White Paper

Intel® Itanium® 2 processor

Data Center Planning

Business-Critical Infrastructure

The End of the Proprietary Era

Itanium® 2-based solutions are changing the economics of business-critical computing

Market momentum for Itanium®-based solutions is accelerating worldwide, as businesses move away from proprietary architectures to reduce their total costs and achieve higher levels of performance, scalability, and availability.

"Itanium solution delivery to mission-critical environments represent a new business model for enterprise and technical computing users bringing choice of hardware platform, operating system, and applications to environments, which heretofore have been limited by proprietary vertical solution stacks."

– Vernon Turner, group Vice President and General Manager, IDC[1]

[1] Source: *Computing Leaders Announce Strategy for New Era of Mission Critical Computing*, Itanium Solutions Alliance Press Release, January 26, 2006: https://www.itaniumsolutionsalliance.org/news/pr/view?item_key=e30f62bc7770a22d9d95e4d267ed1a63a1a803b5

Executive Summary

"Increasingly, organizations are relying on Itanium to address some of the most critical needs of their business."

– Nathaniel Martinez and Thomas Meyer, IDC[2]

Many of the world's largest and most successful organizations are deploying Itanium® 2-based solutions to cut costs and improve agility for some of their most demanding, business-critical applications. Adopters include:

- More than 50 of the world's 100 largest companies (more than 70 have systems either in production or in the planning stages)
- 5 of the top 9 financial services corporations
- 8 of the top 10 automobile manufacturers
- 8 of the top 10 energy companies

Altogether, approximately 90,000 Itanium®-based systems have been deployed around the world since 2002,[3] in configurations ranging from small 2-way servers to massive systems with up to 512 processors. Customers are reporting a high level of satisfaction[4] and adoption is accelerating rapidly.

"At IDC, we saw approximately $3 billion of Itanium sales in the past four years being met with nearly $3 billion in the next 15 months..."

– Vernon Turner, IDC[5]

It has taken time for application support to reach critical mass for Itanium-based solutions, but today's increasing adoption rates indicate the time has come. Application availability has more than doubled in the past 12 months and the pace of application porting continues to increase. In addition, new binary translation technologies will soon enable many thousands of legacy RISC-based applications (including both off-the-shelf and custom code) to run without change and with near-native performance on Itanium-based systems. This will offer truly breakthrough capabilities, enabling many businesses to take full advantage of the flexibility and value of Itanium-based solutions, without the cost and risk of software migration.

[2] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

[3] Based on data from *IDC Server Tracker*, Q4 2005.

[4] *"Satisfaction among current Itanium customers is high, with two-thirds applying the highest satisfaction ratings for their Itanium servers."* Source: IDC, "Customer Perceptions of the Future of Itanium," Michelle Bailey, Crawford Del Prete, Vernon Turner, Matthew Eastwood , Stephen L. Josselyn, Doc #34842, February 2006, available for purchase at: http://www.idc.com/getdoc.jsp?containerId=34842

[5] As quoted in the article: *Vendors Join Forces to Boost Itanium*, by Amy Newman, ServerWatch.com, September 26, 2005: http://www.serverwatch.com/news/article.php/3551391

Businesses are finding that Itanium-based servers enable them to substantially reduce their total cost of ownership in comparison with proprietary RISC systems. At the same time, they gain the flexibility of choosing from 10 operating systems, dozens of hardware vendors, thousands of applications, and a large community of independent solution providers. For organizations that are tired of the high cost and limited choices provided by proprietary mainframe and RISC architectures, Itanium-based solutions offer a new model for business-critical computing—one that is rapidly gaining traction in the worldwide marketplace.

The Escalating Challenges of Business-Critical Computing

"The challenges that IT departments are currently facing are twofold. The first is internal to the organization and pertains to the cost of IT. The second challenge is in response to ever-faster changing market conditions.... IT has historically responded slowly to business change."

– Nathaniel Martinez and Thomas Meyer, IDC[6]

In virtually every industry and field of study, organizations are faced with rapidly growing computing needs. Whether they are involved in disaster relief or energy exploration, health research or automotive design, financial markets or retail, the story is similar. Data and transaction volumes are rising, applications are becoming more complex and integration requirements are increasing.

This is not a challenge that will go away anytime soon. Ubiquitous connectivity, new data sources (RFID, sensor nets, etc.), growing compliance requirements, real-time transactions, and escalating security threats are all adding to the pressure on today's business-critical systems. It is no longer only the largest organizations that need high-end computing capacity. Emerging tools for business intelligence, modeling, data visualization, and process optimization are becoming essential enablers for organizations of all sizes, and these applications typically require highly available systems built to efficiently handle large amounts of data.

Even as computing needs grow, economic constraints are becoming more stringent. Decision-makers are demanding the same kinds of returns and assurances from IT that they demand from other business investments. Technical excellence, alone, is no longer sufficient. Total costs must be contained, and solutions must become easier to deploy, scale and adapt to provide quicker payback and deliver better long-term value.

Many emerging IT capabilities are helping organizations meet this challenge, from Web services and service-oriented architecture (SOA), to virtualization, server blades and automated management tools. Itanium-based solutions are playing a fundamental role in this evolution. By delivering high-end computing capabilities on a standards-based architecture, they bring choice, flexibility and affordability to business-critical computing, an area where high cost and inflexibility have long been the status quo. As the number of optimized applications has grown, IT organizations have taken note, and Itanium-based solutions are seeing steadily increasing adoption worldwide.

"Since 2002, there has been continued momentum around the Itanium-based ecosystem to the point that over $3 billion worth of Itanium servers running over 5,000 applications have been sold to date in the European, Asian, Japanese and North American markets, making its presence visible in all corners of the IT infrastructure world."

