

Intel Corporation

Intel[®] Energy Efficiency Architecture

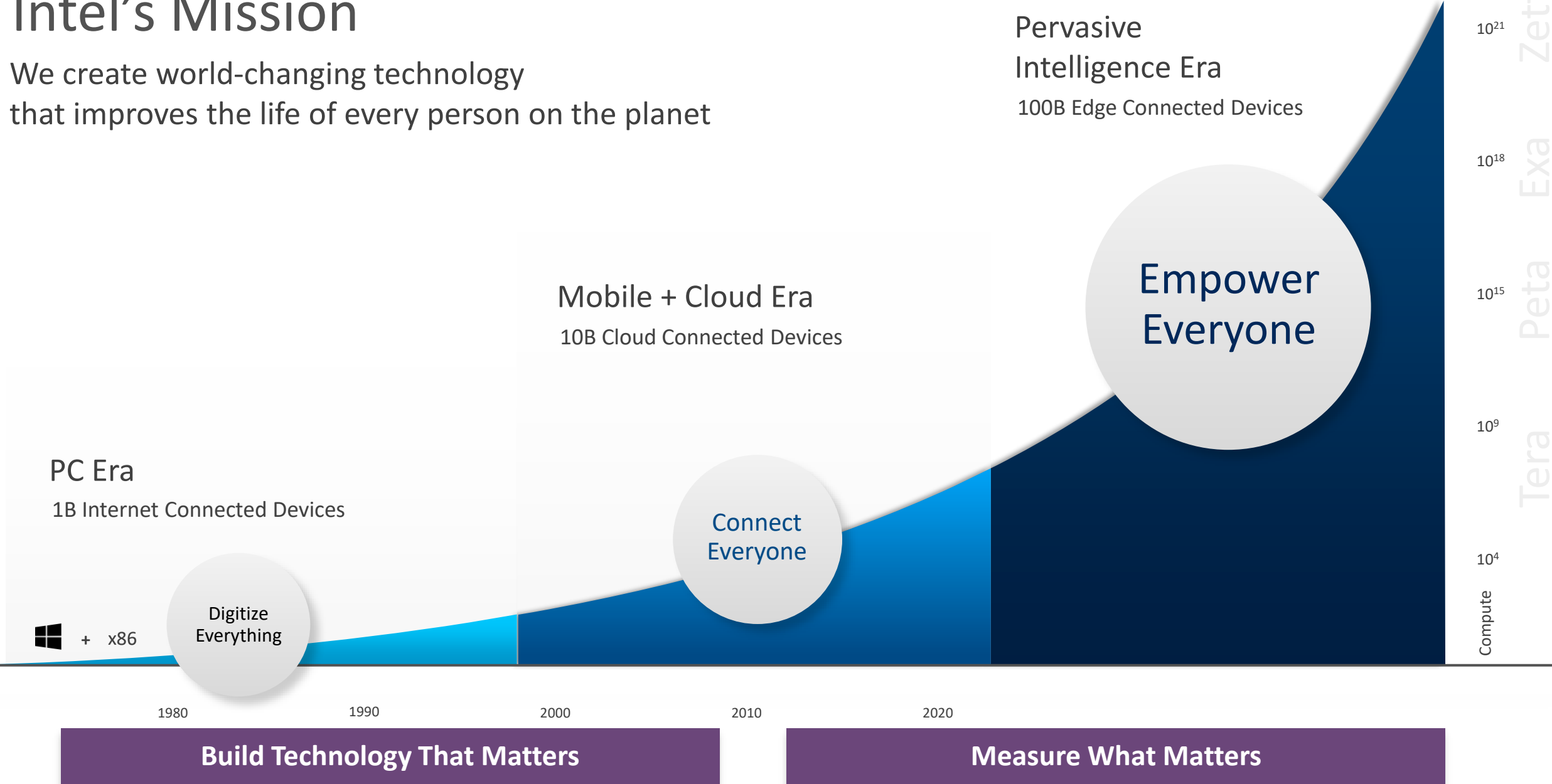
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Intel's Mission

We create world-changing technology that improves the life of every person on the planet



