TECHNOLOGY ASSESSMENT

# Worldwide Technical Computing 2015 10 Key Predictions

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## IDC OPINION

IDC makes the following 10 key predictions for the worldwide technical computing market for 2015 and beyond:

- The HPC Server Market Will Return to Growth After Two Slow Years
- The Bottom Half of the HPC Server Market Is Coming on Strong
- The Global Exascale Race Will Rocket Higher, But Challenges Remain
- The High-Performance Data Analytics Market Will Grow and Diversify
- Market Share for Leading Server Vendors Will Shift Dramatically in 2015
- x86 Will Remain Dominant Amid Growing Competition
- Basic HPC Architecture Will Not Change Soon, But Configurations Will Stress Data Movement, Memory, Storage and Networks
- The Penalties for Neglecting the Software Stack Will Grow More Severe
- Cloud Computing Will Experience Steady Growth and Influence in HPC
- Striking the Right Balance Between Commodity and Custom Is Getting Harder

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## IN THIS STUDY

This IDC study presents a list of 10 key predictions for the high-performance computing (HPC) market for 2015.

## SITUATION OVERVIEW

Key forecast assumptions driving the worldwide technical computing systems sector are:

- The recovery of the global economy will continue to have a positive impact on overall IT markets, IT server spending, and HPC server spending.
- The very high end of the HPC market has stalled for almost two years after a major growth cycle. IDC expects that 2015 will not have major surprises, and so 2015 growth will be slightly higher than 2014. Growth at the high end in 2015 will depend on the global exascale race and a loosening of government HPC budgets in a time of overall moderate economic growth.
- The low range and midrange HPC market revenue profile will see healthy growth in the forecast period as macroeconomic conditions improve.
- Government and university HPC purchasing will likely remain a bright spot during the recovery period, although there is uncertainty in funding levels for HPC in many areas of the world as governments evaluate trade-offs with other national priorities.
- The IBM-Lenovo deal caused major purchase delays in 2014, helping slow the overall HPC server market in 2014. It may cause a sales spike in 1Q15 or 2Q15 as buyers' purchases catch up with the delays.
- Intel's expanding role is already being felt in the HPC marketplace and is likely to assume high significance during the forecast period.

## FUTURE OUTLOOK

### 1. The HPC Server Market Will Return to Growth After Two Slow Years

The overall HPC market recently suffered two consecutive years of decline in 2013 and 2014 due to a slowdown at the very high end of the market and uncertainties over the sale of IBM's x86 server lines to Lenovo. For 2014, IDC is now declaring an overall decline of about 2%. For 2015, IDC projects 7–8% growth over 2014 and is projecting a compound annual growth rate (CAGR) of 6.4% for the years 2015–2018.

IDC projects that worldwide HPC server revenue estimated at over $10.08 billion in 2014 will grow by about three quarters of a billion dollars to over $10.71 billion in 2015. Meanwhile, worldwide HPC server units will grow from about 118,000 to over 127,000 in 2015, as sales in the high-volume, sub-$100,000 HPC workgroup server segment continue to grow. IDC expects that by 2018, worldwide HPC revenue will top $14 billion and the number of worldwide HPC server units exceeding 153,000, representing CAGRs from 2013 to 2018 of 6.4% and 4.3%, respectively.

Optimistic estimates for future HPC growth for at least the next three years are driven by the potential for new users entering the HPC sector that include new commercial and government sites increasing their capabilities in high-performance data analysis (HPDA), sites with large IT infrastructures that are increasingly turning to HPC to improve internal management complexities, the profusion of Internet of

Things (IoT) applications and the necessary compute power needed to collect and analyze large IoT-driven data sets, and a projected upswing from small and medium-sized businesses (SMBs) looking to boost competitive advantage through the use of HPC.

## 2. The Bottom Half of the HPC Server Market Is Coming on Strong

In 2013, sub-$250,000 HPC systems grew by 17% year over year to $4.9 billion, accounting for almost half — 48% — of total HPC server revenue. As such, this sector consumed over 1.7 million processors — about 52% of all processors sold into the HPC sector in 2013. IDC notes that some of this growth can be accounted for by a resurgence in the market after many delayed purchases during the earlier economic slowdown.

IDC predicts that HPC use will continue to proliferate among small and medium-sized businesses, and the firm is tracking many new entrants in that workgroup sector. Indeed, from a review of recent innovative HPC use cases coming out of small organizations, examples of significant innovation include those at BMI Corp., Intelligent Light, Children's Mercy Hospital, Swift Engineering, and RECOM Services. These SMBs are using a variety of methods to access the HPC cycles they need including outright purchase, connections to national research centers, and tapping into HPC in public clouds.

