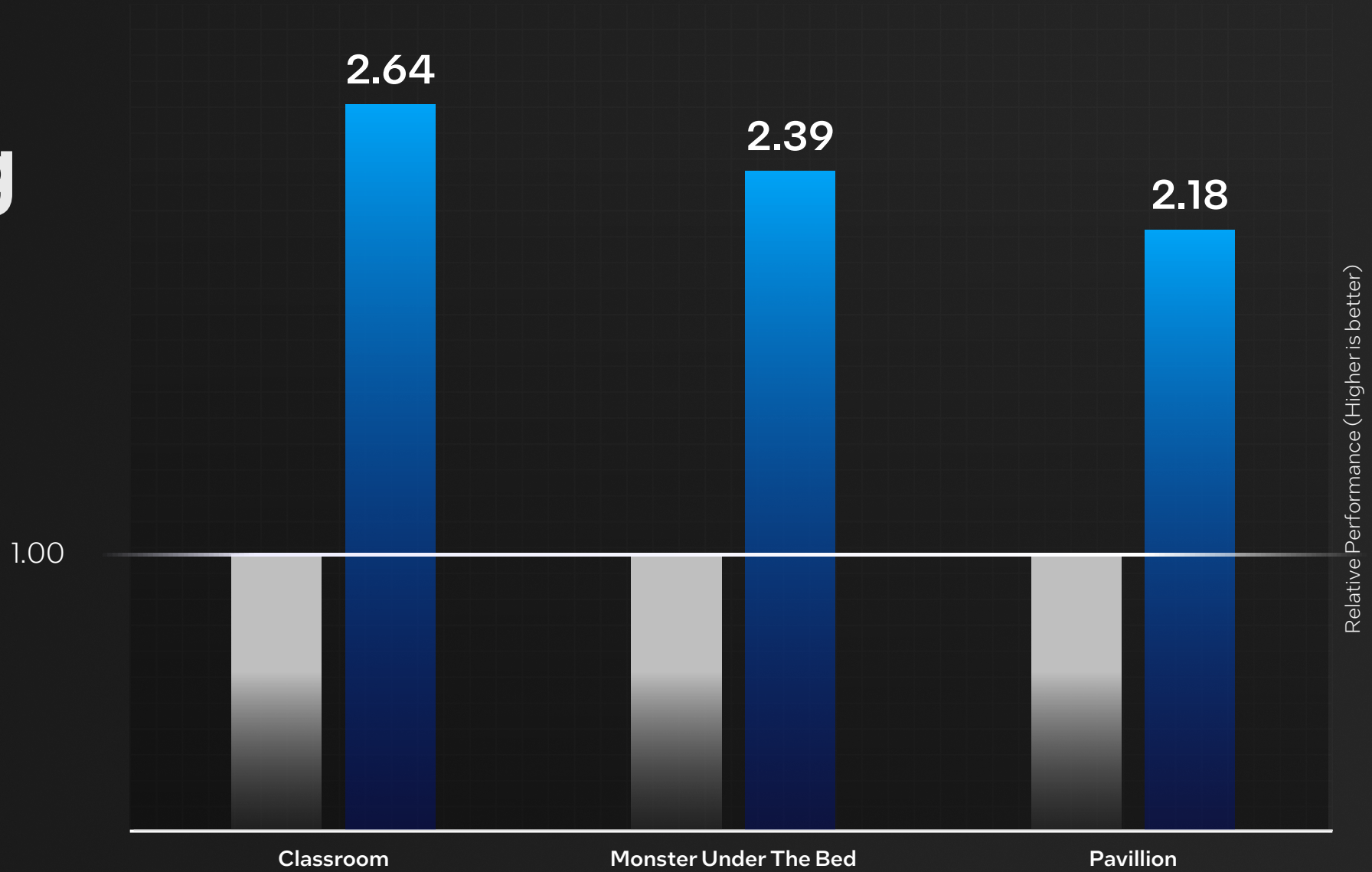
Gaming

Ray Tracing Use Cases



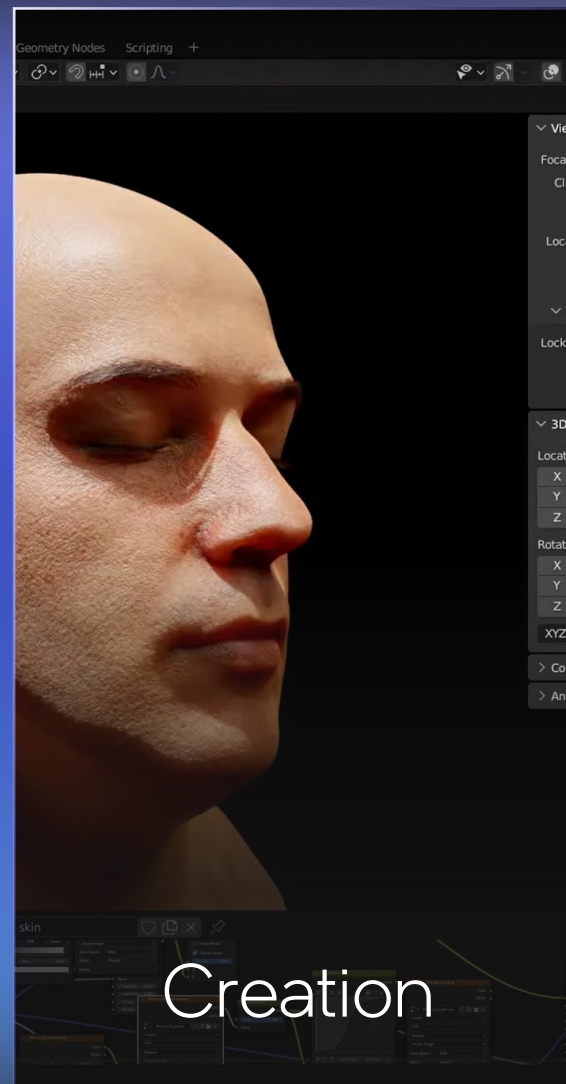
Hardware Ray tracing in Blender

CPU
Embree with HW RT