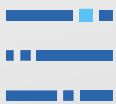
Experience Driven



Purposeful Performance



Experience First



User Preferences



Energy Efficiency



What Matters To A User

Throughput Performance

Responsiveness

Emerging Compute Models

Delivering Performance Costs Energy

System Form Factor - Ergonomics

All Day Battery Life

Carbon Footprint

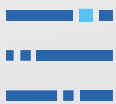
Experience Driven



Purposeful Performance



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User Preferences



Energy Efficiency

Outline

Delivering Performance Costs Energy

Deliver Energy Efficient Value That Matters

- Tech to meet what matters to the user

- Spend the energy only when needed

- Conserve energy rest of the time

Measure What Matters

Manage What Matters



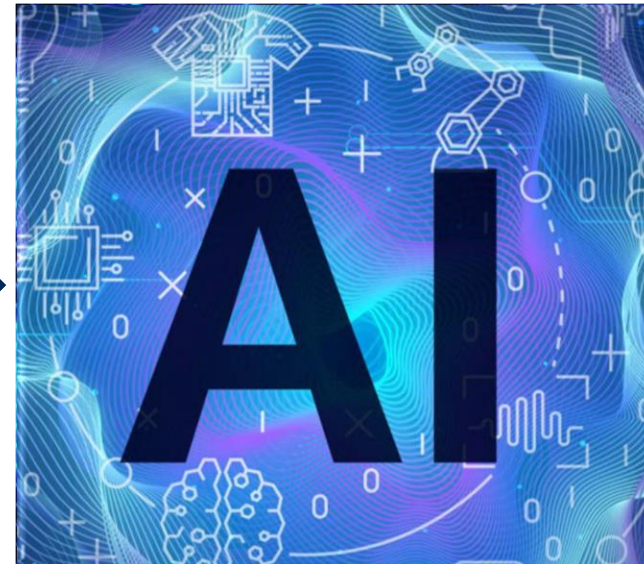
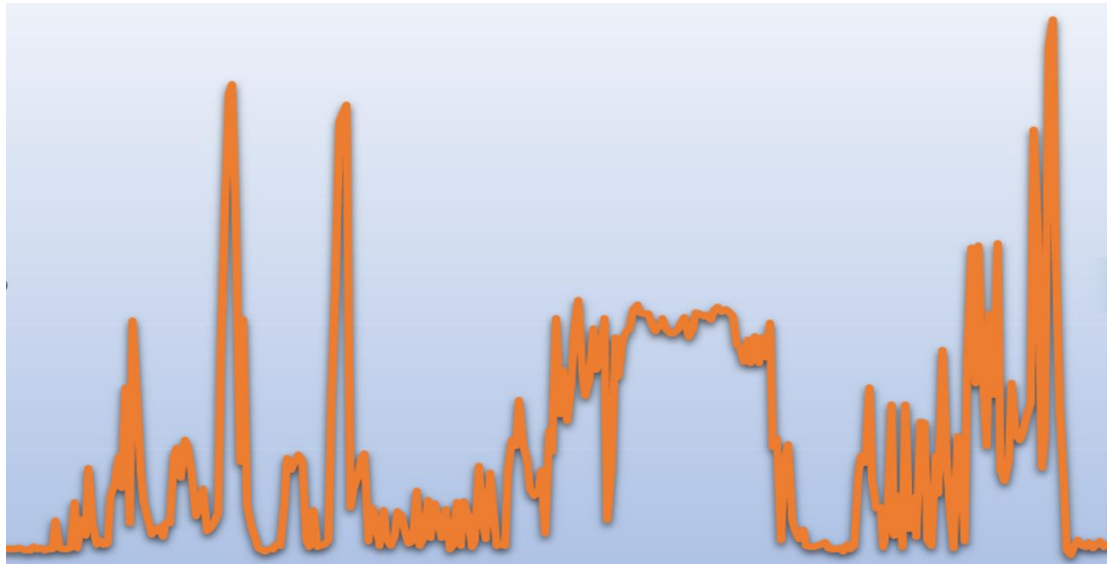
AI Driven Power Management

Characterize Usage Profile

Characterize usage patterns (e.g. bursty, sustained, QoS etc.)