– Matthew Eastwood, IDC[7]

[6] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

[7] Source: IDC White Paper sponsored by the Itanium Solutions Alliance, "The Itanium Solutions Alliance Brings Investment Protection to Enterprise Computing," September 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/ISA_Whitepaper.pdf

Mainframe Capabilities at Mainstream Prices

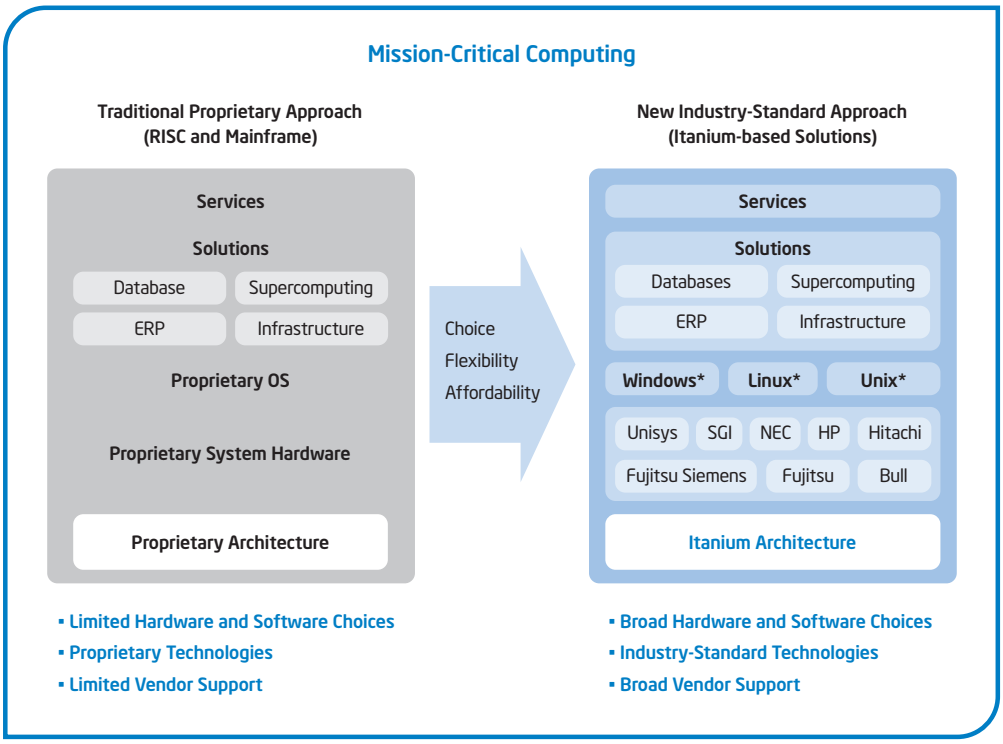
"With the Fujitsu PRIMEQUEST Intel® Itanium® based servers, EDS expects to deliver the most reliable and cost-effective solutions in an open environment with the same level of performance and reliability previously enjoyed by our customers in a mainframe environment."

– Larry Lozon, Vice President, Data Center Services, EDS[8]

For years, affordability and business-critical computing have been mutually exclusive. Solutions have been based on proprietary architectures and solution stacks that are developed and supported largely by a single vendor[9] (Figure 1). Deploying these solutions requires a major investment, and, once that investment is made, customers have few options in terms of systems, technologies, operating systems, and vendors. This leaves them with limited ability to control cost and risk. It also makes it difficult to take advantage of broader industry advances.

Until recently, organizations had little choice but to deploy these proprietary architectures, because industry-standard solutions had not caught up with business-critical application requirements. Today they do have a choice. Itanium-based

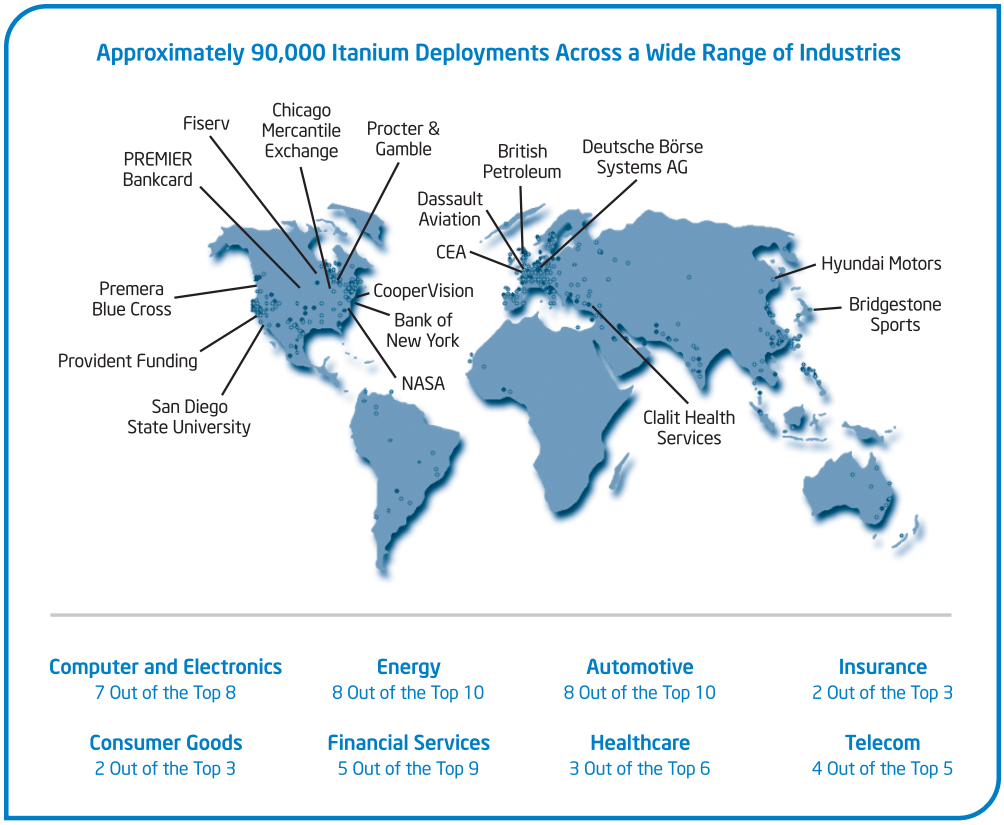
Figure 1. Itanium-based solutions offer an unprecedented level of choice and flexibility for business-critical computing, and can be instrumental in helping businesses get better total value from their IT investments.



