



Research Brief

Itanium vs. Power Architecture: More Bunk from the Itanium Solutions Alliance

Introduction

Well, we now know where at least some of the \$10 billion that the Itanium Solutions Alliance (the ISA — a group of vendors that market Intel's Itanium microprocessor architecture) has pledged to invest in Itanium solutions is going. A quick visit to the white papers section on the ISA's home page shows that the group has been very busy writing white papers extolling the virtues of Itanium architecture over Sun's SPARC as well as IBM's Power architectures...

Now, white papers are an important part of marketing — so we don't begrudge the ISA's attempts to promote Intel's Itanium microprocessor architecture with white papers. But we do have several issues with several of the points raised in the ISA's "Itanium versus Power" white paper (this report can be found at the ISA web site at: <https://www.itaniumsolutionsalliance.org/whitepapers/>).

Most notably, we think this white paper errs in its:

- Characterization of Itanium as "a more open and flexible alternative" than IBM's Power Architecture-based systems;
- Representation of a market momentum shift toward Itanium;
- Omission of important and relevant data and facts (such as the affect that x86 hybrid architecture is having on Itanium positioning; the actual number of operating systems supported on Power Architecture; the sheer number of applications that Power Architecture can run as compared with Itanium; and much, much more);
- Claim that Itanium has better TCO (total-cost-of-ownership) than Power Architecture;
- Implication that Itanium has a better business ecosystem for providing software and support services; and in its
- Portrayal of Itanium as technically superior to Power Architecture in terms of scalability, virtualization, performance, operating systems support, and so on.

So, given our huge differences in opinion, we offer this *Clabby Analytics* white paper as a counterpoint for discussing Itanium versus Power Architectures. And we hope that you'll find it a bit more balanced than the ISA's white paper...

What Are Itanium and Power Architectures?

Itanium and Power Architecture are both 64-bit microprocessor architectures. The primary differences between these architectures are:

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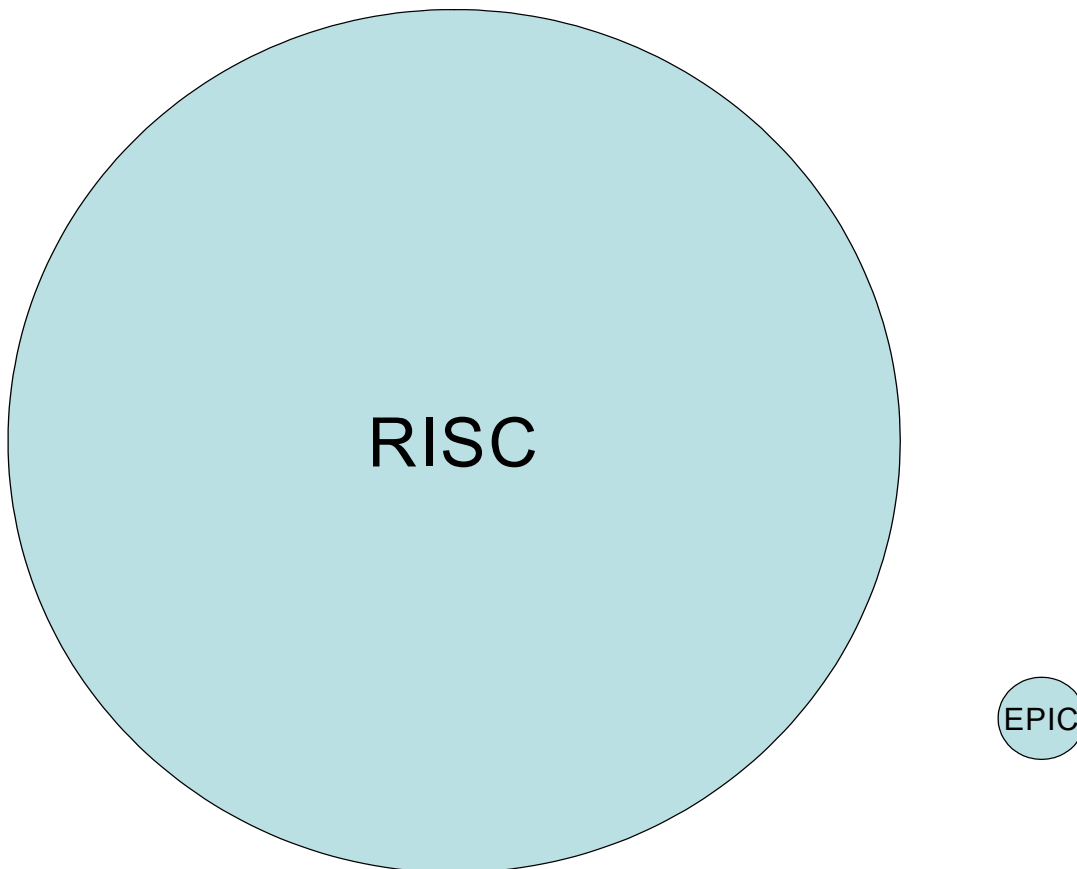
- Intel's Itanium makes use of an approach called explicitly parallel instruction computing (EPIC) to pre-compile instructions before they reach the processor – thereby freeing the processor from having to compile instructions and then execute them.
- IBM's Power Architecture makes use of an approach called reduced instruction set computing (RISC) to process instructions. This design favors the use of a simple set of instructions to execute workloads.