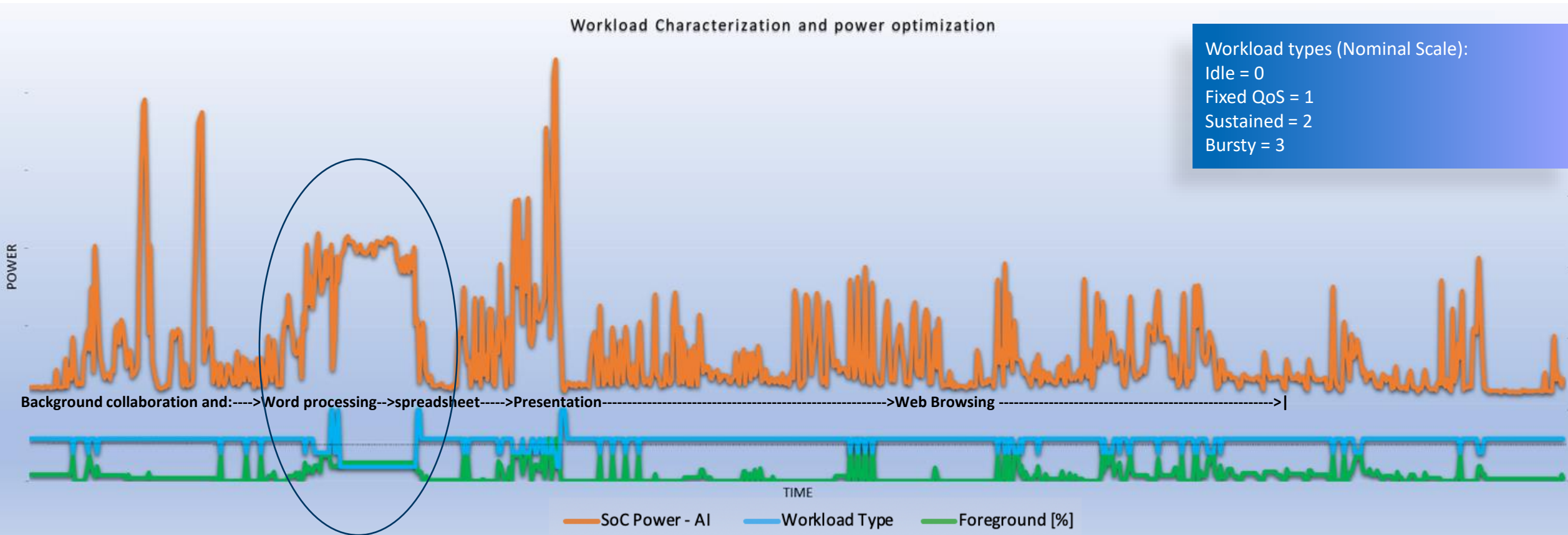
Utilize additional Intel® Thread Director and Speed Shift technology information

