

The Intel logo is positioned in the upper right corner of the slide, set against a white square background. The background of the entire slide is a 3D architectural rendering of a server rack, with glowing blue lines representing data paths and server components.

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TECH .
tour.TW

Intel Thread Director & Power Management Innovations for Lunar Lake

Rajshree Chabukswar
Intel Fellow

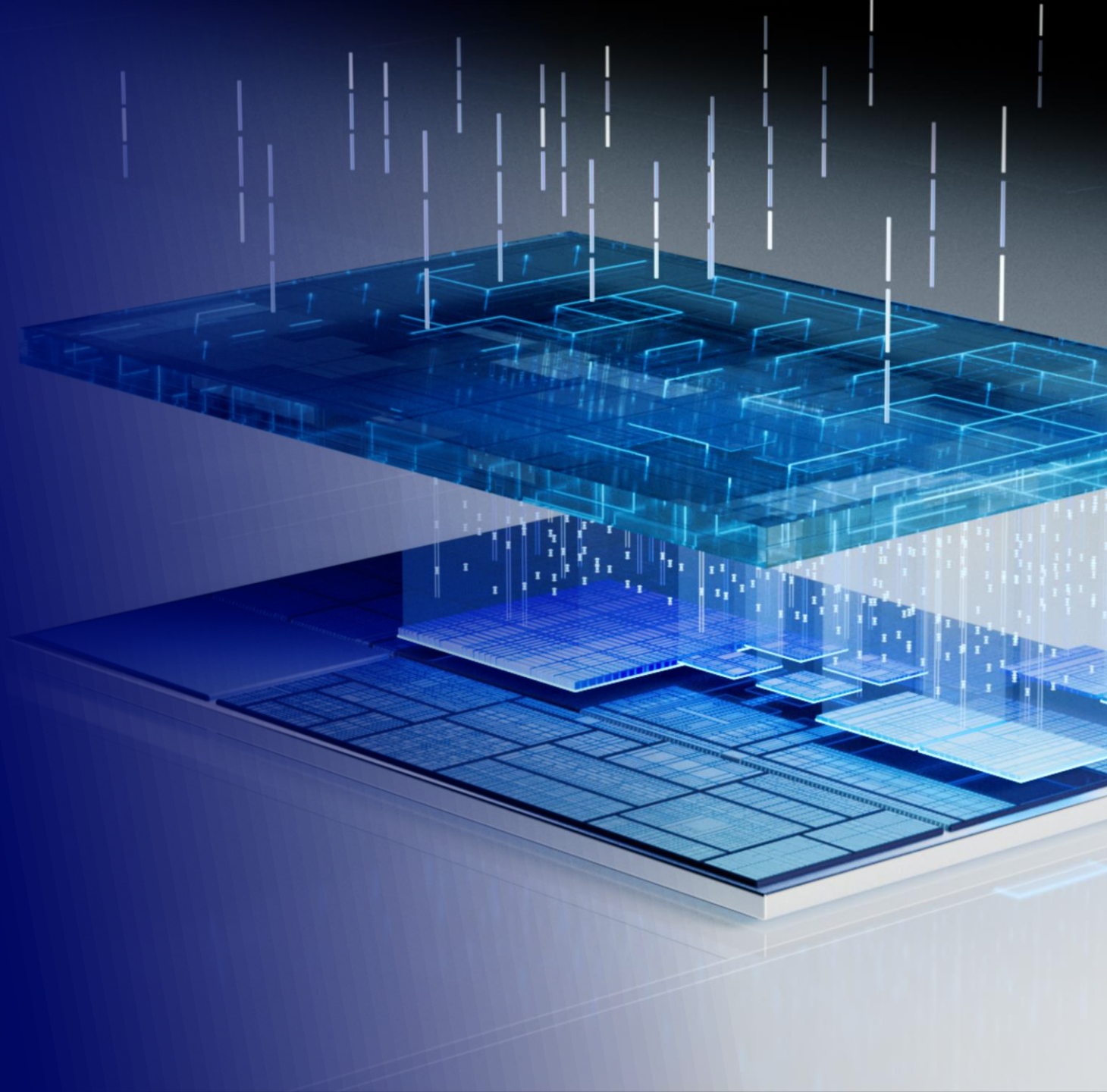
Goals

Optimize right workload for right core

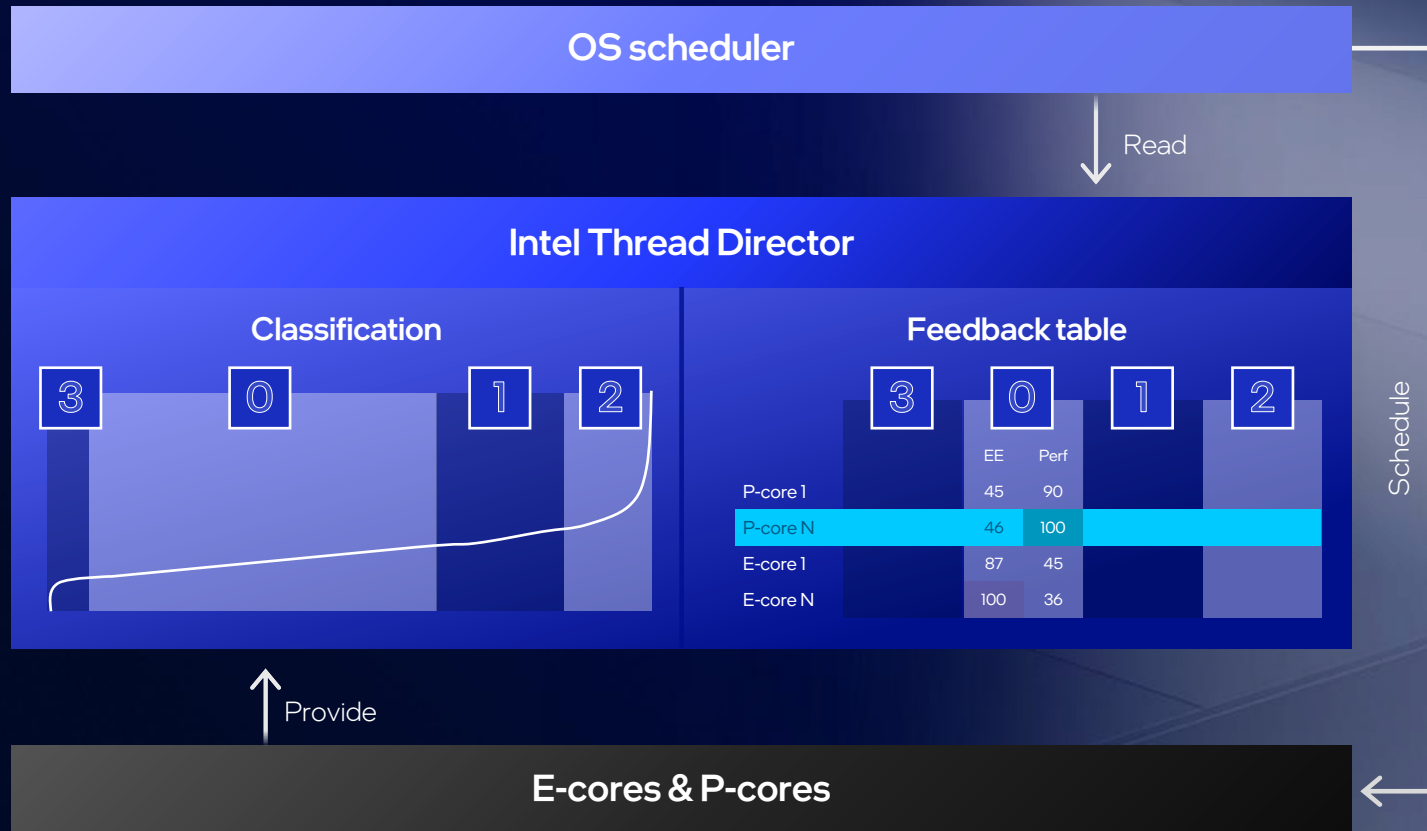
Tighter OS integration

Enhance capabilities for efficiency

Broaden contextual input



Intel Thread Director Architecture Recap

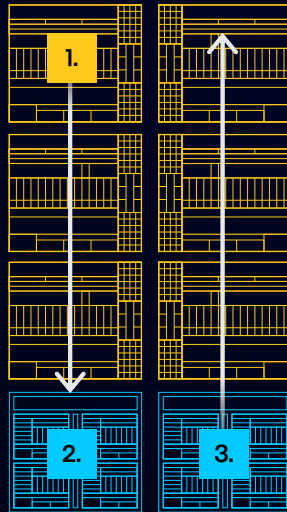


Conceptual representation of Intel Thread Director technology

Intel Thread Director Scheduling Evolution

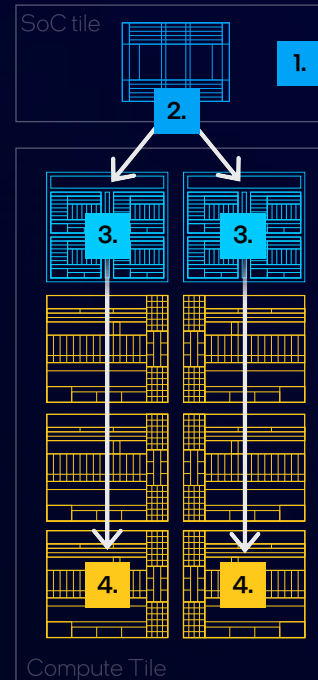
Raptor Lake

1. Higher demand work to **P-cores**
2. Lower demand to **E-cores**
3. Periodically move **E-core** threads to **P-core**



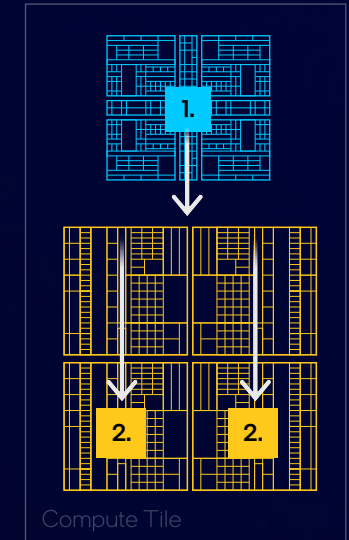
Meteor Lake

1. Contain work on **SoC E-cores**
2. Exceeding capacity? move to **compute tile**
3. Use compute **E-cores** if the work fits there
4. Higher demand work to **P-cores**