[8] Source: *EDS to Offer Fujitsu PRIMEQUEST Servers in Its Mission-Critical Computing Solutions*, Fujitsu press release, Sunnyvale, California, November 3, 2005; Tokyo, November 4, 2005: http://www.computers.us.fujitsu.com/www/news.shtml?aboutus/pressreleases/pr_110305

[9] Although proprietary vendors are moving toward more open software platforms, support for standards-based software should be carefully investigated, and it should be noted that performance claims often depend on proprietary software stacks.

Figure 2. Adoption of Itanium-based solutions is a worldwide phenomenon, with strong growth occurring in both developed and emerging regions.



solutions deliver high-end performance, scalability, and availability on affordable, industry-standard systems that are supported by a broad array of vendors, operating systems, and applications.

Market response has been positive, with consistent growth over the last two years. According to IDC, factory revenue for Itanium 2-based solutions grew 60 percent year over year in 2005.[10] That is faster than factory revenue grew for SPARC or IBM Power architecture at comparable points in their early years. Growth is accelerating and momentum is strong across all geographies and multiple vertical industries (Figure 2).

Given the proven potential for TCO reduction, why has the adoption of Itanium-based solutions not been even faster? Because businesses must have complete solutions that can be deployed easily across a wide range of business needs. As complete solutions have emerged for particular applications and industries, the adoption of Itanium-based systems has increased accordingly. Solution availability has improved dramatically in the past year, and this is fueling broader and faster adoption.

"IDC's most recent forecast for EPIC architecture, or Itanium-based, server spending indicates that there will be steady growth over the next five years from $1.4 billion in 2004 to approximately $6.6 billion in 2009. This expected increase represents a compound annual growth rate (CAGR) of over 35% for the period, compared with 3.4% for the server market overall."

– Michelle Bailey, Crawford Del Prete, Vernon Turner, Matthew Eastwood, Stephen L. Josselyn, IDC [11]

[10] Source: *IDC Server Tracker*, Q4 2005.

[11] Source: IDC, "Customer Perceptions of the Future of Itanium," Doc #34842, February, 2006: http://www.idc.com/getdoc.jsp?containerId=34842

A Rich Portfolio of Business Solutions

"...Itanium servers represent a rich set of server solutions, which can address a full range of requirements and can support a wide range of customer workloads."

– Nathaniel Martinez and Thomas Meyer, IDC[12]

Dozens of server vendors now offer Itanium-based systems, including 8 of the world's 10 largest platform developers. Complete solutions stacks are available across a wide and growing array of business-critical applications. Support is particularly strong for database, data warehousing and business intelligence solutions; large, mission-critical ERP and CRM applications; and HPC and technical computing solutions. Altogether, application availability has more than doubled in the past 12 months, to more than 6,000 optimized applications, and many more are on the way.

"The Itanium ISV's ecosystem grew from 3,000 applications in January 2005 to more than 5,000 in August and continues to grow at a similar run rate, a clear indication of the strong endorsement by the software community of Itanium servers' capacities."

- Nathaniel Martinez and Thomas Meyer, IDC[13]

Case Study: Itanium-based Solutions in Action

China National Offshore Oil Corporation (CNOOC)

- One of the world's largest oil and gas companies
- 5th largest profit engine of all state-owned enterprises in China
- Provides critical support for China's growing economy

The growth and modernization of China's economy was placing new pressures on CNOOC. Oil demand was growing rapidly and the company's monopoly status was giving way to increasing competition from both foreign and domestic oil companies. To increase efficiency and reduce risk, the company migrated its mission-critical RISC-based system to an Itanium-based server that could meet growing demands cost-effectively, and provide a more scalable foundation for future growth.

With this solution, CNOOC is able to run more complex oil reservoir simulations, which helps the company reduce risk in new developments and improve output for existing reservoirs. According to Li Jinshui, Director and General Manager of SGI Greater China, *"The Itanium® 2-based SGI* Altix 350* server is an industry standard server that costs only a quarter of CNOOC's previous system, but improves the company's work efficiency by up to five times."*

Read the complete case study at: http://www.intel.com/business/casestudies/cnooc.pdf

[12] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

[13] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

One key example is the Oracle E-Business Suite, which Oracle is currently working to deliver for Itanium-based systems running HP-UX 11i. Oracle E-Business Suite adds comprehensive application functionality, enabling businesses to host a full range of core Oracle applications on Itanium-based systems. Other Oracle software products available for Itanium-based systems include Oracle Application Server, and Oracle Database which has been available for Itanium-based systems for several years.[14]

Itanium-based servers also support the enormous number of applications already developed for IA-32 based servers, and performance for these applications will be substantially improved on next-generation, dual-core Intel Itanium 2 processor-based servers.