Adapt Performance and Energy to user experience



Workload
Characterization

AI Based Workload Type Detection

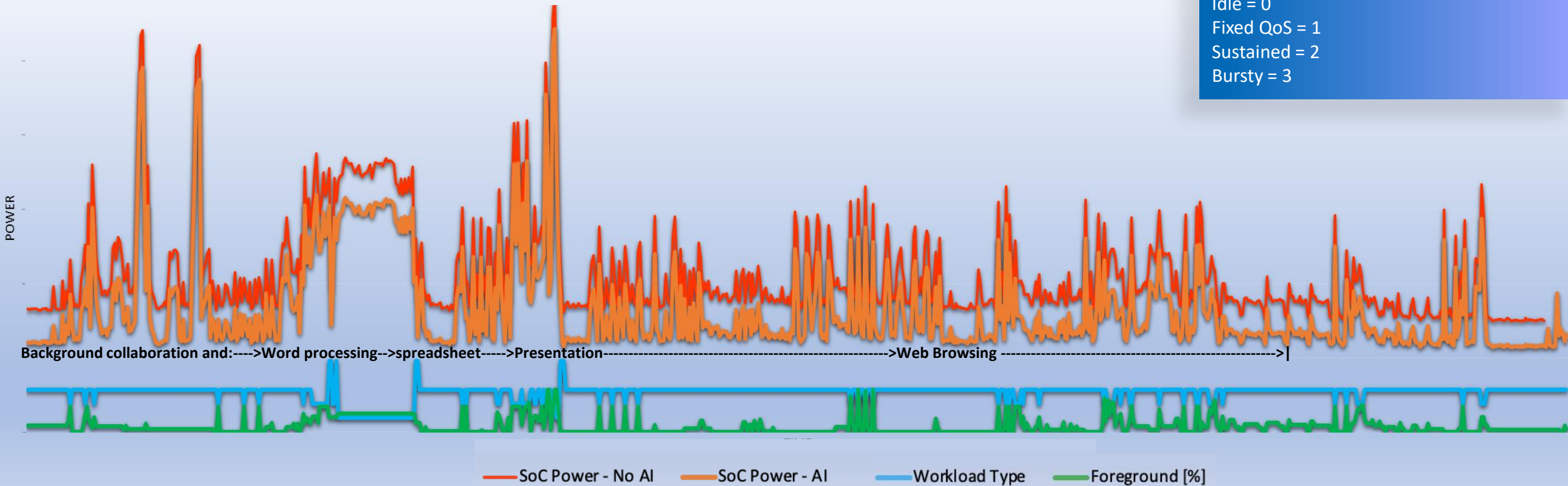


Advanced telemetry and AI algorithms to profile user activity, combined with Intel® Speed Shift technology & Thread Director