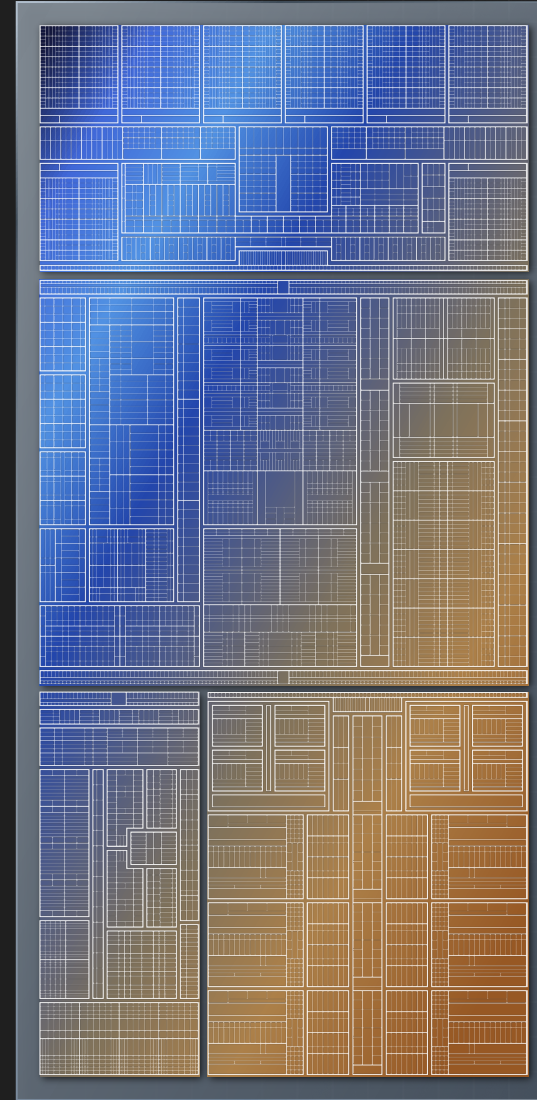
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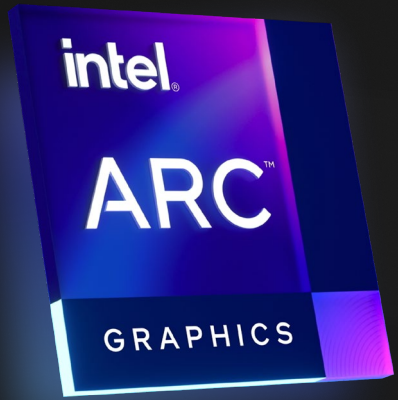
Ray Tracing Use Cases