Lunar Lake

1. Use **E-cores** if the work fits there
2. Exceeding capacity? Move work to **P-cores**



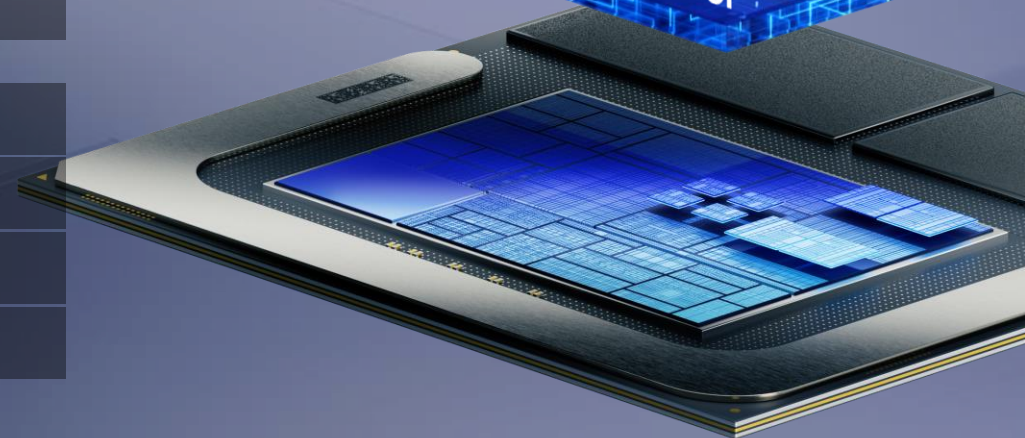
Intel Thread Director

Office Productivity Example

PowerPoint
image insertion



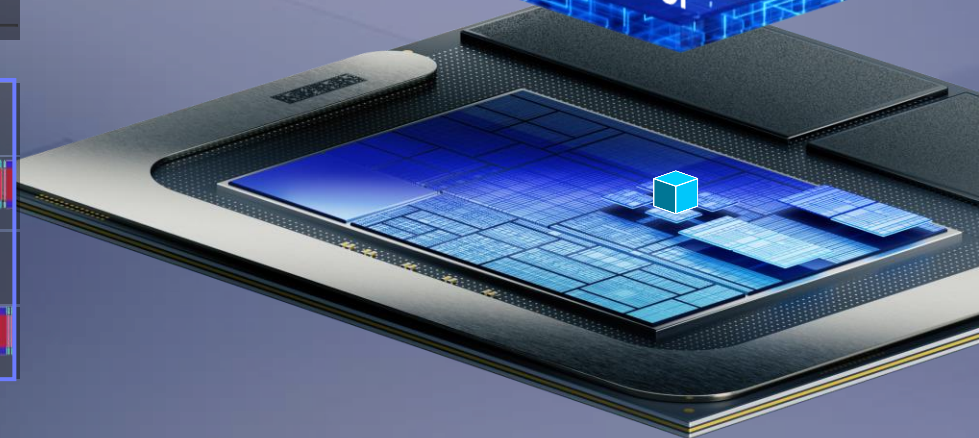
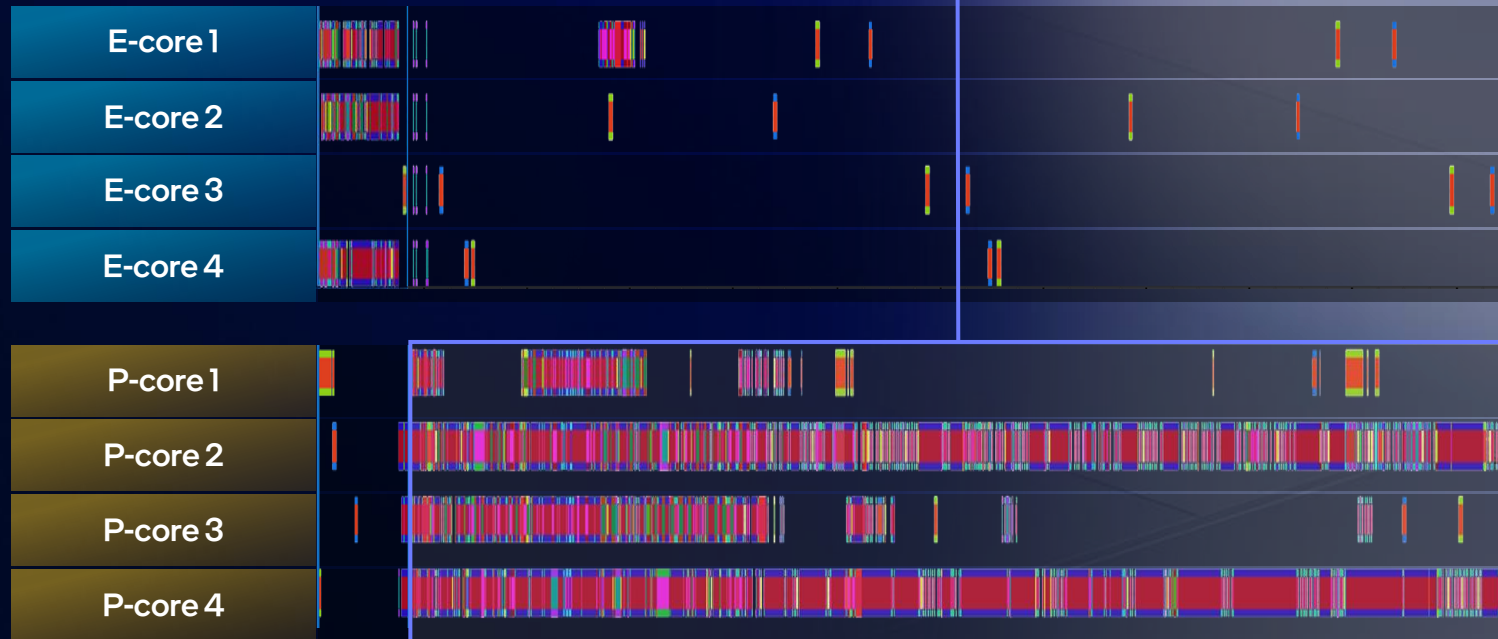
Starts of by scheduling
on E-cores



Intel Thread Director

Office Productivity Example

Moves to P-cores as soon as more performance is needed





Intel Thread Director and Power Management

Innovations

Optimize right workload for right core

More intelligent feedback

Tighter OS integration

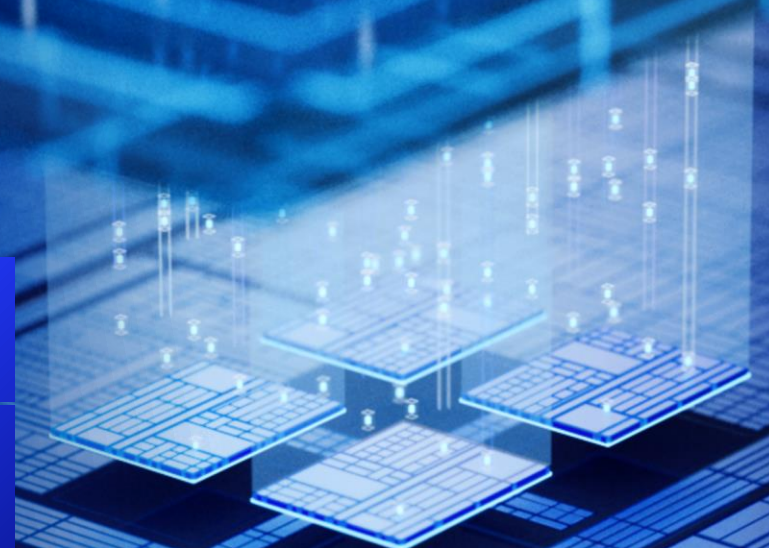
OS containment zones

Enhance capabilities for efficiency

Power management tie-in

Broaden contextual input

Consuming platform intent



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Intel Thread Director

Innovations

More intelligent feedback

OS containment zones

Power management tie-in

Consuming platform intent

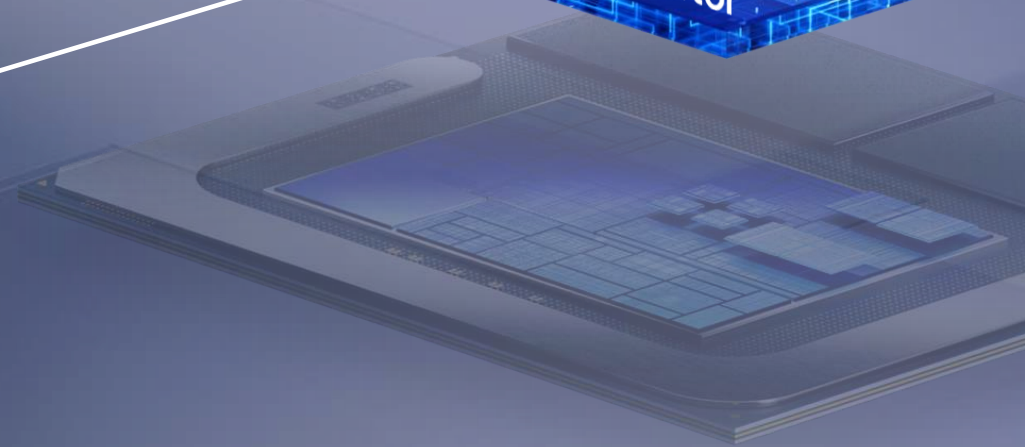
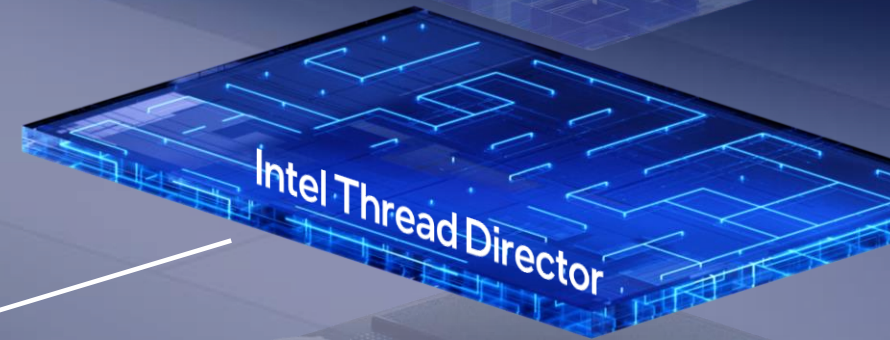
Intel Thread Director

