Sustainable, reliable and scalable SAP ERP landscapes

SAP quote-to-cash (Q2C) and Q2C Power Benchmark-based decision making

1 Executive Summary

This white paper presents results from the latest SAP Q2C Server Power Benchmarking of a Lenovo ThinkSystem SR630 V4 and SR650 V4 powered by the Intel® Xeon® 6 processor family and represents reflects the deep collaboration between SAP, Lenovo, and Intel.

Forward thinking SAP customers will require a scalable and energy-efficient environment for their business workloads. The infrastructure will demand state-of-the-art technology to sustain a reliable and performant platform.

Intel Xeon 6 processors – equipped with either Performance-cores (P-cores) or Efficiency-cores (E-cores) – deliver industry-leading performance and energy efficiency, enabling SAP customers to scale intelligently while meeting sustainability goals. Lenovo benchmarked both Xeon 6 variants with intriguing results that will guide you in your data center modernization projects.

The paper first introduces you to the details of the SAP Q2C benchmarking —the foundation for the Q2C Power Benchmark. It then explains how power is measured while running the Q2C benchmarking. In the end, we present both results and discuss CPU differences leading to those results.

1.1 Authors

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2 Power Consumption for SAP Landscapes in a Data Center

SAP application landscapes require significant resources in a data center environment and infrastructure decisions are no longer based on performance aspects alone. One cornerstone of those resources is power consumption and cooling. To achieve efficient operations, it is relevant to understand the requirements dependent on the size of the systems supporting a business application environment. This applies no matter where the systems are deployed: On-premise at a customer-owned facility, in a co-location facility, or in a private or public cloud deployment model.

The need for a single SAP production system begets several distinct infrastructure stacks, such as pre-production, staging, quality assurance, development or test infrastructure. Each reduction in power consumption for an SAP system benefits multiple infrastructure environments simultaneously. This puts SAP workload into a prominent spot when it comes to running IT more efficiently, contributing to a company's environmental (ESG) goals.

3 SAP Q2C and Server Power Benchmarking

In 2024, SAP introduced the SAP Q2C scenario as the basis for a predefined benchmark workload. It was introduced as a new Standard Application Benchmark as part of SAP's Benchmark Portfolio. It replaces the SD (Sales & Distribution) scenario that will be retired at the end of 2025

The Q2C benchmark runs against SAP S/4HANA 2021 and the in-memory SAP HANA database. It reflects a realistic, end-to-end enterprise business process spanning multiple functional areas.

It delivers a realistic, SAP HANA-native performance view and sets a reliable foundation for infrastructure readiness in the cloud and on-premises SAP S/4HANA landscapes. By integrating both transactional and analytical processing, Q2C defines the new standard for system scalability and performance benchmarking in the intelligent enterprise era.

Key characteristics:

- Based on SAP S/4HANA
- Represents a complete process from inquiry and quotation to delivery, invoicing, and cash receipt
- Includes both transactional and analytical components (OLTP + OLAP).

- Simulates Fiori/UI5 front-end usage
- Uses HANA-optimized KPIs to assess memory throughput, compression, and CPU efficiency

Process Steps:

1. Create inquiry
2. Create quotation
3. Create sales order
4. Material availability check
5. Delivery creation and goods issue
6. Invoice generation
7. Payment posting
8. Embedded analytics queries (KPI dashboards)

Benchmark Metrics:

- aSAPS (advanced SAPS, HANA-optimized): standard metric adapted for in-memory performance
- Throughput: number of Q2C line items processed per hour
- HANA Memory Footprint and CPU Utilization: new additional KPIs
- Response Time: target ≤ 1 second per business dialog step