Despite these innovations, there are some significant challenges that could limit the growth of HPC usage within the SMB community including a lack of access to trained technical staff and related HPC expertise, an inability to translate in-house research and related business processes into an HPC-based workflow, and competing demands on already tight budgets.

IDC believes that some of these concerns can be mitigate d, however, through the support of multiple organizations that are looking to help interested SMBs make the transition. These include the Council on Competitiveness, U.S. initiatives such as National Center for Manufacturing Sciences, and the National Center for Supercomputer Applications, as well as EU-based efforts such as PRACE, HLRS, SURFsara, CINECA, and Teratec.

## 3. The Global Exascale Race Will Rocket Higher, But Challenges Remain

IDC notes that China, the United States, Europe, and Japan could begin deploying 100PFLOPS+ systems in 2015. Indeed, there are already a number of procurements underway, targeting the critical pre-exascale node such as within the U.S. DOE, which recently completed the three-system CORAL procurement. Efforts of similar scope are under way in China, Japan, and Europe. Achieving true exascale capability will require overcoming a number of daunting hurdles including:

- **Technical:** Developing software that can scale to the large complex node and processor dimensions needed to reach exascale capability, concerns with power and spatial densities, and the looming issues of reliability and robustness of a complex exascale hardware and software platform
- **Power and cooling:** Facing the challenges of effectively powering and cooling exascale systems that may require new liquid cooling schemes as well as innovative power generation and distribution, with an increased emphasis on green technology and reusable energy techniques
- **National funding:** Handling concerns that exascale funding will have to compete with other national or regional priorities in a time of relative fiscal austerity

- **Rationale:** Developing overall system architectures that balance the traditional requirements for increasing peak or LINPACK flops performance with less well-defined – but perhaps more critical – use cases for overall system utility, time to solutions, and result-based metrics
- **Usage:** Realizing a sense of overall exascale utility that balances access to such systems for a small class of high-demand jobs versus access models that foster wider usage to encourage broader HPC development and progress
- **Value:** Developing and implementing a more effective and widely agreed-upon model for estimating and documenting exascale system ROI to properly assess and scope further exascale and beyond funding efforts

Ultimately, IDC sees that the high-end HPC user community will come under increasing pressure to evolve into a post-flops era where time to solution and larger national or economic security goals are targeted instead of a continued – and increasingly marginal – emphasis on raw computational performance that seeks to maximize peak flops rates and a correspondingly notable rating on the top 500 list.

## 4. The High-Performance Data Analytics Market Will Grow and Diversify

IDC projects that the high-performance data analytics market will grow and continue to diversify. Specific projections call for HPDA servers to grow at a CAGR of 23.5% from 2013 to 2018 to reach $2.6 billion. Meanwhile, HPDA storage is projected to grow at an even faster rate of 26.5% CAGR in the same time period, with a market worth about $1.5 billion by 2018. IDC research showed that 67% of all HPC sites were using some form of HPDA in 2014.

This impressive growth will come from a rapidly diversifying base of users that include:

- Established users of HPC modeling and simulation (M&S) jobs looking to augment their development efforts with HPDA
- Established users of analytics – such as in the financial and related business sectors – looking to bring increased data and analytical capabilities to build on existing activities
- New commercial users, such as PayPal, looking to explore and realize competitive advantage from new business process improvements that HPDA offers (SMBs with nascent M&S or analytics workloads will also be eager to explore options to apply new HPDA techniques to existing programs.)
- New government users, as seen with the U.S. Postal Service, looking to streamline business processes through the use of HPDA to cut cost, increase operating efficiency, and better serve their missions
- New areas of academic use in the social sciences and humanities, such as the "Blue Thames" historical linguistics project at the University of Reading in the United Kingdom and other projects in social history and archeology

IDC anticipates that there will be a continued convergence of commercial and noncommercial requirements for HPDA. Although in some instances, the use cases for the public and private sectors may appear to be different, many of the underlying HPDA algorithms, architectures, and applications share a common technology basis. Each sector can benefit significantly from mutual cooperation.

## 5. Market Share for Leading Server Vendors Will Shift Dramatically in 2015

IDC projects that market share for the leading HPC server vendors will shift dramatically in 2015, and it could be a few years before a new – and stable – hierarchy is established. This shift will be due mainly to the new dynamics introduced by the sale of IBM's x86 server division to China's Lenovo, while IBM chooses to focus its marketing efforts on its Power-based servers and the related OpenPOWER initiative. As such, this shift is more about the market and corporate dynamics of major players than it is about any significant technology breakthrough or competitive advancement.

In detail, IDC expects that the market will show major shifts from where it was in 2013: HP with a 32.5% market share, IBM with 27.7%, and Dell with 14.4%, to a new composition in 2015 where HP maintains its near 30% share, but IBM, Dell, and Lenovo each hold about 15%, with no single company establishing itself as a solid second-place supplier behind HP. For its part, Lenovo goes from having almost no presence in the sector to becoming one of the leading suppliers – but only if it can retain a significant portion of IBM x86 accounts.