Upgraded Foundations

Enhanced algorithms
for workload classification

Finer granularity
in workload handling

Very low power/thermal hint to OS
for experience continuity



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Intel Thread Director

Innovations

More intelligent feedback

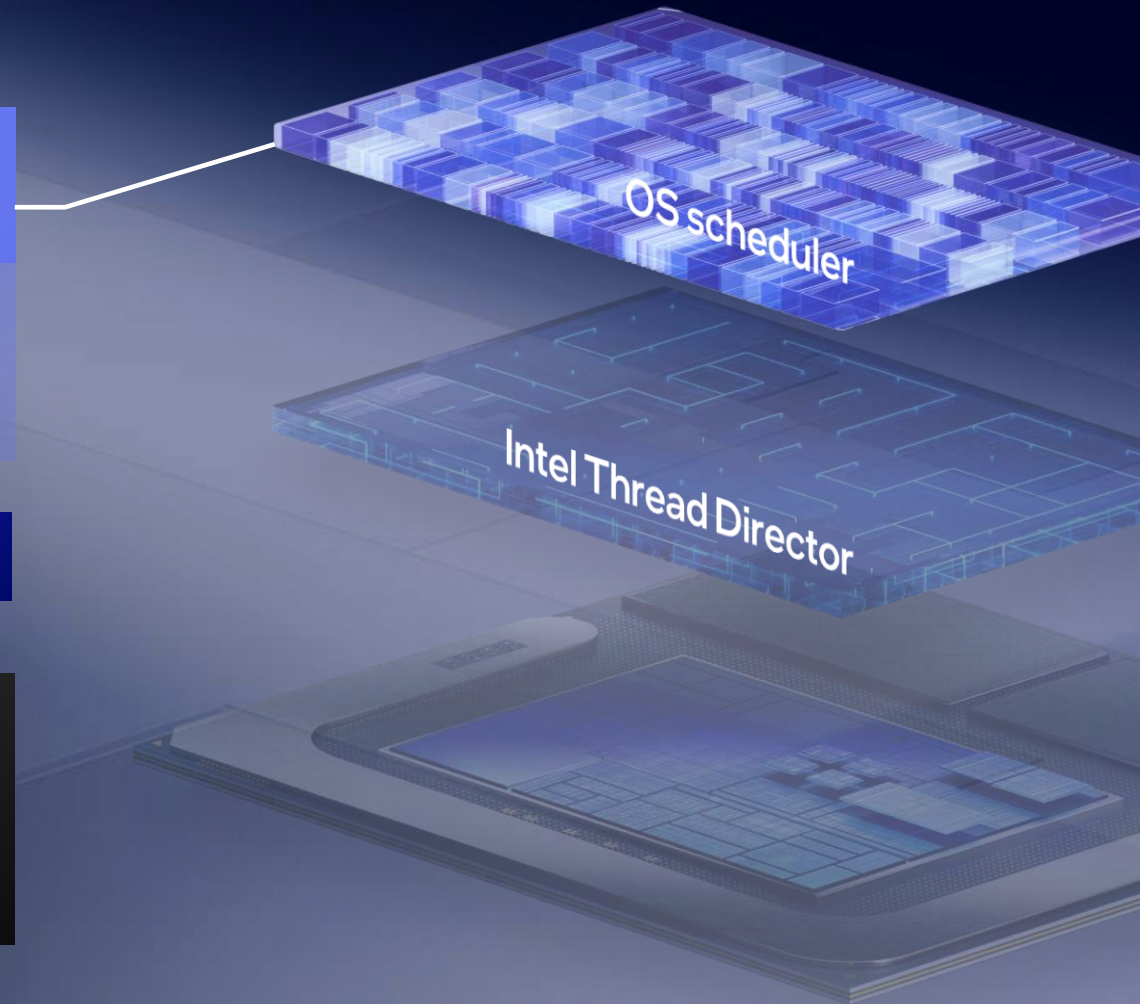
OS containment zones

Power management tie-in

Consuming platform intent

Intel Thread Director

OS Containment Zones



co-design with



//

With Intel Thread Director technology, which identifies the most power efficient CPUs on Lunar Lake platforms, the Windows OS is able to create a ‘containment zone’ to constrain work to only those CPUs and keep the other performant CPUs parked/idle for use only when needed. This is delivering significant power savings for Teams Video Conferencing scenarios that fit well within the containment zone on Lunar Lake.”