Table 1: SAP Q2C Overview

Aspect	SAP Q2C Server Power Benchmark
Era / Platform	SAP S/4HANA 2021
Database	SAP HANA only
Process Scope	Full Quote-to-Cash (Q2C)
Modules Covered	SD, MM, FI, CO, Analytics
Transaction Focus	Inquiry → Quotation → Sales Order → Delivery → Invoice → Payment
Workload Type	Mixed (Transactional (OLTP) + Analytical (OLAP))
User Interface	Fiori / Web UI
Key Metric	Advanced SAPS (HANA-optimized)
Data Model	Simplified S/4HANA data model
Performance Emphasis	Memory throughput & compression efficiency
Use Cases	Sizing and performance validation for S/4HANA
Relevance	Current industry standard

3.1 Benchmark Power Efficiency

SAP leverages the Q2C benchmark to characterize efficiency of an IT infrastructure. Q2C is executed at different load levels, power consumption is captured, and data points are used for an average efficiency calculation.

SAP has two active benchmarks that measure power consumption. Both benchmarks leverage the SAP Q2C benchmark. The two benchmarks differ only in what infrastructure is used:

- Server Power Benchmark (everything within a server)
- System Power Benchmark (server and external storage)

We have benchmarked a single server with local storage. It falls into the first category, a Q2C Server Power Benchmark.

The Q2C Server Power benchmark provides information about the total power consumed by the server(s). This comprises CPU, memory, and in the case of a three-tier setup, the power consumed by the network connections between the servers, excluding the storage.

3.2 Q2C Server Power Benchmark

The Q2C Server Power benchmark consists of nine individual Q2C benchmark running in one sequence.

Each of those nine Q2C benchmarks run at a fixed load level from 0% (also called active idle) to 100%. The different load levels are benchmarked in the following defined order:
50% - 100% - 65% - 20% - 0% - 30% - 80% - 40% - 10%

They must follow the same rules as a standard SAP Q2C performance benchmark. This includes:

- a ramp-up phase, high-load phase (during which power consumption is measured), and a ramp-down phase
- high-load phases must be at least 15 minutes
- average response time during high-load phase must be below 1 second

The benchmark sequence—starting at 50% and progressing through varying load levels—mirrors real-world SAP system utilization patterns, capturing both peak and transitional states to provide a comprehensive view of power efficiency.

4 Power Consumption of IT Equipment

Power consumption can be measured in different ways. Nowadays, each server has basic consumption information built into the Baseboard Management Controller (BMC). The quality and resolution of this information is sufficient for general purpose use cases but for official publications the data must follow neutral, vendor-agnostic requirements.

SAP requires the use of an external power analyzer. It follows the guidance provided by Standard Performance Evaluation Corporation (SPEC), the non-profit organization for vendor-agnostic benchmarking. The analyzer must measure input power supply of all IT equipment under test.

The power analyzer must be calibrated by an ISO-compliant institute. The power analyzer used in this benchmark has been calibrated with Calibration Certificate N.1668_2025_RO_E to ensure compliant operation within approved limits.

SAP also requires the use of an external temperature sensor to ensure that data center temperature stays within reasonable limits during the execution of the power benchmark. Measurements of inlet air temperature must be taken every 15 seconds.

Diagram 1 shows the overall setup when running SAP power benchmarks, with the Lenovo SR630 V4 server under test.