Market Positioning: How Are Itanium and Power Architectures Positioned in the Server Marketplace?

From a market perspective, RISC chips dominate the midrange and high-end server marketplace. Sun's SPARC/UltraSPARC, IBM's Power Architecture, and HP's PA-RISC are the market's leaders in terms of installed base (but note: HP's PA-RISC is at the end of its life cycle – it is being replaced by Itanium).

Itanium, by comparison, has a very small marketshare (not equal in size to RISC as the ISA paper makes it appear when putting forth equally-sized pie charts side-by-side). A more accurate representation of RISC vs. Itanium (EPIC) market share might resemble the graphic depicted in Figure 1 (below).

Figure 1 – RISC versus EPIC (Itanium) – Installed Base



Source: Clabby Analytics – June, 2006

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Competitive Positioning: Hardware, OS, Applications, and Technology

In this section we describe some of the key competitive differences that we see when comparing Itanium and Power architectures. We examine hardware, operating environment, applications, overall technology, performance, and scalability characteristics of each environment to build our comparison.

Hardware Competitive Positioning: RISC Is Not Itanium's Only Competitor

The original intent when Itanium was designed was to make Itanium an across-the-board competitor with RISC — meaning that Itanium was to compete in low-end, midrange, and high-end markets with the likes of IBM's Power Architecture, Sun's SPARC/UltraSPARC, and a number of other RISC chips. But increasing competition from 32-/64-bit hybrids from AMD (with its Opteron) and Intel itself (with Xeon) has now relegated Itanium to midrange and high-end markets. Intel, and original equipment manufacturers (OEMs) that sell Itanium-based systems, now position Itanium as a RISC replacement (Intel's own news release verifies this at: <http://www.intel.com-/pressroom/archive/releases/20050718comp.htm>).

Comment #1: Competition from Intel's own Xeon hybrid, as well as from AMD's very successful Opteron hybrid, has forced Itanium into a position of being primarily a midrange/high-end architecture. Xeon and Opteron have been highly successful when competing with Itanium — largely due to their solid migration path from 32-bit to 64-bit computing. (Itanium is not known for straightforward 32-bit to 64-bit migration capabilities...). Note that Xeon and Opteron were not mentioned in the ISA report — yet both have a strong and significant influence on how Itanium is positioned along with RISC in the 64-bit marketplace.

