Commentary

IBM's Energy Efficiency Smoking Gun

Executive Summary

IBM now has "the smoking gun" when it comes to proving how scale-up architecture is superior to scale-out architecture when it comes to energy efficiency.

What you're about to read is a review of a recent IBM announcement that I consider one of the most important announcements made in the computer industry in 2007. It is the announcement of a power and cooling management program that IBM calls its "mainframe gas gauge". (Yes, I agree — this could be the MOST BORING program name in history — but stick with me).

What IBM announced was that it has begun "gathering and publishing typical energy consumption data for the IBM System z9 mainframe". IBM further states that "the data is derived from actual field measurements of approximately 1,000 customer machines, determining average watts/hour consumed which can be used to calculate watts per unit — similar to automobile miles per gallon estimates and appliance kilowatt per year ratings".

Nap time — right? Time for more caffeine? Ho-hum…

Wrong-O!

With this data, enterprises can now perform comparative analysis that will make it possible for them to understand the true benefit of moving away from distributed, racked and towered computing designs to more energy efficient scale-up designs. If CEOs, CIOs, CFO, and information technology (IT) executives take the time to understand what this data really means — and if they extrapolate how much energy could be saved in their respective computing environments by moving to a scale-up model of computing — they would all be hard-pressed to justify the use of scale-out computing designs to their stockholders, much less to the rest of us who want enterprises to stop wasting greenhouse-gas-producing energy.

Have I got your attention? Good! Let's keep going…

Background

A few years ago I started a research report that sought to compare the cost of powering scale-up versus scale-out computing environments. My instincts were telling me that scale-out computing would be prove to be significantly more costly to operate because scale-out (more specifically: distributed tower servers) these servers were:

- Heavily underutilized (according to industry statistics, most operate at a 20% utilization rate); and,
- Heavily under-virtualized (the virtualization trend had not yet taken-off).

Further, I noted that scale-out computers each had their own power supplies (power supplies are notoriously energy inefficient). And I observed that the distributed nature of scale-out architecture forced a lot of NICs (network interface cards) and external hubs/switches/routers to be used — adding even more energy inefficiency to scale-out architectural designs. And I remember musing about how much additional cooling would be needed to cool tens, hundreds, or thousands of distributed servers that run at only 20% capacity…

I ran into several difficulties as I researched that report — and eventually (and reluctantly) canned it. The biggest problem I had was that there was very little empirical data available at the time to compare energy usage in scale-up versus scale-out environments. But finally, this situation has changed. We now have metrics with which we can measure scale-up versus scale-out energy consumption! And this data shows how truly wasteful scale-out computing really is!

What Does IBM's Mainframe Gas Gauge Do?

IBM's mainframe gas gauge "monitors a mainframe's actual energy and cooling statistics (collected by internal sensors); and presents them in real time on the System Activity Display. With this system, a user can now correlate the energy consumed with work actually performed. Statistics can be observed real time, or also summarized when the machine reports its maintenance health on a weekly basis. These statistics can be summarized for project or trend analysis. Energy consumption statistics are used for demonstrating cost savings for electric rebates and programs to reduce Data Center energy consumption".

Further, IBM says its mainframe gas gauge "calculates how changes in system configurations and workloads can affect the entire energy "envelope" – including the power needed to both run and cool the machines. For example, a customer adding a single mainframe processor for Linux applications could project the exact amount of additional energy required before and when the feature is turned on. Normally less than approximately 20 watts are added when an Integrated Facility for Linux (IFL) feature is turned on. A single mainframe processor with zVM virtualization can perform the work of tens to hundreds of x86 processors, because of the mainframe's design point for running many mixed workloads at high utilization rates. A single processing chip executing hundreds of workloads efficiently is the key to consuming much less energy than many x86 servers which have many more power consuming components This translates into a simplified infrastructure and cost savings".

What This "Gas Gauge" Data Shows So Far

A single mainframe running Linux can perform the same amount of work as approximately 250 x86 processors WHILE USING AS LITTLE AS TWO TO TEN PERCENT OF THE AMOUNT OF ENERGY! Further, IBM has been able to show that the data it collected in August and September shows that typical energy use is normally 60% of the "label" or In an age when energy prices are going through the roof, and where there are real concerns about environmental damage, this kind of messaging should resonate throughout the datacenter…

Summary Observations

What happened here is that most industry observers — as well as many prospective listeners — stopped reading the announcement when they saw "Mainframe Gas Gauge". Despite being the most energy efficient commercial system in the marketplace while running at a 90%+ utilization rate, IT executives still cringe when they see "mainframe" in any title (because most IT executives think mainframes are boring, old architecture).

But look beyond the word "mainframe" to what is really happening here. What IBM has implemented is a monitoring/measurement system that clearly shows how much energy can be saved by using *scale-up systems designs*. IBM should take this program a step further — and compare/contrast its four distinct server lines across various workloads. Standards should be evolved using this technique to compare the servers of Sun, Dell, and Hewlett-Packard with those of IBM.

In the end, this little heralded, barely audible announcement should have major ramifications on the computer industry provided IT executives open their minds and are willing to receive it. IBM's mainframe gas gauge is not the main point — the main point is that now we have empirical data that shows how efficient scale-up designs really are (or conversely, how stupendously wasteful scale-out tower and rack designs really are). This is an extremely important announcement — one I hope IBM doesn't continue to underplay!

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