AI Based Workload Type Detection

Workload Characterization and power optimization

Workload types (Nominal Scale):
Idle = 0
Fixed QoS = 1
Sustained = 2
Bursty = 3

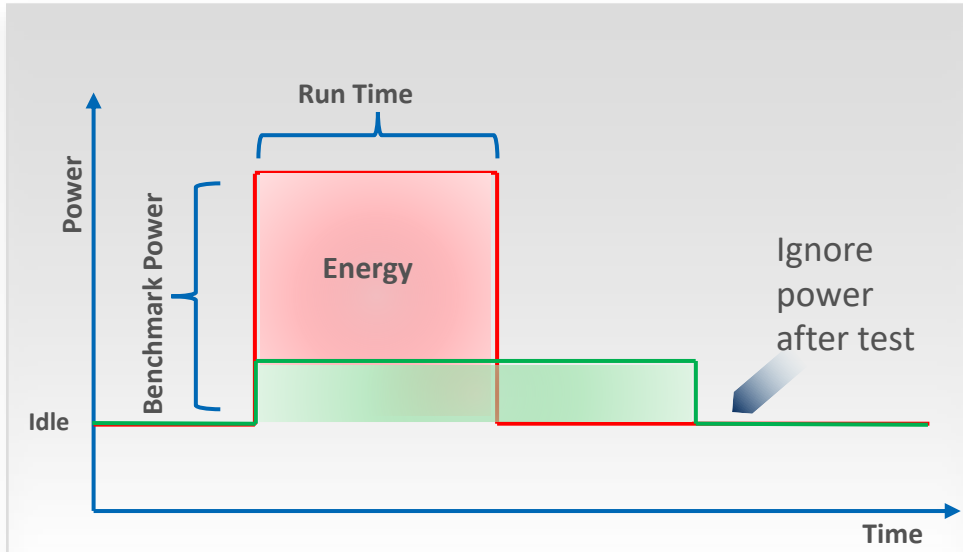


Saving 10-20% energy while not impacting user experience

Measure What Matters



Does “Performance Per Watt” Matter? No



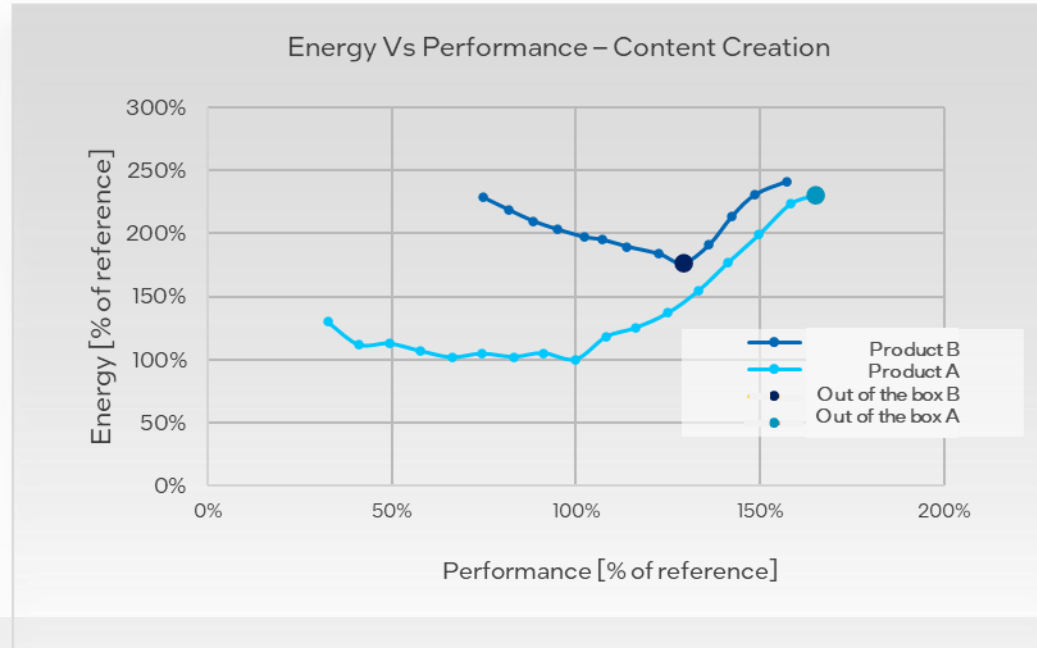
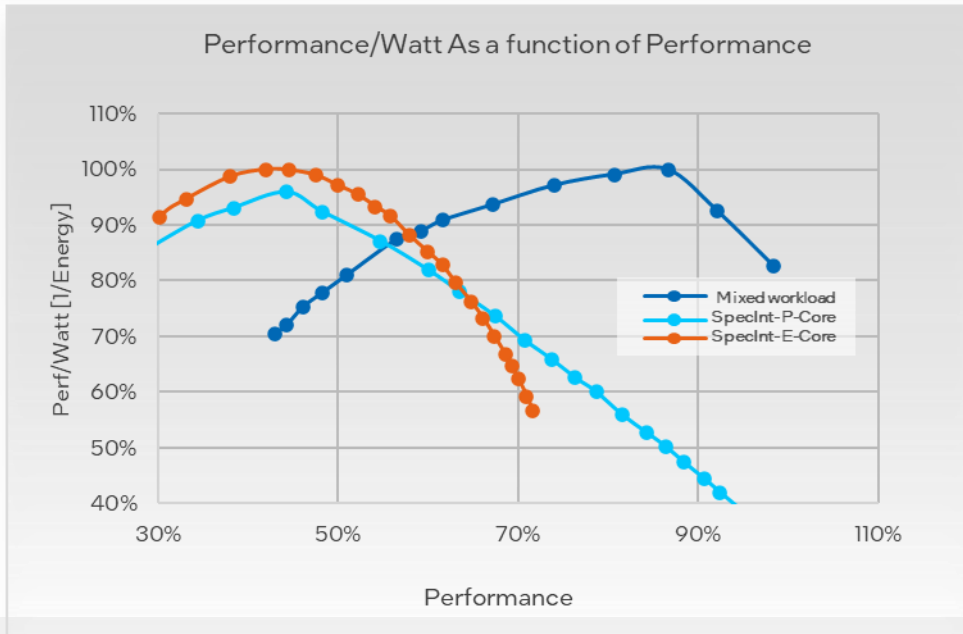
“Perf/Watt” while running active load

- 1/PDP (Power Delay Product) → First published in 1964
- Common industry metric → Ignores 50 years of PM