When the ISA claims that Itanium is "more flexible" than Power Architecture, we wonder on what criteria this claim is based. IBM's Power and Intel's Itanium architectures have both been designed to serve the entire 64-bit market (low, midrange, and high-end opportunities). Both architectures are offered in configurations ranging from blades to large, scaled-up systems. But, in practice, we find very little low-end penetration by Itanium in small and mid-sized business (SMB) markets. These markets generally prefer to buy x86 rather than Itanium solutions.

We do note, however, that IBM is making a serious attempt to move SMB buyers to Power Architecture by offering a Linux-focused, low-cost, well integrated Power-based server platform to the developing 64-bit volume market through low-cost distribution channels. And there are benchmarks that show IBM System p OpenPower Edition outperforming equivalently configured Intel Itanium- and Xeon-based servers, as well as AMD Opteron-based servers (while undercutting the price of these competing servers by almost one-third). We also note that Power Architecture runs in hundreds of devices ranging from automobiles to supercomputers. And, for these reasons, we think Power Architecture is more flexible than Itanium (not the other way around, as claimed in the ISA white paper).

Comment #2: The ISA claim that Itanium is "more flexible" than Power does not appear to be true.

Operating Environment Competitive Positioning

The ISA report makes a big deal about the fact that Itanium can run ten operating environments (but for some reason doesn't list the ten). Our research shows that

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Itanium supports Windows, Red Hat and Novell Linux, several Unix variants, as well as other operating environments such as Hewlett-Packard's (HP's) NonStop and OpenVMS environment.

The report does not explicitly state how many operating environments that IBM its Power Architecture — but rather leaves the impression that IBM supports only three operating environments (labeled "IBM Proprietary, Apple, and Linux — see Figure 2 in the ISA report). Further, the ISA makes note of the fact that the Apple operating environment is transitioning to "IA" (Intel Architecture) — implying that IBM's Power will soon be down to two operating environments.

We at *Clabby Analytics* especially don't like this representation of operating environment support by the ISA. Here's why:

1. Our research shows that IBM's Power Architecture supports four operating environments including IBM's AIX (Unix), the company's i5 operating environment, and Red Hat and Novell Linux variants. That's four, not the three indicated by the ISA graphic.
2. The ISA tries to subtly make the point that Apple's MAC OS X is moving off of IBM's Power Architecture to "IA". Just to be clear, the Intel Architecture that MAC OS X is moving to is Intel's x86 architecture — NOT Itanium. Further, MAC OS X is moving from IBM's PowerPC chip (a Power variant) to x86 architecture (MAC OS X has never run on IBM server-class Power Architecture).
3. We think that the ISA is being a little cagey about the operating environments it supports. The ISA claims that Itanium supports "Windows, UNIX, leading versions of Linux and several mainframe-class operating systems". With the exception of Windows, we can make the same argument about IBM's Power Architecture. It too supports Unix, the same two leading versions of Linux, and a mainframe-class operating environment (i5).
4. Several of the operating environments that Itanium supports are very niche solutions — certainly not high-volume solutions found in the majority of information technology (IT) shops. In particular, we rarely see OpenVMS, Tru64, and NonStop operating environments — and the Bull/NEC Unix variants are also few and far between.

Comment #3: From our perspective, Itanium's support of "ten operating environments" really amounts to Unix, Linux, and Windows support, as well as support for a mainframe-class operating environment. Power Architecture supports Unix, Linux, and a mainframe-class operating environment. Windows support, therefore, is the primary differentiator between Itanium and Power architectures.

With respect to Windows, we observe that Windows users are generally moving up to 64-bit computing from the 32-bit world — and these users are showing a strong preference for x86-based hybrids due to a better migration path from 32- to 64-bit computing. We don't see strong demand for Windows on Itanium — nor would we expect strong demand for Windows on Power Architecture. So, in reality, how big is this Windows differentiator anyway?