In addition to porting and new application development, binary translation solutions are emerging that can deliver near-native performance for legacy RISC applications on Itanium-based servers—without any software changes. This will dramatically increase application options and further simplify migrations from legacy platforms (see the sidebar: *Porting Made Painless*).

"From the early days, we've gotten fantastic performance for the Oracle database running on Itanium-based servers. This has become a strategic platform for us and our customers, and we believe performance, reliability and cost-effectiveness will continue to grow very rapidly as time goes on."

– Prem Kumar, VP, Server Technologies, Oracle

Porting Made Painless

"Transitive's ability to deliver up to 80 percent of 'native' performance, when executing binary images targeted for one platform on incompatible hardware or software platforms could be a game-changing event that restructures the computer industry."

– Nathan Brookwood, Principal Analyst, Insight 64

Most businesses have an enormous investment tied up in their legacy software applications, and migrating that code to a new platform can be a daunting proposition. With its high-performance binary translation software, Transitive eliminates that critical roadblock. Intel is working closely with Transitive[a], and leading server vendors will soon be offering Itanium-based systems that can run applications that were compiled for RISC-based systems—with no code changes and near native performance.

Software from Transitive is already being used successfully to run SGI Prism visualization software on Itanium-based servers, and to run Apple software on the new Macintosh computers based on the Intel® Core Duo processor. It will also be used to enable applications from RISC environments to run without change on Intel® Xeon® processor-based servers, as well as Itanium 2-based systems. For businesses around the world, these capabilities will provide a low-cost, low-risk path to moving legacy applications onto a more flexible and cost-effective server infrastructure.

For more information, visit www.transitive.com

[a] For details on the collaboration, see the article, *Intel launches RISC-free strategy*, by Stephen Shankland, CNET News.com, March, 2006: http://news.zdnet.co.uk/hardware/chips/0,39020354,39256032,00.htm

[14] In addition to the porting effort, Oracle is offering very favorable software licensing. For an overview of these developments, see the article, *Oracle Designates HP-UX on Itanium as a Strategic Platform*, by Timothy Pricket Morgan, The Unix Guardian, March 2, 2006: http://www.itjungle.com/tug/tug030206-story02.html

Case Study: Itanium-based Solutions in Action

AVTOVAZ

- The leading auto manufacturer in Eastern Europe
- Manufactures 3 cars per minute in one of the world's largest factories
- Shipped nearly one million cars in 2004

To continue its rapid growth and meet the demands of an aggressive international auto market, AVTOVAZ needed to increase the performance, scalability, and accessibility of its core ERP application. According to Yuriy Katyanov, CIO of AVTOVAZ, *"We needed a system that could guarantee the delivery of our business-critical reports, as well as support wider employee access to the portal-based applications."*

To meet this need, the company consolidated 29 RISC-based servers onto just two Itanium-based systems. The new solution has accelerated data retrieval up to 250 percent, doubled the number of concurrent users that can access the system, and substantially reduced total cost of ownership. The business impact has been equally positive. According to Katyanov, *"The new solution has given us the ability to work much more efficiently and productively. Staff are now able to create and deliver vital reports in a fraction of the time it took before."*

Read the complete Intel case study at: http://www.intel.com/business/casestudies/avtovaz.pdf

"Every time I talk to the team, it's: Wow! SQL Server 2005 running on the latest generation Itanium® 2-based platform is better and faster every step of the way. The data warehouse drives growth, makes us more efficient and optimizes our operational excellence."*

– Doug Gray, IT Director CompUSA[15]

High Value in Real-World Deployments

"In our experience, expectations have been exceeded with our Itanium implementation. We have better cost effectiveness, fewer systems, easier monitoring of the systems, and much higher performance."

– Infrastructure Specialist, Dairy Industry[16]

When a catastrophic tsunami struck Indonesia, an Itanium-based system helped scientists turn hundreds of gigabytes of satellite data into real-time, three-dimensional maps that were used to assess the impact and coordinate relief efforts.

According to John Graham, chief scientist of San Diego State University's Visualization Center, *"The integration of the Linux software and sheer performance of the Itanium system have made a major impact on remote sensing and GIS in ways that are changing the world."*[17] Clearly, it is the capacity and performance of the system that made such a difference. Yet it is its affordability that made deployment possible, and its scalability that will allow the research team to grow the solution cost-effectively as requirements increase.

This is just one example among many. Since 2002, approximately 90,000 Itanium 2 processor-based systems have been deployed worldwide.[18] Some organizations are using them to reduce costs for new deployments. Others are using them to scale and consolidate existing Windows* and Linux* applications, and still others to migrate away from costly and proprietary RISC architectures.

[15] Source: *CompUSA Gets a Business Intelligence Boost with Microsoft SQL Server* 2005 and Itanium® 2-Based Server*, an Intel case study: http://www.intel.com/business/casestudies/compusa_2.pdf

[16] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

[17] Source: Itanium Solutions Alliance Press Release, January 26, 2006: https://www.itaniumsolutionsalliance.org/news/pr/view?item_key=16bc7596a8faf9d28b7f69e2c70ebd10e265a379. For a complete case study of the San Diego State University deployment, see *Accelerating Tsunami Relief at San Diego State University*, an SGI case study: http://www.sgi.com/pdfs/3827.pdf

[18] Based on data from *IDC Server Tracker Q4 2005.*

The multi-OS support of Itanium architecture provides considerable choice and flexibility for consolidating and migrating legacy applications. Several vendors offer robust virtualization and partitioning capabilities in their particular operating environments. Xen* virtualization software (http://www.cl.cam.ac.uk/Research/SRG/netos/xen/), developed by the open source Linux community, is also compatible with Itanium-based solutions, as is SWSoft's Virtuozzo* (http://www.swsoft.com/en/products/virtuozzo/). Organizations can use these solutions to carve up an Itanium-based server into multiple virtual servers, and to host large numbers of consolidated applications in secure partitions.