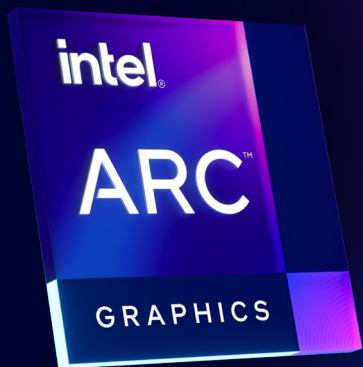
Graphics Software Stack





Graphics Software Stack

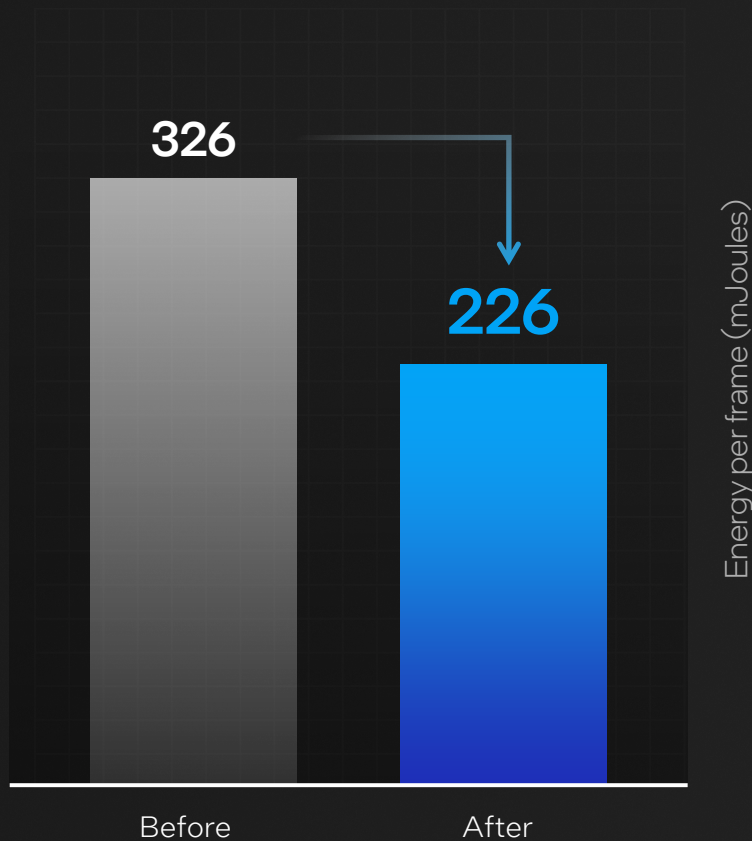




Leveraging Intel Arc Software Effort

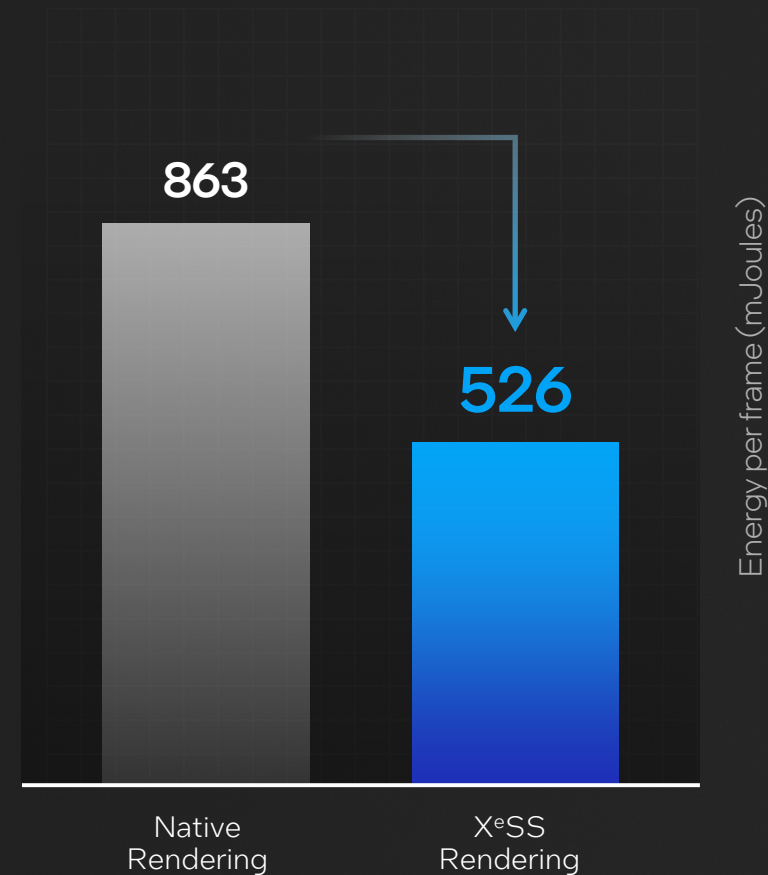
DX9 Driver Optimization

New driver architecture with **lower API overhead**



Intel XeSS

High-performance
AI-based upscaling



See appendix for workloads and configurations. Results may vary.