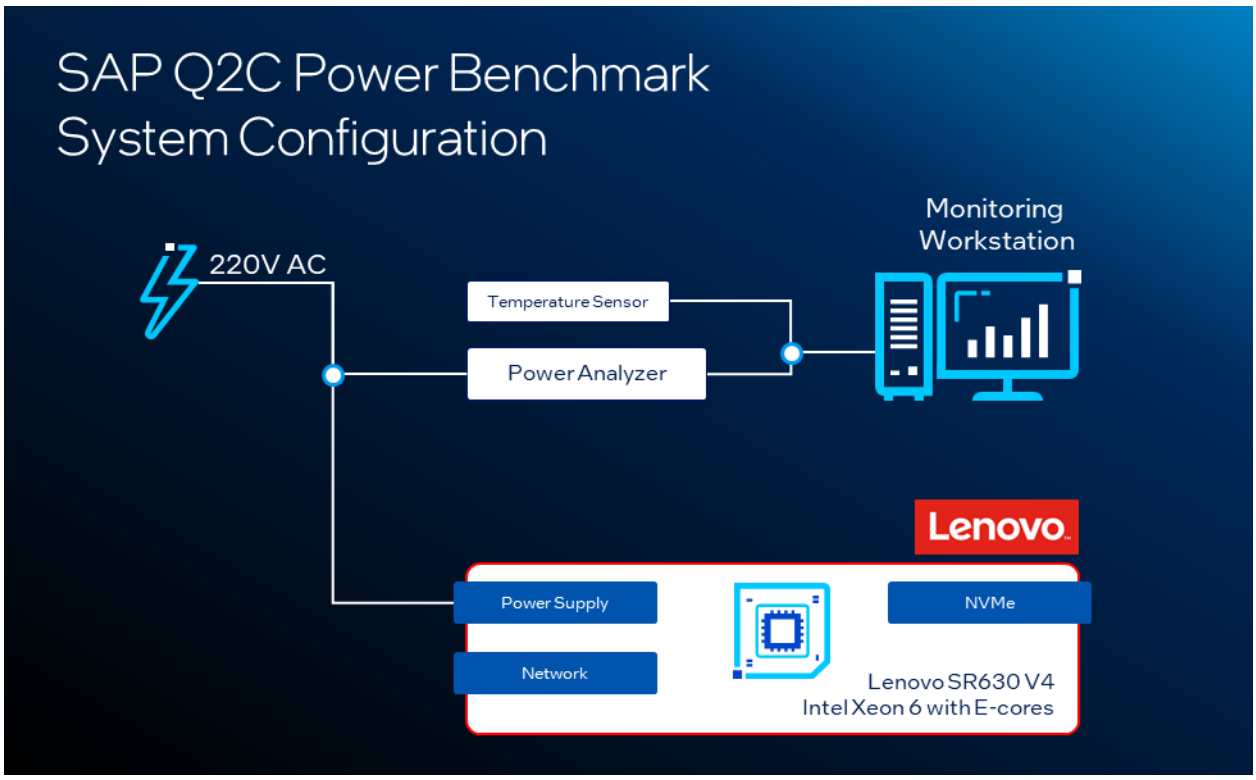

Diagram1: Schematic setup of the benchmark landscape

The power analyzer reads and stores consumption values on the device itself and a monitoring workstation simultaneously with a timestamp. The timestamp allows exact correlation between a specific activity in the Q2C- Power benchmark sequence and a consumption value in Watt.

To ensure that short peaks in power consumption are also captured, there must be at least one data point captured every second.

For the SAP Q2C- Power benchmark the most significant power value, or power efficiency indicator, in the certificate is watts/kilo aSAPS, calculated as the average power consumption (in Watt) over all load levels divided by the average throughput (in aSAPS) over all load levels.

$$\frac{(\sum all\ Wattvalues):9}{(\sum all\ aSAPSvalues:1000):9} = Watt/kilo\ aSAPS$$

5 Lenovo ThinkSystem SR630 V4

The Intel Xeon 6 with E-cores system under test for Q2C Power benchmark is the Lenovo ThinkSystem SR630 V4. It is a 2-socket 1U rack server for customers that require industry-leading reliability, management, and security, as well as maximum performance and flexibility for future growth. It is based on the same elements as the SR650 V4 server.

The SR630 V4 can be configured with Intel Xeon 6700-series or Xeon 6500-series processors, with P-cores, formerly codenamed "Granite Rapids-SP", or with E-cores, formerly codenamed "Sierra Forest-SP".