Tapan Ansel

Senior Software Engineer,
Windows Core OS

Bret Barkelew

Principal Software Engineering Lead
(Energy Efficiency), Windows Core OS

Intel Thread Director Lunar Lake Scheduling

Hetero scheduling policy used

First single E-core as long as work fits



Intel Thread Director Lunar Lake Scheduling

Hetero scheduling policy used

First single E-core as long as work fits

Expand to other E-cores for MT



Intel Thread Director Lunar Lake Scheduling

Hetero scheduling policy used

First single E-core as long as work fits

Expand to other E-cores for MT

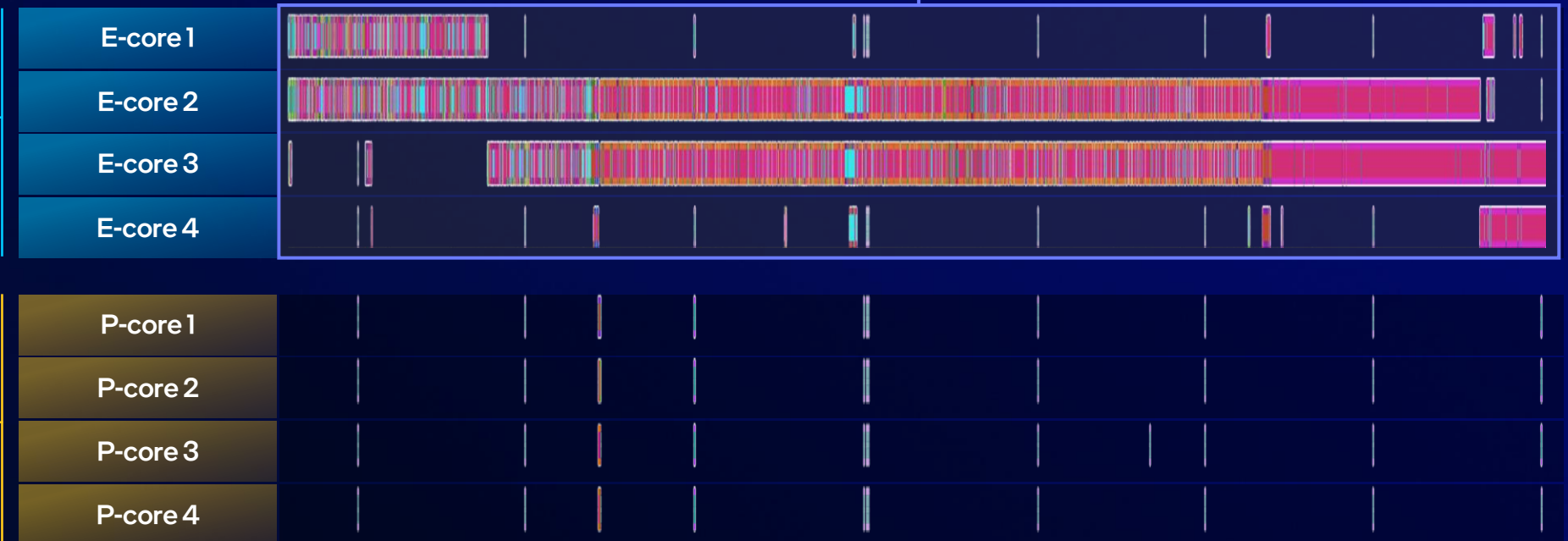
Move to P-cores based on demand ITD guidance