Applications

In its report, the ISA also makes a big deal about the number of applications available on Itanium — and also describes significant momentum by software vendors toward hosting their applications on Itanium systems.

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To set the record straight, there are some 15,000 applications that run on IBM's Power architecture. There are approximately 7,000 applications that run on Itanium.

Comment #4: Itanium has a lot of catching-up to do to match Power architecture in the applications space.

Also worthy of comment is the ISA's claim that "the number of applications for Itanium2-based servers has doubled in the last 12 months, and that momentum can be expected to increase". When we talk to independent software vendors (ISVs) we are finding few that are aggressively pursuing application migration to Itanium. In fact, VMware (the market's lead-selling virtualization software) has just dumped support for Itanium. Instead of mass migration to Itanium, we're finding greater interest amongst ISVs in deploying applications on the hot selling Xeon and Opteron hybrids. So we're curious — where is this expected influx coming from?

Comment #5: We're not sure why the ISA is so optimistic about Itanium application momentum — but it doesn't jive with what we're seeing and hearing. We suspect that many of the new Itanium applications are coming from Linux ISVs and from the open source community — and that these applications have generally not been optimized to exploit Itanium architecture. We also observe that the same Linux and open source vendors are also very active in porting their products to RISC architectures...

Technology

We agree with the ISA that Itanium does have a couple of nice technology edges (hard and soft partitioning, and seven-nines [99.99999 according to HP] percent availability are a few of them). But we take issue with portraying Itanium as a technology leader; and we find the ISA positioning of Itanium as a performance leader a little curious.

From a technology perspective we view Itanium as a follower — not a leader — in terms of bringing several of the new, more advanced features and functions to the market. In short, Power Architecture has set the pace for multi-core, multi-processing, virtualization, and several other leading edge processor technologies — Itanium has followed IBM's lead (generally lagging by 18 months or more). We detail our view of Itanium technology innovation perspectives in a report called "\$10 Billion More on Itanium: Is this a Wise Investment?" that can be found at: <http://valleyviewventures.com/content/00-/01/03/59/23/userimages/Itanium--Is%20This%20a%20Wise%20Investment%205-1-06.pdf>.

Performance

On performance, we note that the ISA uses SPECint benchmarks to prove its performance case for Itanium versus Power Architecture — not the tpm-C benchmarks we would have expected. SPECint is a benchmark that is used to measure a computer's integer processing capability (and Itanium's SPECint benchmarks are excellent — it's a real good number cruncher). But why, when the ISA report mentions several times that Itanium architecture has been designed to "deliver balanced performance across a wide range of workloads (transactional, batch, analytics, etc.)", did they choose to use SPECint benchmarks. Everyone knows that TPC-C benchmarks have been designed to bang transactions against a database, seeking to show how a system performs when managing, selling, or distributing a product or service (in other words, the tpm-C benchmark is a better gauge when

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measuring a wide range of workloads). And guess which architecture owns the number one and number two spots in tpm-C benchmarks...

Comment #6: In its report the ISA makes the point several times that Itanium is good at processing varied workloads — yet uses SPECint benchmarks to prove its point. To us it would have made more sense to use a transaction processing benchmark such as tpm-C to prove the point that one architecture is better than another at varied workloads (rather than the number-crunching SPECint benchmark). As of this writing, two IBM Power Architecture-based servers own the number one and two spots in TPC-C performance benchmarks; an HP Itanium-based Superdome is in third place with less than half the transactions per minute of the leader at a slightly lower cost per transaction minute.

In the performance section of its white paper, the ISA points out how great its next generation Itanium chip (Montecito) will be. It will double performance, and finally offer enhanced virtualization, multi-threading improvements (with two software threads per core), while providing increased RAS (reliability, availability, and security).

Comment #7: We actually expected this functionality last year — but Montecito slipped way into this year... By the time Montecito makes it to market, IBM will have had its advanced hardware virtualization, simultaneous multi-threading and improved RAS features out on the market for almost two years. And by the time Itanium catches-up, how much further ahead will Power Architecture be?