For the benchmark, the machine had the following configuration:

- 2x Intel Xeon Platinum 6780E 144-core 2.2GHz processors
  - 2 processors, 288 cores, 288 threads in total
  - 96 KB L1 cache and 4,096 KB L2 cache per 4-core cluster, 108 MB L3 cache per processor
- 2,048 GB of Lenovo DDR5 memory (16x 128GB DDR RDIMM, 6400 MT/s)
- 1x U.3 7450 MAX 6.4TB Mixed Used NVMe
- 1x 1300W power supply
- SUSE Linux Enterprise Server 15 SP5
- SAP HANA 2.0 Revision 84
- SAP S/4HANA Server 2021

An Intel Xeon 6 system with E-cores is well-suited for SAP environments requiring less processing power but aim for improved energy efficiency.

6 Lenovo ThinkSystem SR650 V4

The system under test for the P-core benchmark is the Lenovo ThinkSystem SR650 V4. It is a 2-socket 2U rack server for customers that requires industry-leading reliability, management, and security, as well as maximum performance and flexibility for future growth. It is based on the same elements as the SR630 V4 server.

The SR650 V4 can be configured with Intel Xeon 6500-series processors with P-cores, formerly codenamed "Granite Rapids-SP".

For the benchmark, the machine had the following configuration:

- 2x Intel Xeon Platinum 6787P 86-core 2GHz processors
  - 2 processors, 172 cores, 384 threads in total

- 112 KB L1 cache and 2,048 KB L2 cache per core, 336 MB L3 cache per processor
- 2,048 GB of Lenovo DDR5 memory (16x 128GB DDR RDIMM, 6400 MT/s)
- 1x 2.5-inch 7.68TB Read-Intensive NVMe
- 1x 2000W power supply
- SUSE Linux Enterprise Server 15 SP5
- SAP HANA 2.0 Revision 84
- SAP S/4HANA Server 2021

An Intel Xeon 6 system with P-cores is well-suited for tasks that require the highest amount of processing power. One of the key differences between Intel Xeon P-cores and Intel Xeon E-cores is the availability of simultaneous multithreading (SMT, also called Hyperthreading) and different memory cache structures.

7 Results and Interpretation for Lenovo SR630V4 Powered by Intel Xeon 6 with E-cores Q2C Power Benchmark

The power consumption at 0% load, in other words active idle with 0 aSAPS, was measured at 278W. The other consumption values are shown in Figure 1, with a peak of 1008W at maximum Q2C throughput.

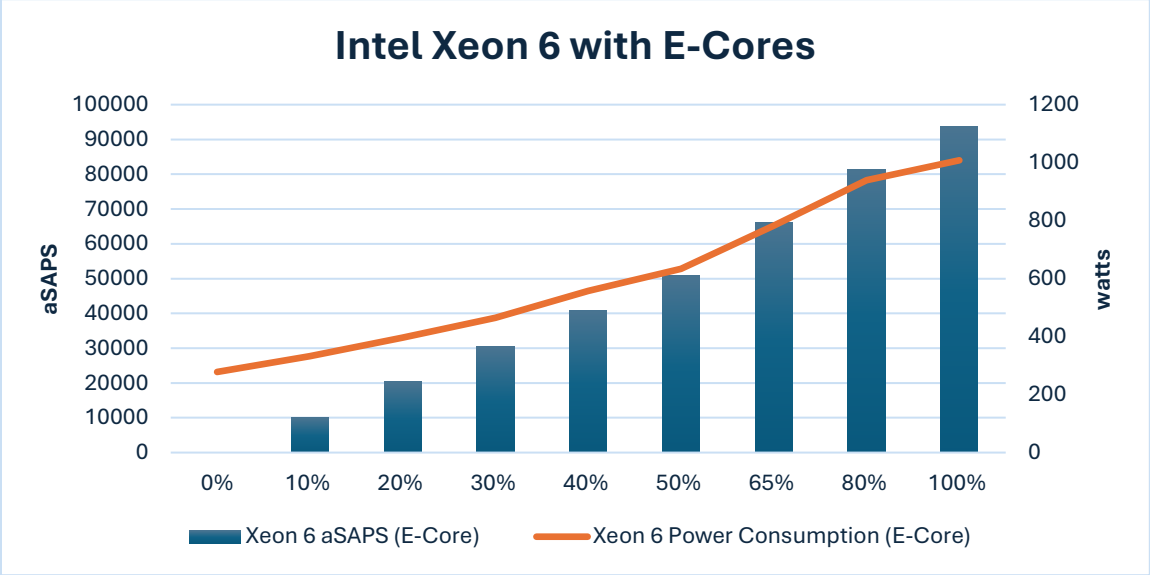

Figure 1: Intel Xeon 6 with E-cores, throughput in aSAPS and electrical consumption vs. simulated workload (x-axis)