Itanium architecture also supports true mainframe-class implementations. As one example, Platform Solutions, Inc. (http://www.platform-solutions.com/) offers IBM-compatible mainframes on Itanium architecture. This allows organizations to continue running their legacy mainframe applications, but on a more affordable and flexible system that delivers near-native performance. With this approach the mainframe is no longer a functional silo, but can be more easily integrated with other systems and applications (see the sidebar, *A New Era in Mainframe Flexibility*).

Itanium-based solutions offer similar benefits for legacy RISC solutions. By migrating these applications onto Itanium-based servers, organizations can improve performance, reduce costs, and establish a more consistent operating environment across their business-critical and mainstream applications.[19] They can also take advantage of the larger pool of engineers and technicians with expertise in Intel-based technology. (For information on migrating RISC/UNIX solutions to Microsoft Windows on Itanium-based systems, visit http://www.migrationforunix.org/; for extensive resources for Linux on Itanium solutions, visit http://www.gelato.org/).

A New Era in Mainframe Flexibility

"PSI is committed to providing customers with the security and reliability of traditional mainframe computers, but with the flexibility, affordability and choice of open, standards-based technology. The Intel® Itanium® 2 processor is the platform that is enabling us to do it."

– Michel Maulick, President and CEO, Platform Solutions, Inc.

Platform Solution, Inc. (PSI) is introducing a new era in mainframe computing, by delivering highly scalable and reliable Itanium-based servers that can run the IBM z/OS* and OS/390* operating systems, as well as Linux, UNIX, and Windows. This provides an ideal path for mainframe modernization, and a great way to cost-effectively preserve the value of legacy applications.

The solution currently scales up to 128 processors, and supports mainframe-class I/O using industry-standard components. Businesses can integrate a broad range of business applications in a virtualized, manageable, and consolidated environment that supports the highest levels of security and availability. They can continue to reap the benefits of a mainframe computing environment, while reducing their costs and taking advantage of the rapid innovation provided by a broadly supported architecture.

For more information, visit: http://www.platform-solutions.com/

[19] For more information about UNIX migration, see the IDC report, Understanding Unix Migration: A Demand-Side View, by Matthew Eastwood, IDC #34816, Volume:1, January 2006. Available at: http://www.migrationforunix.org/

Smooth Migrations

"Importantly, most of the customers interviewed stated that their business faced barely any disruption in the architecture switch to Itanium.... End-users can benefit from vendors that can transfer years of experience, know-how and skills with x86 standardization to Itanium servers."
– Nathaniel Martinez and Thomas Meyer, IDC[20]

Any new deployment or migration of business-critical applications involves some level of risk. Yet an extensive survey by IDC indicates that businesses are migrating to Itanium-based solutions with relative ease and with very little disruption.[20] Several factors contribute to the success of these migrations.

- **Multi-OS Support**—Organizations have a broad array of operating systems to choose from, so they can often take advantage of existing expertise within their organization. Migrations are simpler and learning curves are reduced.
- **Easy Integration with x86**—Itanium-based solutions have much in common with today's standards-based x86 solutions, so experience and skills translate easily to the new environment. The two architectures also integrate well together. Intel® Xeon® processor-based servers are appropriate for many workloads, such as Web transactions and computations that can be split into smaller components and reassembled (e.g., Google-type searches and many HPC applications). Itanium 2-based solutions are better for data-intensive, business-critical workloads that can take full advantage of large memory and enhanced parallel processing. Many businesses are choosing to host data-tier applications on Itanium 2-based servers, while using Intel® Xeon® processor-based servers at the application layer.
- **Strong Vendor Support**—Leading Itanium-based server and software vendors offer services and support that can simplify migrations and reduce risk, as do many independent solution providers. Additional resources are available from the Itanium Solutions Alliance (https://www.itaniumsolutionsalliance.org), the Intel® Software Network (http://www.intel.com/cd/ids/developer/asmo-na/eng/dc/itanium/index.htm), and Intel® Solution Services (http://www.intel.com/cd/services/intelsolutionservices/asmo-na/eng/index.htm).

The Itanium Solutions Alliance (ISA)

Some of the most trusted names in high-end computing have joined an alliance to drive coordinated development and support for Itanium-based solutions, including Bull, Fujitsu, Fujitsu Siemens Computers, Hitachi, HP, Intel, NEC, SGI, Unisys, BEA, Microsoft, Novell, Oracle, Red Hat, SAP, SAS and Sybase. The Alliance offers extensive resources for software vendors and corporate IT organizations interested in developing and deploying Itanium-based solutions, including:

- **The Itanium Solutions Catalog**—a comprehensive list of applications optimized for Itanium-based servers.
- **The Itanium Solutions Network**—a global network of centers to facilitate remote porting and testing of applications.
- **Developer Days**—Organized events providing developers with tools and technical assistance for porting and optimizing applications.

For more information, visit: https://www.itaniumsolutionsalliance.org/home

[20] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

Investment Protection Through Broad Vendor Support

"In what should send shivers down their rivals' spine, Intel, Hewlett-Packard and seven other leading server companies have committed $10 billion over a period of the next five years until 2010 in order to promote the usage of the Itanium processor."
– Martin Booth, EarthTimes.org[21]

On January 26, 2006, the Founding Sponsors of the Itanium Solutions Alliance publicly committed to investing $10 billion in Itanium-based solutions over the remainder of this decade. That investment will continue to drive advances at every level, from processor and systems development, to ongoing application porting—and it does not include the parallel investments that will be made by many smaller platform vendors, and by leading software and solution providers in support of Itanium-based solutions.