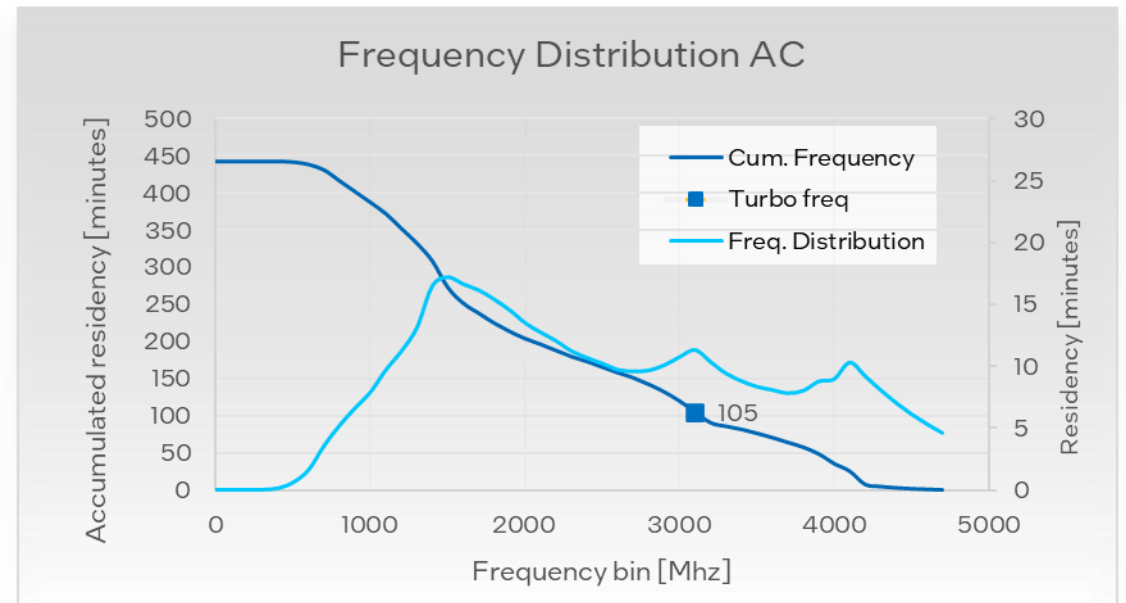
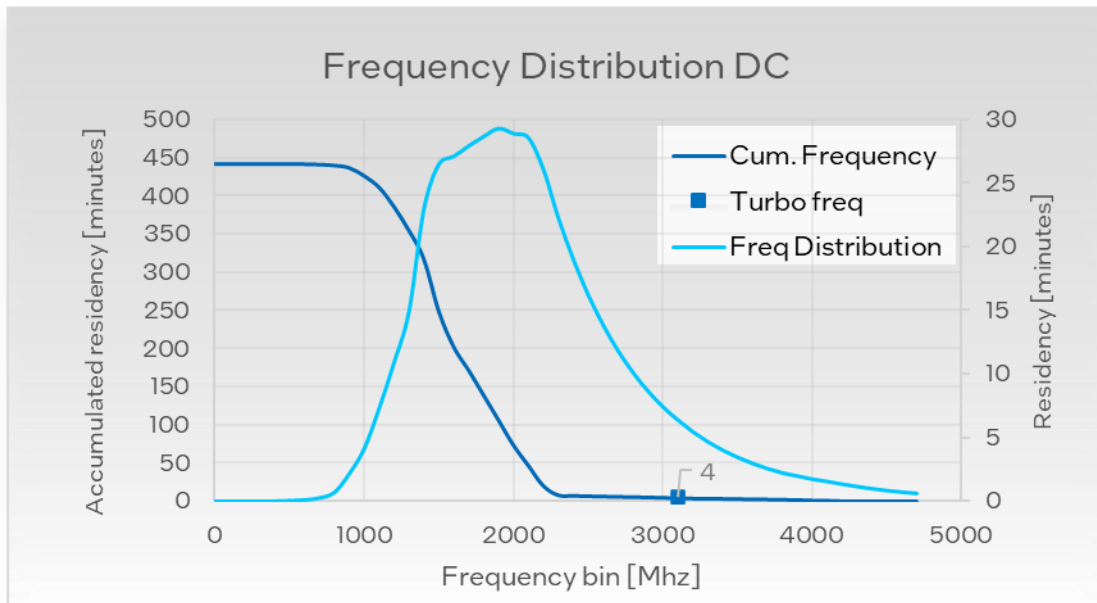
$$Performance = \frac{1}{Runtime [Sec]}$$