The average Q2C throughput is calculated with 43,720 aSAPS, which results in an overall power efficiency value of 13.70 watts / kilo aSAPS.

8 Results and interpretation for Lenovo SR650V4 Powered by Intel Xeon 6 with P-cores Q2C Power Benchmark

The power consumption of 0% load, in other words active idle with 0 aSAPS, was measured at 289W. The other consumption values are shown in Figure 2, with a peak of 1060W at maximum Q2C throughput.

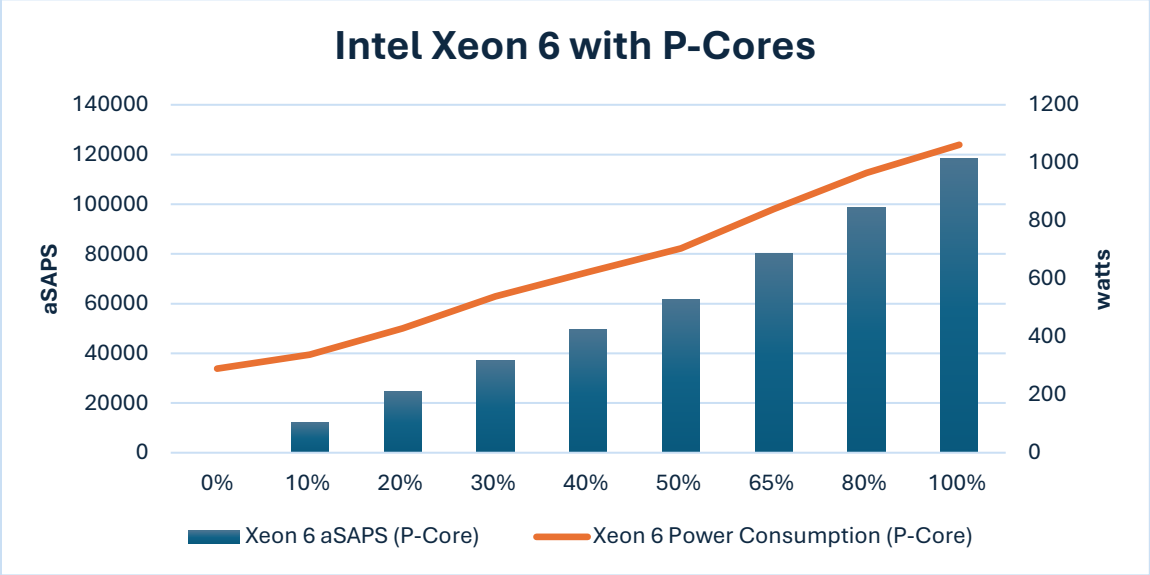

Figure 2: Intel Xeon 6 with P-cores, throughput in aSAPS and electrical consumption vs. simulated workload (x-axis)

The average Q2C throughput is calculated with 53,720 aSAPS, which results in an overall power efficiency value of 11.97 watts / kilo aSAPS.

9 Q2C Performance and Power-Based Decision Making

No customer environment runs at one load level across longer periods of time. SAP environments experience periods of higher and lower load profile, with detailed utilization unique to every installation.

Looking at previous Intel Xeon platforms, it's clear that Intel Xeon 6 with P-cores and E-cores provide significantly higher performance, while lowering power consumption, driving higher Power Efficiency.