Scalability

On scalability, it is true that Itanium 2 can scale from 2-way servers and blades to large SMP (symmetrical multiprocessor) systems with up-to 512 processors — although, as described before, we believe that Itanium is really more suited to compete with RISC in the high-end of the server market due to low-end/midrange competition from Xeon and AMD. But the real question is: “are Itanium-based systems more scalable than RISC-based systems”. The above mentioned TPC-C performance data would seem to refute that Itanium scales better in some way than IBM’s Power Architecture-based systems.

Cost Structures

We were quite surprised by the ISA’s assertion that “users report up to 50% lower TCO for Itanium-based solutions versus comparable RISC-based implementations”. When we sought to substantiate this statement we read (in fine print) the following:

“Based on a number of customer reports. Formal studies are currently underway to corroborate savings across a wide range of deployments”.

Our first reaction to this claim was “you’ve got to be kidding me”! The ISA is alleging that Itanium TCO is better than Power Architecture TCO based-upon some vague discussions with some customers — with formal research to be conducted later? Amazing...

Comment #7: The ISA’s use of anecdotal data to claim a 50% lower TCO for Itanium-based solutions is astounding — especially considering that formal studies that back-up this claim “are currently underway”.

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We wonder how the ISA could arrive at a 50% cost savings when these studies haven't even been completed...

Migration Arguments

Whenever we see migration claims — the first thing we think of is that migration is a two way street. Plenty of examples of customers migrating from “system x” to “system y” can always be found — as well as the converse. In the ISA report the organization describes “one of the world’s largest retailers” that migrated its “legacy IBM applications onto a less expensive, more versatile machine”. Well, so be it — there are always a few mainframe migrations taking place. What would be more interesting would be if a *large number* of mainframe migrations to Itanium were taking place. So far, we are unaware of such a trend...

But there is a migration trend that readers should be made aware of — the migration of HP-UX/PA-RISC users to AIX/Power Architecture platforms. For the past few years Hewlett-Packard has been weaning its base of PA-RISC microprocessor users over to its new line of Itanium-based servers (because HP’s PA-RISC processors are in an end-of-life cycle with no further new spins scheduled). Due to this forced migration, HP customers now have several choices to make:

- Should they migrate to HP-UX on Itanium;
- Should they migrate to Linux on Itanium (as long as they have to make a major systems migration move, it may be time to evaluate a new operating system too); or,
- Should they move to a RISC platform?

Comment 8 — We’d like to see a large list of recent customers who have migrated from mainframes to Itanium-based systems (by large list we mean just show us 10...). By contrast, IBM has executed dozens-upon-dozens of migrations from HP PA-RISC and Sun UltraSPARC systems to its System p platform. IBM has invested heavily in its “Migration Factory” tools and services to accomplish such migrations. In short, we believe that a few migrations from mainframe architecture to Itanium does not a major market trend make...

Comparing Business Models/Ecosystems

We were quite amused by the ISA’s view of the ecosystem that surrounds IBM’s Power Architecture-based servers as one based-upon “greater reliance on software and services for its core revenue”. A closer look at most of Intel’s 75 Itanium systems partners will undoubtedly show that these partners make most of their money primarily on services and software because these are the areas where the greatest margins can be achieved...

The ISA then goes on to intimate that “companies who rely on Power find themselves with few alternatives for these post-deployment purchases [presumably meaning services, support, and software]”. Does the ISA know that IBM has 50,000 channel partners; 10,000 ISV partners; and that there are also thousands of independent professional service providers that can provide support and consulting services for IBM products? Just because a customer buys hardware from IBM or its channel partners doesn’t mean they have to buy IBM software or services.

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Comment 9 — The claim that IBM's business model relies heavily on software and services is true. Hardware margins are good — but software and services margins are usually significantly better. We suspect that a close analysis of Intel's 75 Itanium partners would reveal that they too rely on software and services for high-margin revenue.