Intel® Itanium® 2 microarchitecture is younger than competing platforms, and can be expected to scale well into the future. It supports very large addressable memory (up to 1 petabyte, or 1,0000 terabytes), a high level of parallelism and a large number of registers, all of which provide substantial capacity for future scaling. It was also uniquely designed to allow explicit, compiler-based software optimization. This will enable ongoing performance scaling through software enhancement, without requiring major optimization efforts from software vendors.[22]

Intel Itanium 2 microarchitecture also includes advanced security features that offer fundamental advantages for protecting business systems, applications, data, and transactions. These features include 4 privilege levels (versus only 2 in RISC architectures), support for more than 16 million memory protection keys, and ultra fast parallel throughput for encryption algorithms. Software solutions are already on the way that will help businesses take advantage of these capabilities to enhance the security of existing applications and networks (see the sidebar, *Better Security for Enterprise Networks*).

Better Security for Enterprise Networks

"Itanium is ideal for solving the security problems associated with delivering mission-critical content on the Web edge."[c]

The core security architecture supported in today's most popular operating systems and hardware architectures has been around for decades. It was never designed for the openness of the Internet, and businesses everywhere are paying the price. The Intel Itanium 2 microarchitecture *was* designed for these needs, and Secure64 (http://www.secure64.com) is developing software that takes advantage of its advanced capabilities to deliver mainframe-class security on industry-standard, Itanium-based servers.

Secure64's SourceT Platform Control Software* supports guest operating systems to enable substantially higher security and better performance for existing enterprise applications (applications can also be written directly to the Secure64 OS kernel). Through incremental migration, businesses will be able to fundamentally improve the security, scalability, and performance of their mission-critical, Internet-connected systems, and begin reducing the heavy burden of today's patchwork security solutions.

[c] Source: *The 64-bit Inflection Point*, by Bill Worley, Jr., PhD and Peter J. Cranstone: http://www.secure64.com/products/64-Bit_Inflect_White_Paper-FINAL1.pdf

[21] Source: http://www.earthtimes.org/articles/show/5158.html

[22] *"I'm bullish on IA-64 because a dream world of compilers that take their sweet time to build and optimize but produce mind-blowing code will surface there first."* Source: The CPU's next 20 years, by Tom Yager, ComputerWorld, September 7, 2005: http://www.computerworld.com/printthis/2005/0,4814,104436,00.html

"This system is smoking fast—well beyond expectations. It is amazing hardware."

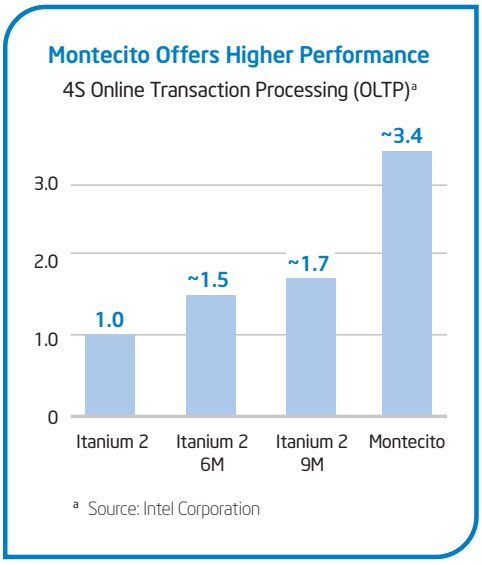
– Quentin Hurd, Product Manager Licensing Technologies and Analytics Group, Microsoft Corporation, referring to a pre-production server with the next-generation, dual-core Intel® Itanium® 2 processor[23]

The performance of Itanium-based systems has ramped steadily, and results are strong across a wide range of industry benchmarks and real-world applications.

The next-generation dual-core Intel Itanium 2 processor will deliver another important step in processor capability (Figure 3). With two execution cores in each processor, it is expected to double performance while reducing power consumption from 130 watts to about 100 watts (for a targeted 2.5X increase in power efficiency). It also includes new virtualization and RAS features, which will help to further enhance flexibility, utilization, and availability across diverse implementations.

Intel has four future Intel Itanium 2 processors in development, and a long-term roadmap that can be expected to drive rapid and ongoing performance scaling through 2010 and beyond. Intel also leads the industry in silicon process technology and manufacturing capacity. As one example, Intel is at least a year ahead of the rest of the industry in shipping products in volume based on 65nm process technology. These strengths will be instrumental in delivering future generations of Intel Itanium 2 processors that provide leading performance, functionality and value for business-critical solutions.[24]

Figure 3. The next-generation, dual-core Intel® Itanium® 2 processor adds another step in the ongoing capacity and performance scaling of Intel Itanium 2 architecture.



Case Study: Itanium-based Solutions in Action

Forbes.com

- World's leading business Web site
- 14-15 million unique visitors each month
- More than 1,500 stories published daily

Forbes.com delivers news, information, analysis, and advice to a demanding audience of affluent and influential business leaders, along with precisely targeted advertising from some of the world's leading companies. Success depends on fast delivery of media-rich content, and on sophisticated data-mining tools that help channel the right advertising to the right visitors. To make it work, Forbes.com has standardized much of its infrastructure on Intel processor-based servers, with Itanium-based systems handling the most demanding workloads.