Containment Zones

Lunar Lake with Containment

Most real workloads stay on E-core cluster



Intel Thread Director + Power Management

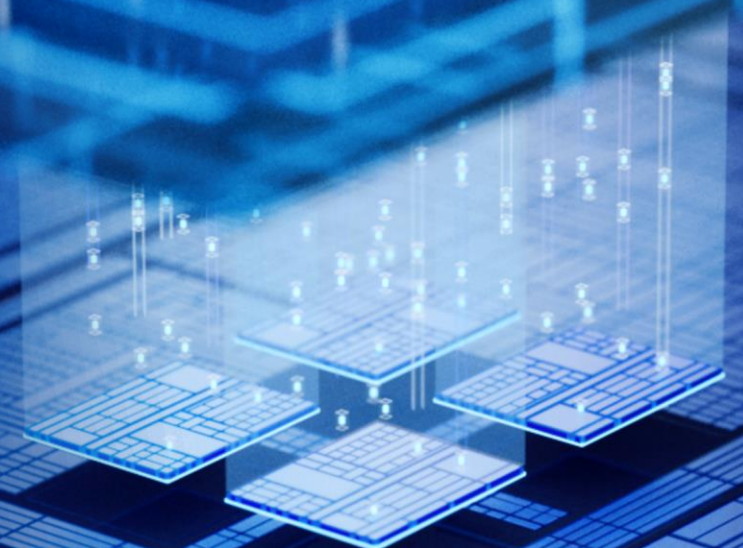
Innovations

More intelligent feedback

OS containment zones

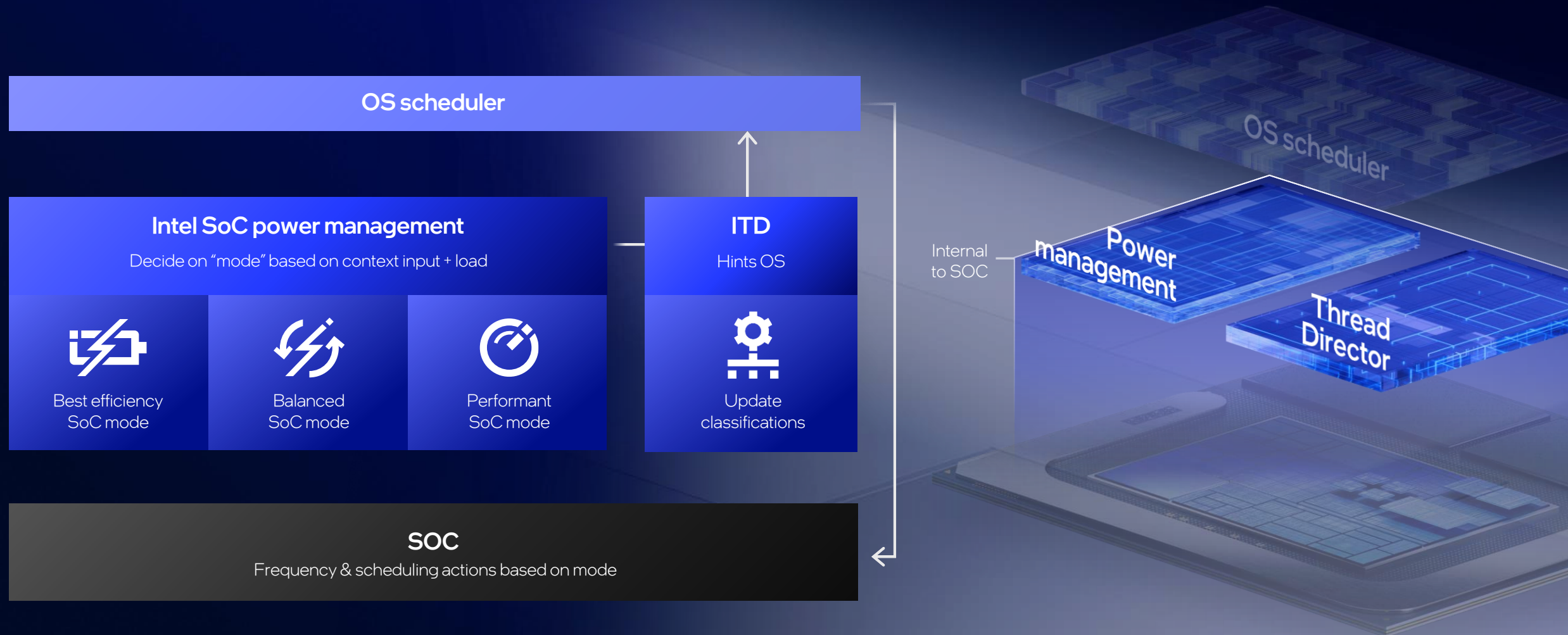
Power management tie-in

Consuming platform intent



Intel Thread Director + Power Management

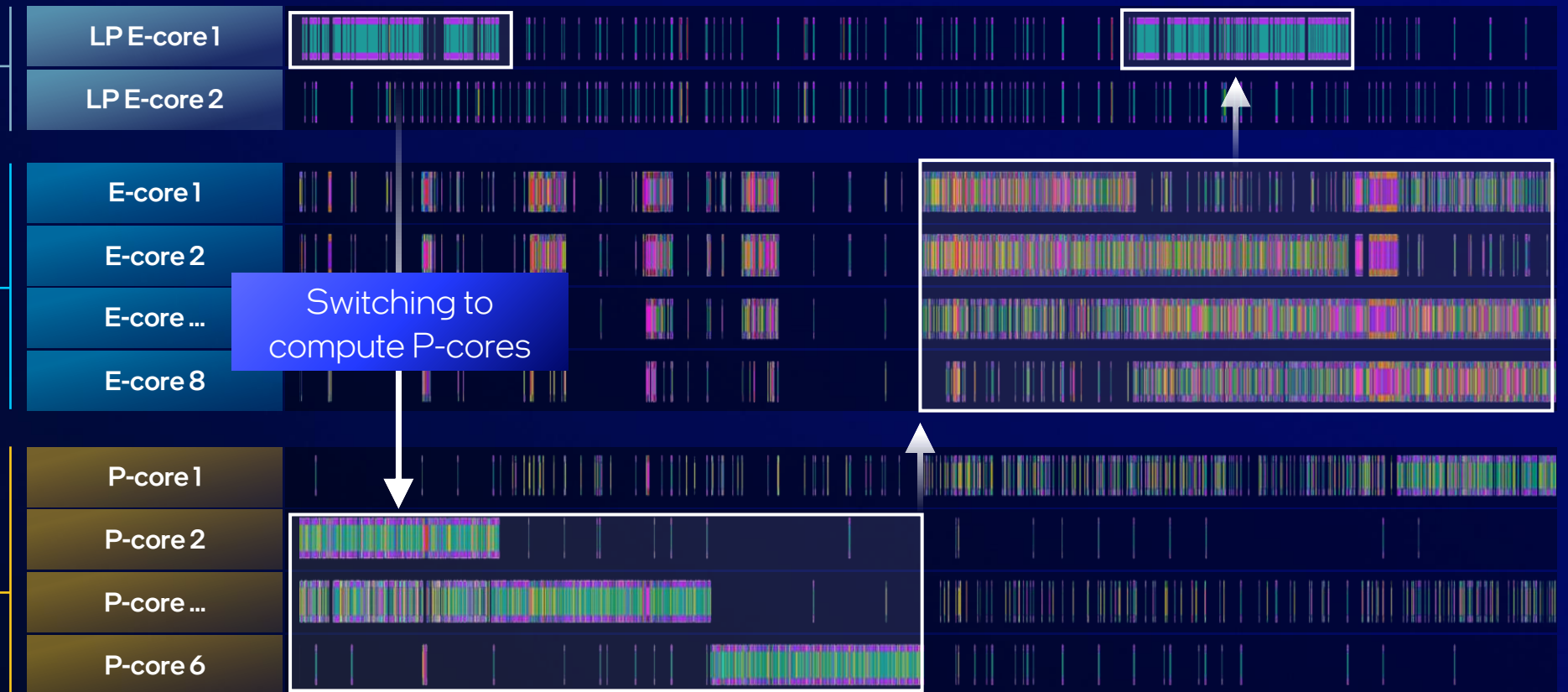
Internal Power Management Optimizations





Teams Power Efficiency

Meteor Lake Scheduling

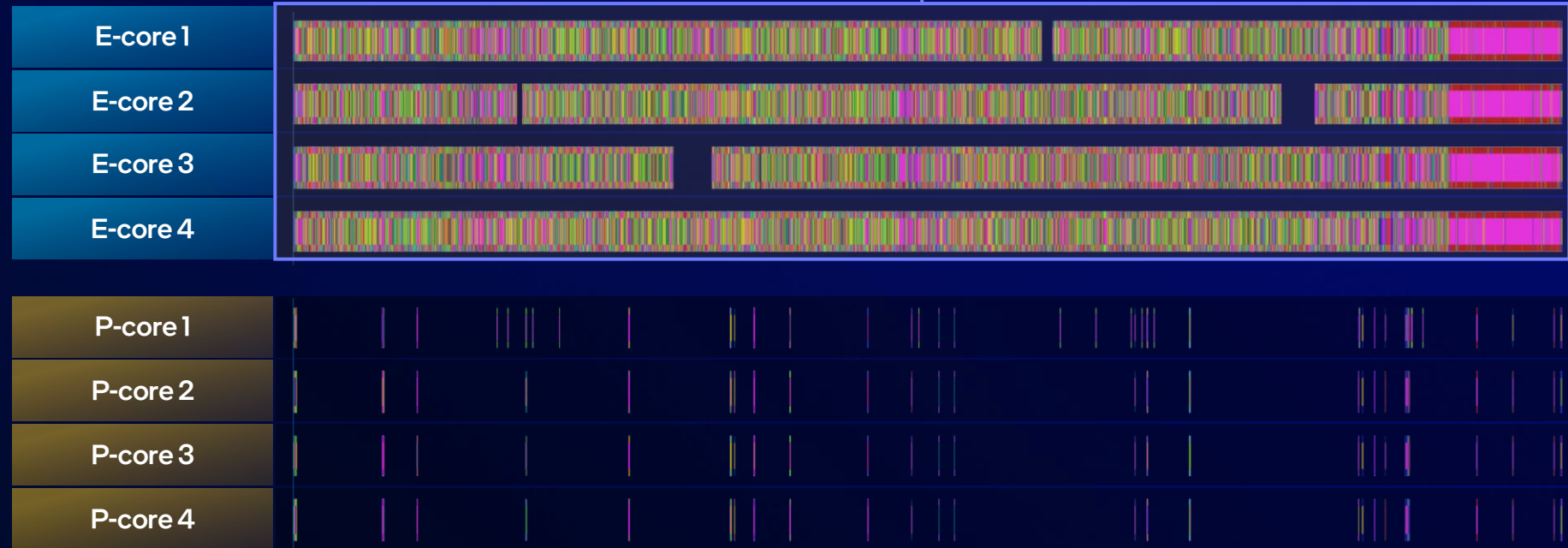




Teams Power Efficiency

Lunar Lake Scheduling

Teams stays in efficiency zone

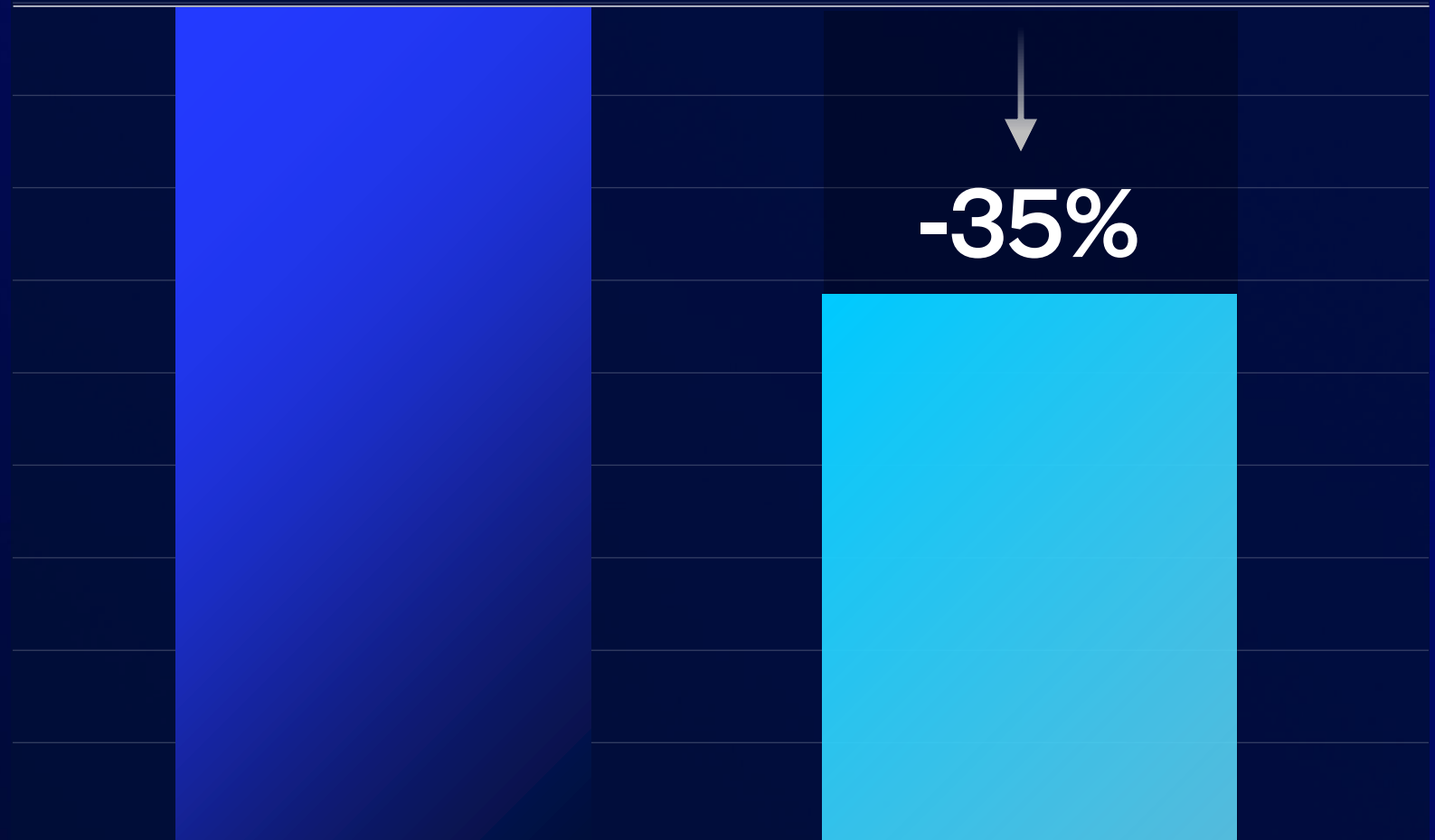


Improved experience

With OS containment & power management optimization on Lunar Lake



Teams power reduction