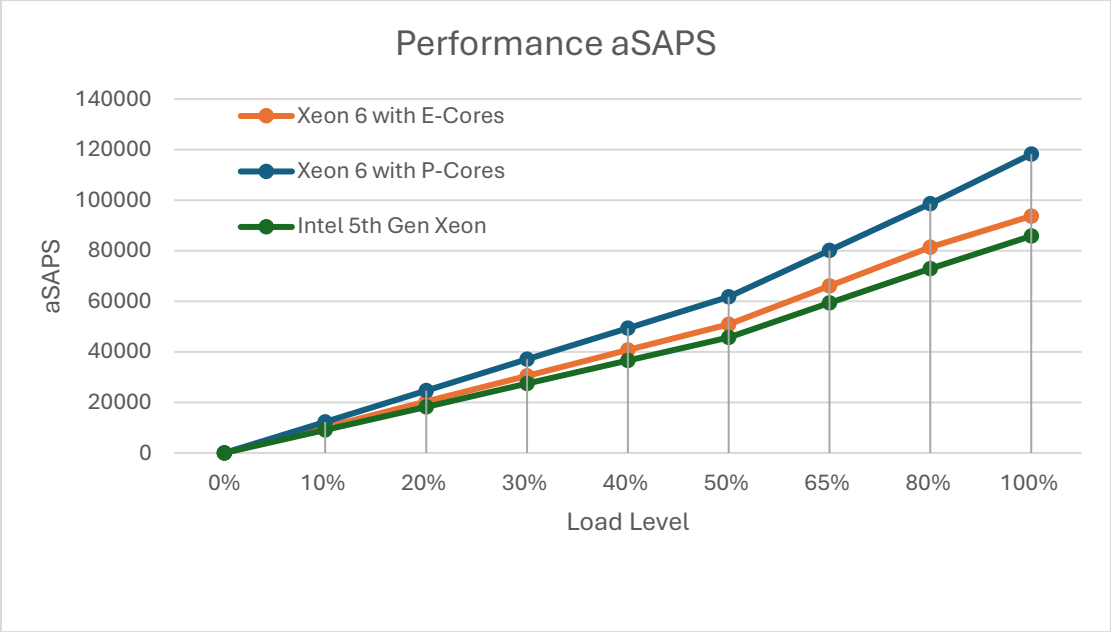

Figure 3: Performance characteristics in aSAPS

Figure 3 shows the performance characteristics of Intel Xeon 6 and 5th Gen Intel Xeon processors at various load levels. At all levels Intel Xeon 6 provides more aSAPS at a given performance point which, in return, means better user experience, responsiveness and additional headroom for growth.

Xeon 6 with P-cores delivered the highest performance in the Q2C benchmark, followed by the newly introduced Xeon 6 with E-core product family. The 5th Gen Xeon Processor delivers the lowest results.