XeSS Overview

Frame History



Jitter

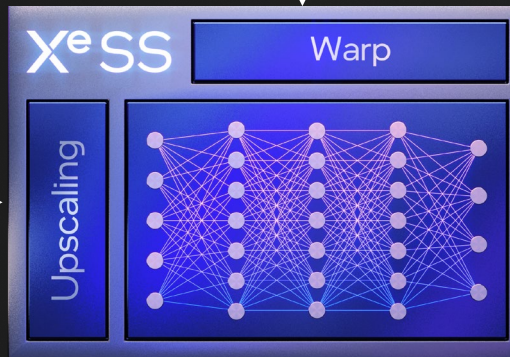
Raster, Lighting & Post-Processing



Motion Vectors



Low-Res
Frame Render



Super Sampled
Render

Post-Processing



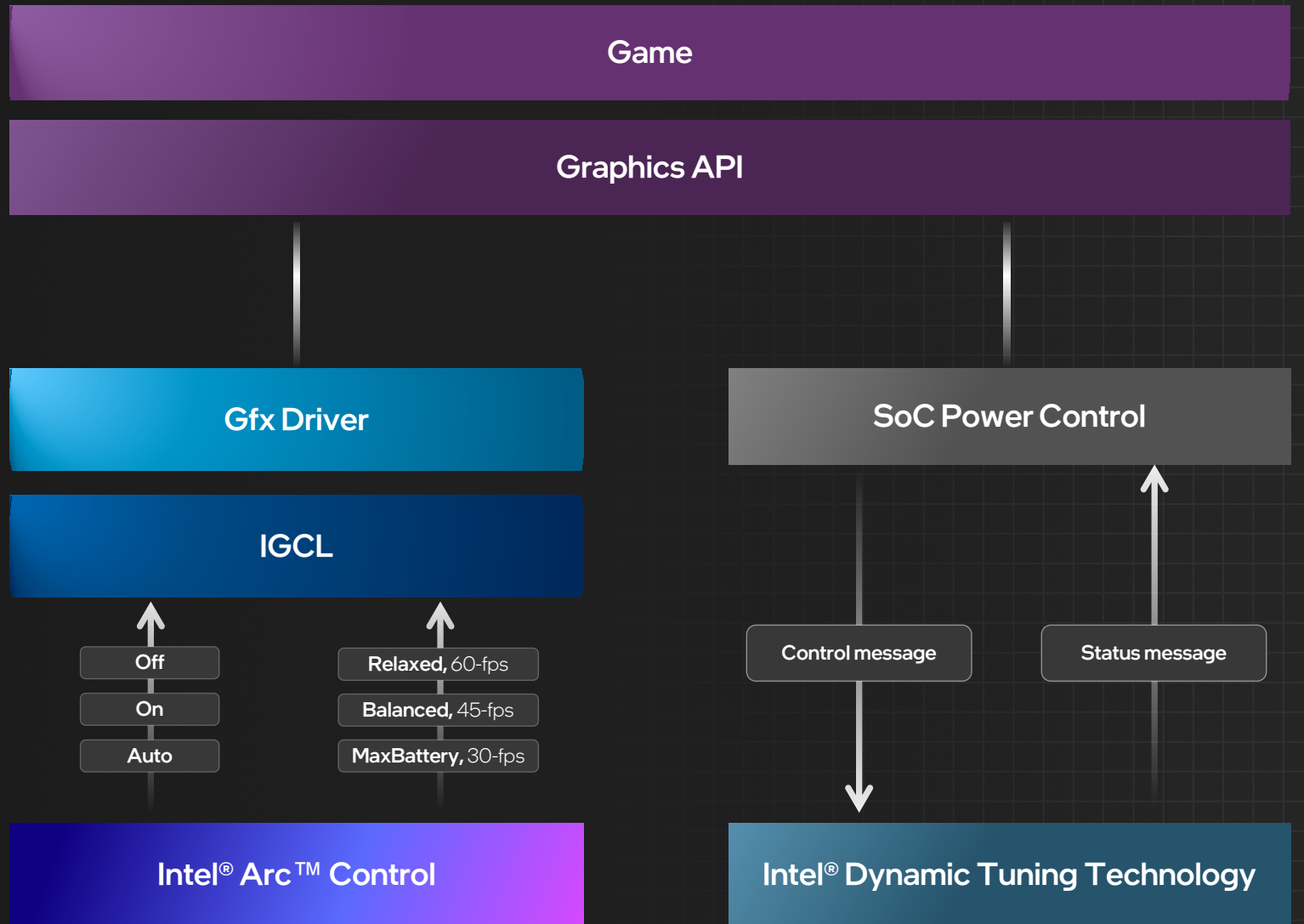
Rendering With X^eSS



Image provided for conceptual use, not intended to represent actual data.



Endurance Gaming

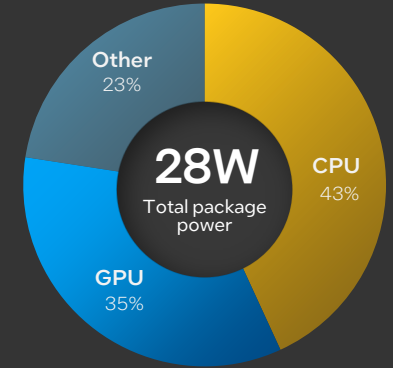
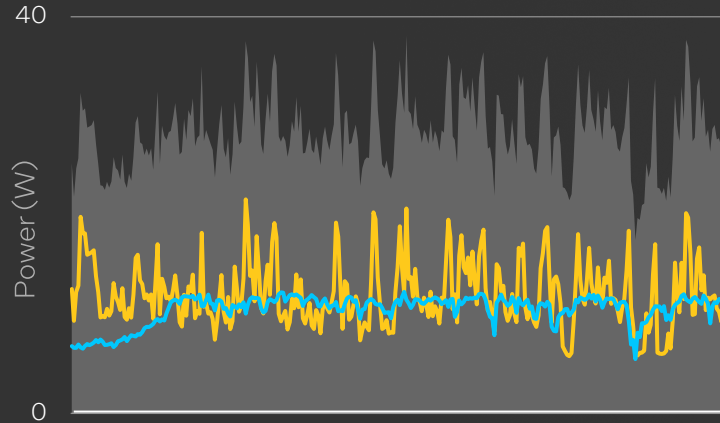