The ISA goes on to claim that the business model for Itanium 2-based solutions is "very different" based-upon the "range of hardware, OS, application and solution providers" that can ensure "competitive solutions both during and after deployment". The ISA further states: "since individual vendors do not control the complete solution, they also have greater incentive to deliver upgrades that are backwards compatible, and the can be integrated into existing systems".

Comment 10 — We have a couple of issues with these statements. First, IBM offers a good mix of hardware, operating system, and applications that run on its Power Architecture (we have already established that Power Architecture ranges from low-end to very high-end systems; it supports multiple operating systems, and there is a large community of service providers that support it — both on the System p and the System i platforms). Second, the claim that individual vendors "because they don't control the complete solution — have a greater incentive to deliver upgrades" is not consistent with what we're seeing. For instance, in the application server marketplace IBM constantly upgrades its WebSphere application server as well as provides backward compatibility. This is also true with IBM's Tivoli product line; IBM's Rational product line; IBM's DB2 product line and so on. Competition drives all vendors — the fact that one vendor can supply a complete solution does not somehow negate the fact that the vendor needs to compete to stay on top of its chosen markets. This laissez faire competition is how IBM has become the number one application server in the world, for instance.

We also would like to add that many customers want a single source to supply a solution in order to eliminate finger-pointing should a problem occur. In this respect, we could accuse the Itanium solutions model of being deficient.

Standards and "Openness"

Our final issues with the ISA report are in the areas of standards and openness.

The reason that standards are important is that standards help break down barriers to interoperability — enabling unlike systems to more easily be integrated. Standards also serve to help eliminate vendor lock-in.

In its white paper, the ISA cautions prospective Power Architecture buyers that buying into an environment in which IBM controls much of the hardware, software and support might cause Power Architecture buyers to "tie themselves into a single vendor which limits their technology options and reduces their ability to manage costs and risks going forward".

Comment 12 — From where we sit, IBM has made a huge commitment to standards and openness. We believe that IBM has to do this in order to ensure cross-platform interoperability within its five distinct server lines (including z, i, p, x, BladeCenter & Storage). We observe that IBM is a major driver of Web services standards (for cross-platform program-to-program communications); for database standards; for storage standards; and so on. And with the introduction of even more standards almost daily, the days of vendor hardware lock-in are fast fading. We regard the ISA's cautionary vendor lock-in advice to be largely FUD (fear, uncertainty, and doubt). Finally, with five distinct server offerings, we think IBM offers plenty of choice to prospective buyers.

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Comment 13 — We also observed that the ISA referred to IBM's AIX as a proprietary operating system. And we comment that if AIX is a proprietary operating system — then we would also call Microsoft Windows, HP-UX, Non-Stop, Tru64, OpenVMS, and the Bull and NEC operating systems that run on Itanium proprietary also. After all, these operating systems are controlled by single vendors — just as IBM's AIX is. Does this plethora of proprietary operating systems on Itanium make it more proprietary than AIX on Power Architecture? Something to ponder...

Finally, we do note that IBM has opened its Power Architecture via Power.org. Power.org is an organization dedicated to “all constituencies and stakeholders in Power Architecture technology”. By sharing information and skills, the organization seeks to “enable the development of standard methods and tools thereby accelerating platform innovation and reducing development costs”. More information about this open standards organization can be found at: <http://www.Power Architecture.org>.

Comment 14 — Any portrayal of IBM's Power architecture as proprietary is just plain inaccurate as all of the specs are now available to Power Architecture.org members. But heh, where's Itanium.org?

Summary Observations

The bottom line of this report is that the ISA and *Clabby Analytics* view the positioning of Itanium versus Power Architecture very differently. The ISA argues in its white paper that the primary differences between Itanium and Power Architectures can be found in flexibility and affordability. We see the primary differences as being market share, applications base, Windows operating systems support, technology leadership, and openness.