"The Intel-based servers give us great performance and responsiveness—and the reliability is well beyond 99.999 percent," says Michael E. Smith, Vice President and General Manager of Operations. *"Whatever our advertisers want to try, our Intel server platforms give us the confidence that we can deliver."* They also give Forbes.com the flexibility to scale quickly and cost-effectively as workloads grow, so they can continue to deliver world-class value to both their readers and their advertisers.

Read the Intel case study at: http://www.intel.com/business/casestudies/forbes.pdf

[23] Source: *Dual-Core Intel® Itanium® 2 Processor, SQL Server* 2005 Yield 8X Speedup for Microsoft*, an Intel case study: http://www.intel.com/business/casestudies/microsoft_2.pdf

[24] For an overview of the advantages this brings to business customers, see the article: How Intel Keeps Its Enterprise Customers Coming Back for More, by Roger L. Kay, eWeek, March 10, 2006: http://www.eweek.com/print_article2/0,1217,a=173288,00.asp For more information about Intel's latest technological advances, visit the Intel Web site at: http://www.intel.com/technology/silicon/index.htm

A Better Foundation for Business Growth and Innovation

"For the first time ever, businesses can choose from a wide range of standards-based servers, operating systems, applications, and vendors for their most demanding enterprise solutions."
– The Itanium Solutions Alliance[25]

A stable business environment lends itself well to core computing solutions that are costly and complex. Today's rapidly changing business environment does not. To stay competitive, businesses must be able to adapt their business processes, along with the underlying computing infrastructure that supports them.

The flexibility and choice offered by Itanium-based solutions are particularly valuable given today's challenges. The broad choice of platform vendors, servers, operating systems, applications, and solution providers simplifies integration across diverse environments. It also provides a more scalable and flexible foundation for future growth.

Intel Itanium architecture supports 10 operating systems, including Windows, Unix, and multiple flavors of Linux. Platform options range from affordable 2-processor servers and blades to SMP systems with up to 512 processors and up to 128 terabytes of globally shared memory. Itanium-based solutions also support the highest levels of availability for mission-critical environments (Figure 4). As one example, an Itanium 2-based system now supports 7-nines availability (99.99999 percent uptime)[26], and multiple Itanium

"Our successful transition to the Unisys ES7000 server [based on the Intel® Itanium® 2 processor] is not only important to our ability to serve our mission to our members, it's critical to the company's ability to do that while staying financially strong."
– Alan Smit, Chief Information Officer, Premera Blue Cross[27]

Figure 4. Architecture Reliability Comparison of Business-Critical Servers—The Intel®Itanium® 2 processor is built for the most demanding, business-critical environments, and off-the-shelf systems are now available that support an industry-leading 99.99999 percent availability. (See the Appendix for a more detailed chart.)

RAS Feature	Intel Itanium® 2 Platforms	Typical Mainframe	Typical RISC
Cache ECC Coverage	✔	✔	✔
Memory Single Device Error Correct	✔	✔	Select Vendors
Memory Retry on Double-Bit Error	✔	✔	✔
Error Recovery on Data Bus (ECC)	✔	✔	✔
Internal Logic Soft Error Checking	Mid 2006	✔	Select Vendors
Bad/Poisoned Data Containment	✔	✔	Select Vendors
Cache Reliability (Pellston)	Mid 2006	✔	
Memory Sparing	✔	✔	✔
Memory Mirroring	✔		
Hot Plug I/O (PCI-X, PCI Express)	✔	✔	✔
Memory Hot Swap	✔		
Processor Lockstep Support	✔		

Real-Time Protection | Fail Safe Systems | On-Line Repair | Real-Time Cross-Check

[25] Source: *Itanium® 2-based Solutions versus the IBM Power* Architecture: Getting Better Value from Your High-End Solutions,* an Itanium Solutions Alliance White Paper: https://www.itaniumsolutionsalliance.org/programs/whitepapers/ISA_WP_VsIBMPower_R2.pdf

[26] 99.99999 percent availability is supported off-the-shelf by the HP Integrity Non-Stop* family of servers. For more information, see the HP Web site, at: http://h20223.www2.hp.com/NonStopComputing/cache/121352-0-0-0-121.html

[27] Source: *Real World Business Intelligence*, an Intel case study : http://www.intel.com/business/casestudies/premera_cs.pdf

2-based system vendors offer highly robust, fully redundant solutions.

Just as important is the lower TCO enabled by Itanium-based solutions. Organizations not only get more value from their investments but can free up funds for new projects and upgrades.

With a steady stream of cost-effective computing resources, businesses can focus more resources on unlocking growth through business and technical innovation that improves their product development, customer service, business efficiency, and overall responsiveness.

Conclusion

"Moving forward, the credibility and recognition of the market will move up rapidly as OEM support for the high-end Itanium solutions is extending."

– Nathaniel Martinez and Thomas Meyer, IDC[28]

As the world works to solve the economic, social, and business challenges of the 21st century, the need for cost-effective and flexible computing power will continue to increase. From energy creation and conservation, to disaster responsiveness and healthcare efficiency, the ability to collect, analyze, and share large amounts of information can be expected to play a central role in solving some of our greatest challenges.

By delivering high-end computing power on an affordable and broadly supported architecture, Itanium-based solutions provide a fundamental resource for these efforts. Large organizations will be able to deploy more computing capacity at less cost, and adapt their solutions more easily to stay in the forefront of innovation. Many smaller organizations will be able to afford high-end computing power for the first time, which will help them take advantage of emerging software tools to accelerate research, growth, and development.

As the decade moves forward, the $10 billion investment in Itanium-based solutions will help to ensure rapid advances and ongoing innovation, so organizations can continue to build on their current investments. Most important, the community of Itanium-based vendors will continue to grow, so businesses will have even more options, better value, and increased investment protection in the years ahead.