$$\frac{Performance}{Watt} = \frac{1}{Watt * Sec} = \frac{1}{Energy [joules]}$$

- Subject to Arbitrary Work Point Choice



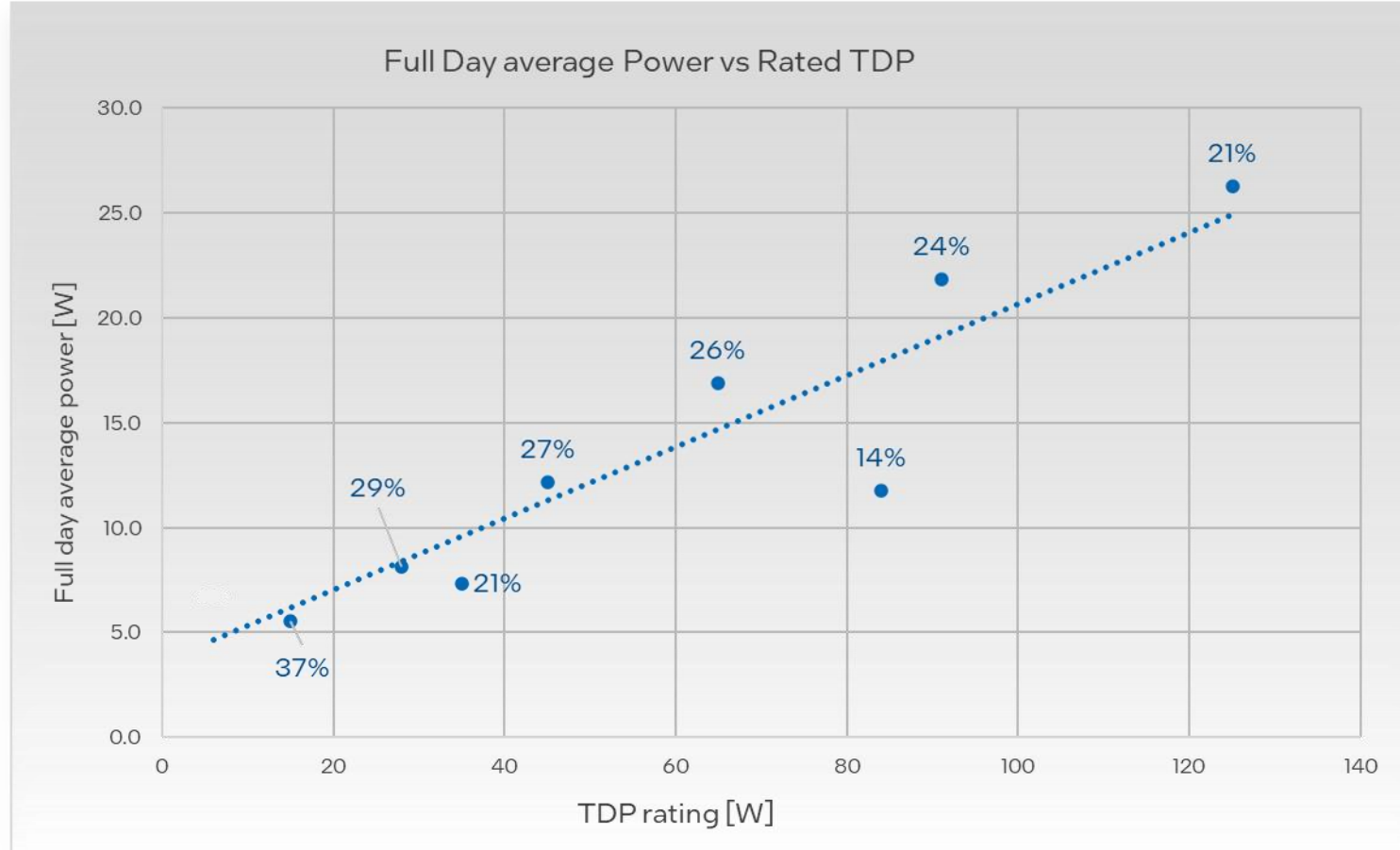
What matters is Performance AND Watts



Real Computer
Usage In The
Real World
With Power
Management

- Deliver performance when needed to meet user experience
 - While energy is accumulated over the entire workday
-
- Performance AND Watts both important - not at the same time

Real life power consumption



- TDP models remain stable over time – deliver more compute performance
- Energy efficiency comes from more efficient use of this TDP budget

Conclusion

Advanced Design & Technology

- Deliver amazing performance and user experience
- Delivers even higher performance on emerging workloads
- While mentioning highly efficient full day energy

Create Metrics That Matter

- Existing tools measure throughput compute and responsiveness
- Common industry energy efficiency metric is missing
- Call for action – measure energy efficiency that matters

Q&A



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