In its paper, the ISA claims that Itanium is a flexible architecture. Yes — it can scale from a two-way configuration through 512 processors. And yes — it does support multiple operating systems. But IBM's Power Architecture offers even better scalability (see the TPC-C benchmarks we referred to) — and IBM's Power Architecture also supports multiple operating systems (four, to be precise). We do not see Itanium as being any more- or less-flexible than IBM's Power Architecture.

When we compared Itanium and Power Architecture we looked at market positioning, hardware characteristics, operating environment support, application portfolios, technology innovation, scalability, and performance. Here's what we found:

- **Hardware** — although Itanium can scale from two-way servers through large SMP servers, Intel and its partners know that Itanium is really a niche processor aimed at mid-range and high-end server markets. The ISA didn't tell us this in their paper — but Xeon and Opteron are the preferred choice for most of the market as it segues from 32-bit computing to 64-bit computing. And these hybrid processors are driving Itanium out of low-end, many midrange, and now even high-end 64-bit opportunities.
- **Operating environments** — The ISA's argument that Itanium's support of 10 operating environments makes it more flexible than Power Architecture doesn't hold water from our point-of-view. First, several of these operating environments are simply Unix variants (HP-UX, Tru64, and the Bull and NEC

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variants). IBM offers a single version of Unix (AIX). We ask: "how is having several Unix versions a major advantage?" Second, the ISA claims that Itanium has several "mainframe-class" operating environments (OpenVMS, Non-Stop, etc.). IBM's AIX as well as its i5 operating environments are mainframe class also. Third, we note that several of these operating environments are not in broad use throughout the market. So how does one gain a major advantage if the operating environment being hosted on Itanium only sees niche use? Fourth, Microsoft Windows is a legitimate differentiator. Itanium supports it; Power Architecture doesn't. (But remember, there are few Windows installations on Itanium — most Windows deployments can be found on x86 architecture — a point the ISA paper neglects to mention).

- **Applications portfolio** — Power Architecture offers over 15,000 applications; Itanium only 7,000. Enough said... We also note that the ISA expects to see continued application migration momentum to Itanium. When we talk to ISVs we hear of their plans to migrate to hybrid Opteron and Xeon platforms — not Itanium. Meanwhile, we have noticed that some very important ISVs (such as EMC's VMware) are moving away from Itanium. We must be missing something...
- **Technology innovation** — We see Itanium as a follower, not a leader. Our views are detailed in another white paper called "Itanium: Is this a Wise Investment?" that can be found on valleyviewventures.com.
- **Scalability** — Both Itanium and Power Architecture scale well. Power Architecture scales better.
- **Performance** — We prefer the TPM-C benchmark to measure varied workload performance, not the SPECint used in the ISA white paper. We also observed that the ISA is relying heavily projected performance when Intel introduces its next Itanium spin (Montecito). When Montecito finally begins shipping after multiple delays, it will be interesting to see if it delivers the 2X performance improvements (using TPC-C benchmarks) that have been promised.

This white paper took umbrage with the ISA's characterization of Itanium's alleged total-cost-of-ownership advantages; its view of the Power Architecture business model/ecosystem; its mass-migration to Itanium argument; and its characterization of some elements of Power Architecture-based servers as "proprietary". Most irksome was the ISA allusion to Itanium as being more affordable (to be exact, they claim by as much as 50 percent more affordable). But when you read the fine print you'll find that they don't substantiate their claims with hard data — only vague promises that formal studies are underway. Meanwhile, IBM has studies that conclusively illustrate significant operational savings that can be attained through server consolidation on the System p, for instance. The ISA needs to provide firm evidence of its 50% better performance claim — not anecdotal heresay...

In conclusion, we have a short message for the ISA: hey, this was fun — let's do this again sometime. We're ready when you are...

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June, 2006

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