Containment & power management optimization
disabled

Containment & power management optimization
enabled

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Intel Thread Director

Innovations

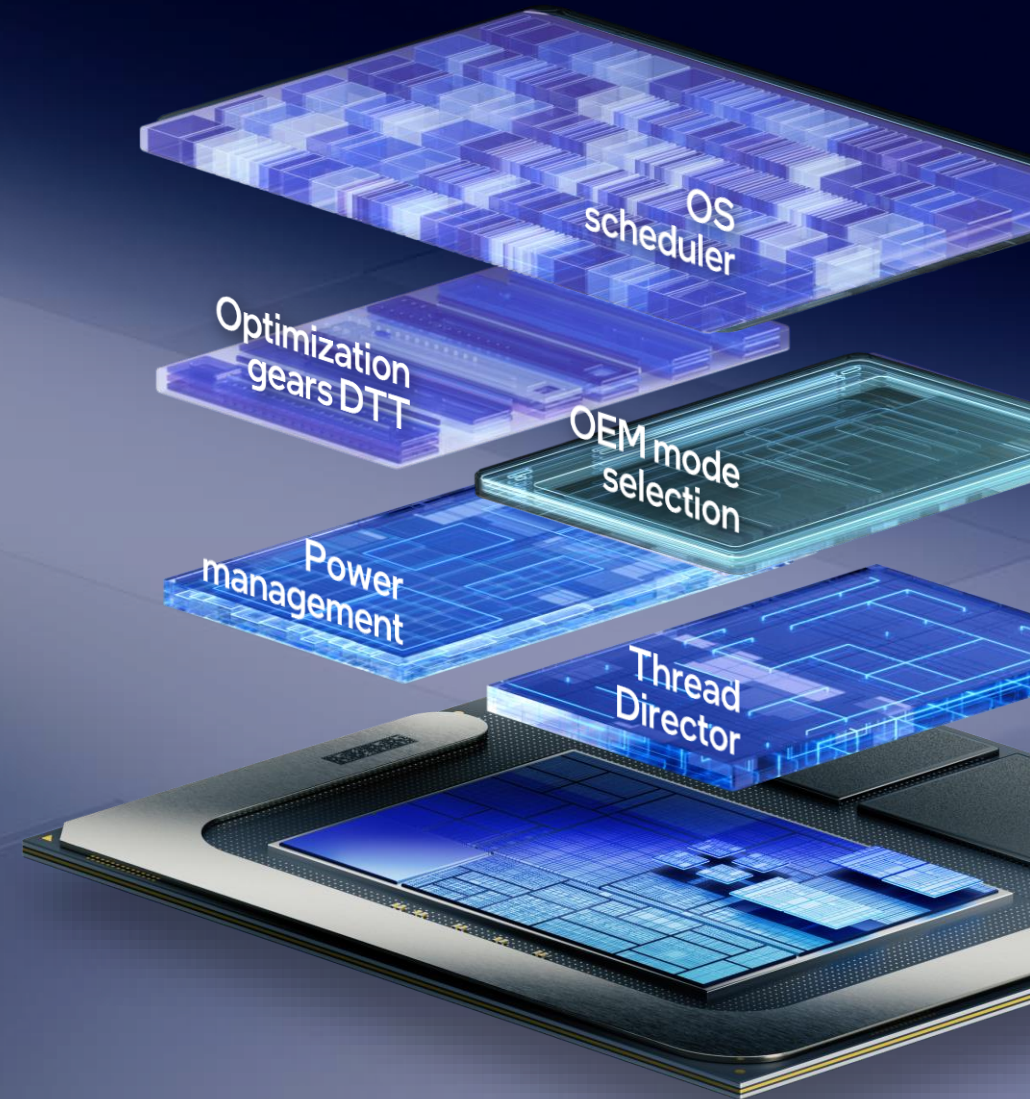
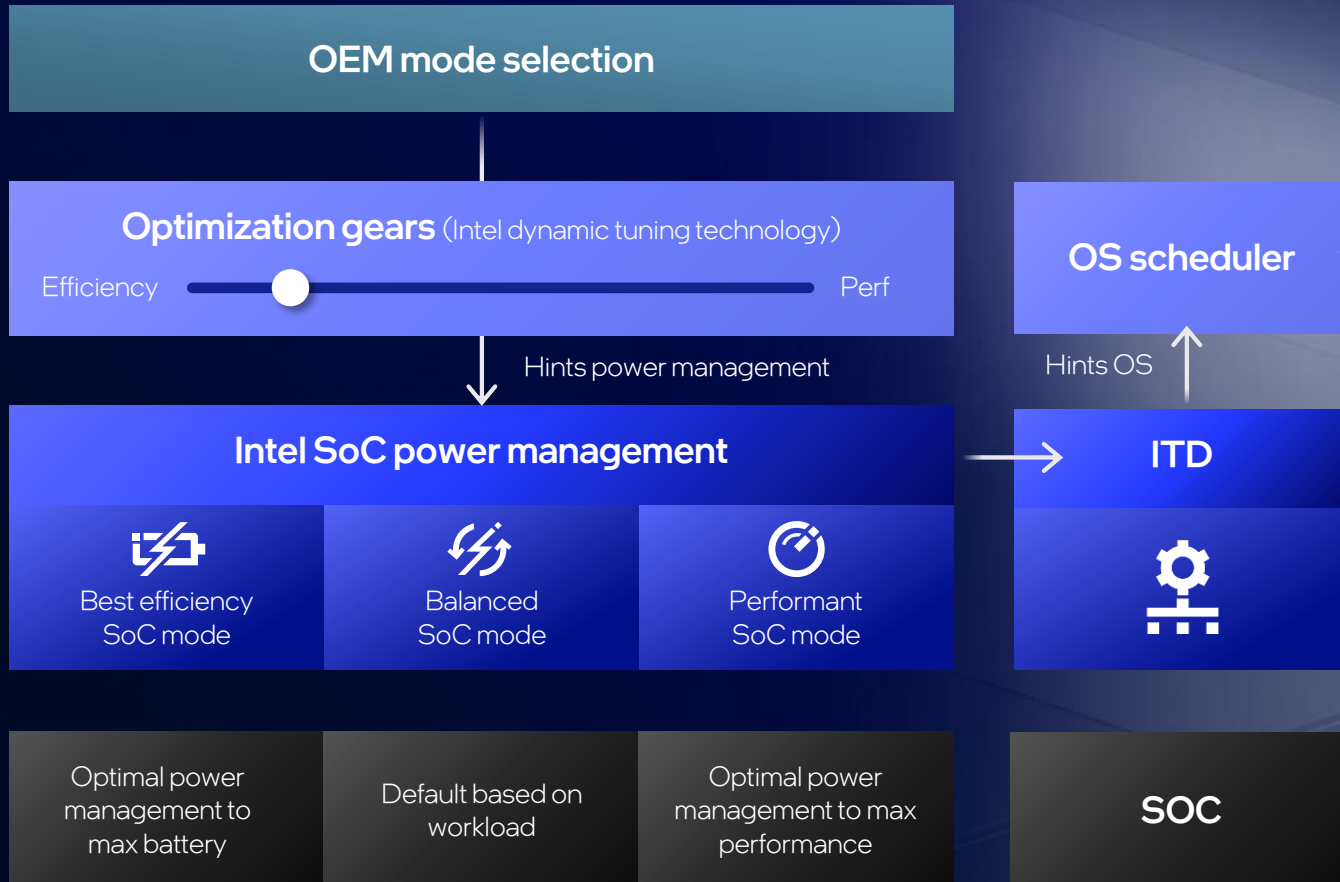
More intelligent feedback

OS containment zones

Power management tie-in

Consuming platform intent

Intel Thread Director + Power Management Bringing it All Together



Intel Thread Director

Implementation Recommendations

Customers

Upgrade to
the latest
software
stack

Recompile
with latest
SDK

Developers

Avoid hard
affinities

Usage of
QoS APIs

Optimize with
latest ISA

Intel Thread Director

Future Direction

Increasing
scenario
granularity

AI-based
scheduling
hints

Cross IP
scheduling

Intel Thread Director – Lunar Lake

Summary

Goals

Optimize right workload for right core

Tighter OS integration

Enhance capabilities for efficiency

Broaden contextual input

Innovation

More intelligent feedback

OS containment zones

Power management tie-in

Consuming platform intent



The Intel logo is positioned in the top left corner of the image. It consists of the word "intel." in a white, lowercase, sans-serif font, set against a solid blue rectangular background.

intel.

The "TECH tour.TW" logo is located in the upper left quadrant. The word "TECH" is in a bold, white, uppercase font, with a small blue square icon to its right. Below it, "tour.TW" is written in a white, lowercase font. The entire logo is set against a blue background that is part of a larger graphic element.

TECH
tour.TW

The words "Thank You" are centered in the lower half of the image. They are written in a large, white, serif font. The text is overlaid on a dark blue, semi-transparent rectangular area that has a subtle gradient and is positioned over a background of glowing blue digital circuitry and data streams.

Thank
You

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APPENDIX

Claim # & Statement	Slide # & Title/Details
	SLIDE 22: Improved Experience
35% power reduction when containment & power management optimization are enabled	As of May 2024, based performance estimated with measurements on Lunar Lake reference platform with power optimizations enabled vs. power optimizations disabled.

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