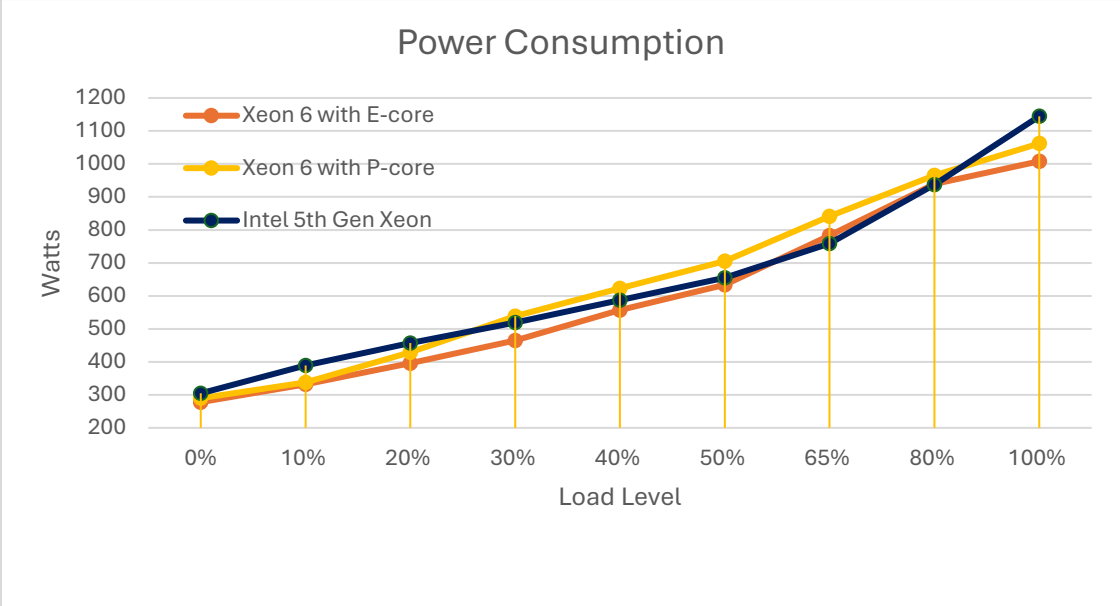

Figure 4: Electrical power consumption in Watts

Figure 4 shows the power consumption between Intel Xeon 6 and 5th Gen Intel Xeon Processor. Not only has the performance improved, but at the same time, the power consumption can be optimized so that more requires less energy. If you want to learn more about, reference the 5th Gen Intel Xeon Q2C Power Benchmark (https://www.sap.com/dmc/benchmark/2025/Cert25045.pdf) or access the Intel Xeon 6 Product Brief (The Intel® Xeon® 6 Processor Family).

10 Summary

The Q2C benchmark is a strong indicator of how well Lenovo SR630 V4 and SR650 V4 powered by Intel Xeon 6 will handle a real-world SAP order-to-cash and analytics workload in SAP S/4HANA.

The latest generation of Intel Xeon 6 (P-cores) architecture has been demonstrated to deliver significant improvements in both performance and power efficiency for SAP environments.

For SAP customers, that translates into being able to handle more business load, faster response times, lower cost per transaction (both CAPEX and OPEX), better sustainability, and headroom for future growth.

When proposing a hardware refresh or new landscape, anchoring on benchmark results (throughputs, aSAPS, watts/kaSAPS) gives credibility and helps shape the right size and architecture based on a realistic sizing exercise.

It’s not just about raw horsepower — it's about matching the business process load, analytics and real-time requirements, and ensuring the infrastructure can support those goals effectively and efficiently over time.

To explore how these benchmark insights can guide your SAP infrastructure strategy, contact your Lenovo or Intel representative.

11 Further resources

SAP Q2C
https://www.sap.com/about/benchmark/appbm/q2c.html

SAP Q2C Server Power Benchmark
https://www.sap.com/about/benchmark/appbm/power.html

Lenovo ThinkSystem SR630 V4
https://lenovopress.lenovo.com/lp1971

Lenovo ThinkSystem SR650 V4
https://lenovopress.lenovo.com/lp2127

Lenovo Performance Benchmark publication
https://lenovopress.lenovo.com/lp2299

Intel Xeon 6 Processor

https://www.intel.com/content/www/us/en/products/details/processors/xeon.html

The SAP Q2C-Power benchmark results are published here:
https://www.sap.com/dmc/exp/2018-benchmark-directory/#/q2c-power

Features/ Product	Core Count	Memory Capacity	Scalability	Power Efficiency	Ideal SAP Use Cases
Xeon 6 E-Cores	Up to 144C = 144 vCPUs	Up to 2TB per Socket	Up to 2S/4TB	Optimized	High Density / Scale-out SAP Transactional & Analytical Workloads
Xeon 6 P-Cores	Up to 86C = 172 vCPUs	Up to 4TB per Socket	Up to 16S/64TB*	Balanced	Large Scale-Up & Compute Intense SAP Transactional & Analytical Workloads

* Subject to SAP Certification. See SAP Hardware Directory.

Figure 5: Summary table of key differences between E-core and P-core

If you have questions or feedback, please contact sapsolutions@lenovo.com .