Maximum Battery Life Endurance Gaming

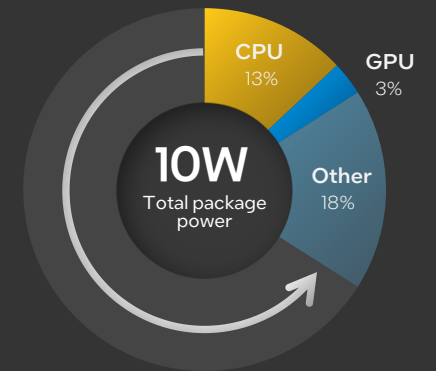
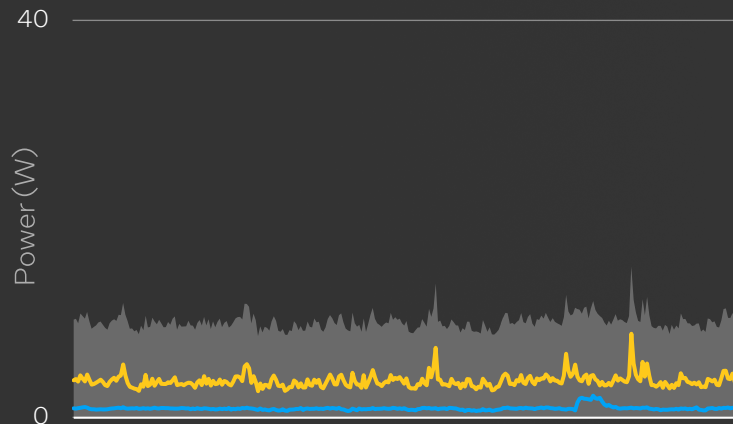
Regular Gaming

30s gaming
segment



Endurance Gaming

30s gaming
segment



Total Power (W)
 CPU Power (W)
 GPU Power (W)
 Other (W)

See appendix for workloads and configurations. Results may vary.

Meteor Lake GPU



*Compared to prior generation. See appendix for more information. Results may vary.

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