[28] Source: IDC White Paper sponsored by HP, "End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization," August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf

Appendix A: Mainframe-Class RAS

The Intel® Itanium® 2 processor provides mainframe-class RAS capabilities, which is allowing some of today's most trusted, high-availability system vendors to deliver business-critical solutions on an affordable, industry-standard architecture.

Figure 5. Architecture Reliability Comparison

RAS Feature	Typical Mainframe	Typical RISC	Intel Itanium® 2 Platforms	Intel Xeon® MP Platforms	Intel Xeon® Platforms	Other x86 Systems
Cache ECC Coverage	✔	✔	✔	✔	✔	✔
Memory Single Device Error Correct	✔	Select Vendors	✔	✔	✔	✔
Memory Retry on Double-Bit Error	✔	✔	✔	✔	✔	
Error Recovery on Data Bus (ECC)	✔	✔	✔	✔		
Internal Logic Soft Error Checking	✔	Select Vendors	Mid 2006			
Bad/Poisoned Data Containment	✔	Select Vendors	✔			
Cache Reliability (Pellston)	✔		Mid 2006	2H 2006		
Memory Sparing	✔	✔	✔	✔	✔	2006
Memory Mirroring			✔	✔	✔	
Hot Plug I/O (PCI-X, PCI Express)	✔	✔	✔	✔	✔	Select Vendors
Memory Hot Swap			✔	✔		
Processor Lockstep Support			✔	✔[a]		

Real-Time Protection | Fail Safe Systems | On-Line Repair | Real-Time Cross-Check

[a] All time-frames, dates, and products are subject to change without further notification; 2 Lockstep is supported by selected vendors via enabled chipsets and platforms. Source: http://www.intel.com/business/bss/products/server/ras.pdf

Appendix B: Additional Resources

Deployment and Migration Support

System Vendors

- Fujitsu User Data Migration Services: http://www.computers.us.fujitsu.com/www/services.shtml?services/professional/operational/data_migration_user
- Fujitsu Siemens Computer Professional Services, Migration and Tuning: http://www.fujitsu-siemens.com/le/services/prof_services/index.html
- HP Porting and Migration Services: http://h20219.www2.hp.com/services/cache/10788-0-0-225-121.html?jumpid=reg_R1002_USEN
- Platform Solutions Inc: http://www.platform-solutions.com/
- Unisys Migration Services: http://www.unisys.com/products/es7000__servers/business__solutions/migration/services.htm

Software Vendors

- Microsoft Resources for Interoperability and Migration of UNIX and Windows: http://www.microsoft.com/technet/interopmigration/unix.mspx
- Novell Data Center Migration Services: http://www.novell.com/linux/migrate/
- Redhat Migration Center: http://www.redhat.com/rhel/migrate/

Other

- Gelato Federation—an open community promoting and supporting Linux on Itanium-based systems: http://www.gelato.org
- Intel RISC Migration Resource Center: http://www.intel.com/business/bss/products/server/itanium2/risc.htm
- Intel Solution Services Data Center Migration Solutions: http://www.intel.com/cd/services/intelsolutionservices/asmo-na/eng/solutions/dcf/dcm/index.htm
- Itanium Solutions Alliance: http://www.itaniumsolutionsalliance.org
- Itanium Solutions Catalog—a comprehensive list of applications and tools for Itanium-based systems: https://www.itaniumsolutionsalliance.org/kshowcase/view
- Transitive: http://www.transitive.com
- Unix Migration Resource Center: http://www.migrationforunix.org

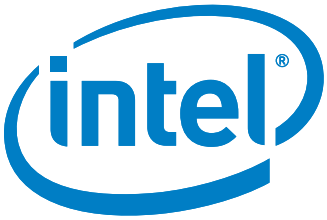
Analyst White Papers

- End-Users' Feedback: Transform IT and Increase Business Performance Through Itanium-Based Standardization, an IDC white paper sponsored by HP, August 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/CG18M_Web.pdf
- Customer Perceptions of the Future of Itanium, IDC, Doc #34842, February 2006: https://www.itaniumsolutionsalliance.org/programs/whitepapers/34842.pdf
- The Itanium Solutions Alliance Brings Investment Protection to Enterprise Computing, an IDC white paper sponsored by the Itanium Solutions Alliance, September 2005: https://www.itaniumsolutionsalliance.org/programs/whitepapers/ISA_Whitepaper.pdf
- Scalable Windows Servers for the Datacenter, by Jean S. Bozman and Matthew Eastwood, an IDC white paper sponsored by HP and Intel, March 2006 http://www.migrationforunix.org/downloads/ScalableWindowsfortheDatacenterItanium_Integrity.pdf

Itanium Solutions Alliance White Papers

https://www.itaniumsolutionsalliance.org/home/

- Itanium® 2-based Solutions versus Sun's SPARC® Architecture: Reducing Risk and Building a More Solid Foundation for Business Success https://www.itaniumsolutionsalliance.org/programs/whitepapers/ISA_WP_VsSunSPARC_R2.pdf
- Itanium® 2-based Solutions versus the IBM Power* Architecture: Getting Better Value from Your High-End Solutions https://www.itaniumsolutionsalliance.org/programs/whitepapers/ISA_WP_VsIBMPower_R2.pdf
- Migrating Business-Critical Applications from UNIX to Windows and Itanium® 2-Based Servers https://www.itaniumsolutionsalliance.org/programs/whitepapers/06_02_10_UNIX_to_Windows_Migration_FinalFinal_0.pdf



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