Research Report

Why Power Systems Will Overtake x86 Servers in the In-Memory Database Marketplace

Executive Summary
For some workloads, the differences among processor and systems architectures won’t make or break a systems deployment. But for Big Data, SAP HANA in-memory and other data-intensive workloads, choosing the wrong systems architecture can result in tremendously increased cost and much slower performance.

For enterprises running Big Data and SAP HANA workloads on x86 architecture, here’s why that decision needs to be revisited:

- Power Systems designs offer significant symmetrical multiprocessing advantages over x86 servers, providing:
  - More addressable memory
  - More memory bandwidth
  - Faster input/output bus speed
  - Faster processors
  - Denser cores with higher throughput per core

- Power System designs are more flexible than x86 designs
  - Power Systems scale-out H924 server offers 4TB of memory for S4/HANA in a 2-socket configuration vs. the need for 4 sockets to deploy this size of S4/HANA environment on x86 servers
  - Power Systems scale-up designs offer up to 64 TB of memory per system (the new Power E980 configuration), and up to 230 GB/s of bandwidth access per socket to buffered memory.

- Virtualization/Density
  - Power Systems include built-in virtualization that drives workload density

- Dynamic resource allocation drives high performance and service levels, increasing the efficient use of shared resources with up to 24TB of main memory on 4 sockets and 16TB per socket on scale-up. Compare this to x86 limited to 4TB virtualization and cores bound to the socket or half-socket!
With significantly increased adoption rates, IT buyers are showing that they now understand that there is a better alternative to x86 architecture when it comes to processing Big Data and SAP HANA: POWER-based systems. With that understanding, and with straightforward x86-to-POWER migration services, Clabby Analytics even sees a scenario where IBM’s Power Systems will start to seriously erode existing x86 HANA deployments.

Inthis Research Report, Clabby Analytics discusses the IBM Power Systems/SAP relationship; we explain why POWER processors are superior to x86 processors when it comes to handling Big Data; and we consider the numerous system design advantages that Power Systems have over typical x86 competitors.

Finally, we conclude with the following observation: "With all of the performance, cost, acceleration, virtualization, security and reliability advantages offered with Power Systems, IT executives will be better served deploying Power Systems rather than x86-based servers when processing large data sets and in-memory databases."
IBM Power Systems and SAP: Tight Integration

IBM made SAP HANA generally available in 2015. A year later, in 2016, Clabby Analytics noticed that SAP software engineers were showing stronger interest in IBM Power Systems. We suspect that SAP’s interest piqued after initial benchmarks showed that Power Systems could outperform x86-based servers by a wide margin (processing speed is a very important buying consideration for in-memory database and Big Data customers).

A closer look at the IBM Power Systems/SAP relationship shows that the two companies are working closely to tune Power Systems for maximum performance, while also focusing on exploiting IBM’s PowerVM for more efficient resource utilization. With PowerVM (packaged with IBM Power Systems) Power Systems now adhere to SAP’s Tailored Datacenter Integration model which emphasizes efficient reuse of available resources.

Clabby Analytics expects that new benchmarks detailing SAP HANA performance on Power Systems will be released shortly – and we believe that those benchmarks will show that Power Systems have the ability to process a variety of in-memory workloads twice as fast as x86 servers. We will update this report with the new benchmarks when available.

IBM’s POWER Microprocessor vs. x86

Both Intel x86 and IBM POWER microprocessor architectures are general purpose processors. Each can process serial, batch, analytics, cognitive, parallel and data intensive workloads – each can run tens-of-thousands of applications. But, there are distinct differences in the design of each microprocessor – and those differences make POWER microprocessors the better choice when dealing with large databases.

The biggest difference between x86 and POWER microprocessors has to do with each respective microprocessor’s instruction set:

- x86 architecture is CISC-based (Complex Instruction Set Computing): CISC architecture emphasizes putting complex instructions directly on the chip (making this architecture hardware-oriented).
- POWER is RISC-based (Reduced Instruction Set Computing). RISC emphasizes processing instructions in one cycle (but may require a lot of software instructions to complete a program – making this architecture software-centric).

Because CISC instructions are complex, they tend to be slower than RISC. Sometimes, for some workloads, markedly slower...

In comparison to x86 architecture, POWER core performance is at least twice as fast, and sometimes three times faster than Intel cores. Or, put another way, an Intel core performs at about half the rate of a POWER9 processor. This is an important consideration given half as many POWER cores are needed to process the same amount of work as an equivalent number of x86 cores. (This is also a very important consideration if software is priced on a per-core basis).

As for how many threads that can be processed, a POWER9 can process 8 threads per core, 96 threads per socket – or a total of 1536 threads on a single 16-socket system. For the thread count on the myriad of Intel x86 processors, see this link. After viewing this Intel link, readers will find that Intel x86 processors are not as thread dense as POWER9 processors.
Summary Observations

We attribute IBM Power System’s rapid increase in Hana in-memory sales to superior microprocessor and systems architecture (as compared to x86 processor/system designs) that is better suited for processing Big Data and in-memory databases. IBM made SAP HANA generally available on Linux on Power Systems in 2015 – and now, less than three years later, the company boasts 1200+ HANA in-memory deployments on Power Systems – an impressive rise that we expect will continue.

There are huge differences between POWER architecture and x86 architecture at the microprocessor level. x86 architecture is CISC-based making this architecture more hardware-reliant for performance. POWER microprocessors are RISC-based – an approach that emphasizes processing instructions in one cycle (well-suited to Big Data and in-memory database processing). Because CISC instructions are complex, they tend to be slower than RISC.

From a system design perspective, Power Systems focus on speeding workload processing by improving system throughput. Improved throughput is achieved in a variety of ways including increasing internal bus speed, reducing communications overhead, off-loading tasks to other types of processors, improving memory management, reducing I/O drag, tuning execution methods, creating new interfaces that streamline peripheral access to processing power, and more. Again, when compared to x86 server designs, Power Systems have strong advantages here.

In short, when comparing Power Systems to x86-server designs, be aware that Power Systems’ data processing performance eclipses that of Intel’s best x86 processors thanks to faster cores, faster CPUs, more cache, faster and varied interconnects, the ability to process more threads. And x86 competitors have still not matched IBM’s scale-up Power Systems design that provides direct access to up to 64 TB of memory (the new IBM Power E980).

In summary, IBM’s POWER microprocessor architectures are a significantly better choice than x86 architecture for processing data intensive workloads such as SAP’s HANA; and IBM’s Power System designs are better optimized, more flexible and less costly than equivalent, competing x86-based server designs.