## 6. x86 Will Remain Dominant Amid Growing Competition

IDC expects that within the base processor sector, x86-based systems will continue to capture over 80% of all HPC server revenue. However, key wins for the OpenPOWER Foundation – the open source consortium centered on IBM Power architecture – could build on the momentum of IBM Power's success in the recent DOE CORAL acquisitions, and make a dent in Intel's x86 market dominance over time. In addition, IDC expects to see some interest in server suppliers looking to differentiate their products by offering ARM-based options. Gains will be small at first, and future viability will depend heavily on the development of a heretofore limited HPC software ecosystem for ARM chips. Finally, IDC will be closely watching the spate of indigenous processors developments, coming out of Japan and – more notably and aggressively – China, looking to build processors targeted initially for domestic HPC inclusion, but with a long-term prospect to sell those chips in foreign markets as well. Progress here will come slowly and not without significant fits and starts along the way. In addition:

- For coprocessors and related accelerators, IDC notes that sites using such hardware jumped from 28% in 2011 to 77% in 2013, and this trend will likely reach saturation of 90%+ within the next year or so. Coprocessors from NVIDIA lead the pack today, but there is a strong and growing interest in the approaching second generation of Intel Xeon Phi offerings.
- IDC sees the option of placing both processors and accelerators on the die as an attractive one, and such offerings would help redefine how processors and coprocessors exist within a single HPC system. As such, issues of cache management, interconnect latency, bandwidth, and topology, as well as programmability, will come to the fore.

## 7. Basic HPC Architecture Will Not Change Soon, But Configurations Will Stress Data Movement, Memory, Storage, and Networks

HPC storage spending will grow to record levels: from $3.8 billion in 2013 to $5.9 billion in 2018, with a 9.0% CAGR. IDC sees storage spending outpacing related HPC server revenue by 1-2 % each year out to at least 2018. Meanwhile, a raft of new solid state storage choices (such as SSD and burst buffers) will increasingly offer improved performance by deepening the memory hierarchy. However, there will be difficulties associated with programing those increasingly complex hierarchies, and realizing potential performance gains is not assured. IDC expects that memory/data movement will rapidly become a more critical performance consideration than raw computational capability.

IDC projects that HPDA users will increasingly look to exploit large memories that are logically or physically shared, with faster I/O than counterpart traditional HPC cluster architectures that currently use distributed memory schemes.

For interconnects, IDC sees the fabric wars heating up: currently for the highest end of HPCs, about 50% of sites use high-speed Ethernet as their interconnect scheme, while about 40% use InfiniBand. The remainder use some form of a custom interconnect specific to a particular architecture or vendor. However, within the interconnect space, IDC sees a number of emerging competitors that could shake up the status quo in HPC interconnects, including Bull, EXTOLL, Numascale, and Data Vortex.

Likewise, the HPC market could be strongly affected by Intel's efforts to move up the hardware food chain by offering its own version of an InfiniBand interconnect. Ideally, many HPC users would like to see a single notional fabric that extends seamlessly from the embedded world across the entire HPC stack and from processor to mass data storage devices, simplifying integration, shifts in vendors and related product lines, and new architectural or programing paradigms.

## 8. The Penalties for Neglecting the Software Stack Will Grow More Severe

IDC projects that the penalties for neglecting the overall HPC software stack will grow more severe. Indeed, software may be the major limiting factor in the overall drive to develop exascale systems. Issues that will need to be adequately addressed include:

- Overseeing the extreme scalability of high processor counts and large memory in a distributed layout, as well as complex and widespread I/O requirements across a deepening storage hierarchy – all coexisting in a seamless, managed workflow environment
- Addressing the need to effectively support systemwide robustness and resiliency that effectively manages the inevitable hardware and software faults
- Fostering the development of reusable software modules to create an effective software library of needed functionality that spans architectures and minimizes the need for new software development within and across vendor offerings
- Inculcating capabilities for autonomic or related machine learning capabilities to gather new insights but also to alleviate – or at least confine to critical areas – the burden of human-based software development
- Fostering an era of portability whereby critical software is easily moved to alternate architectures in both time and space

IDC also sees some of the technical requirements for visualization – particularly in the area of real-time HPDA data transactional analysis – as a driver of both new hardware and software requirements as more and more users will be demanding on-the-fly access to HPDA analysis.

Despite some of these key uncertainties swirling around exascale-based software progress, IDC is optimistic about the HPC software sector writ large. Indeed, IDC projects that HPC systems software will grow to $1.6 billion in 2018, from the $1.1 billion level of 2013, and the related HPC application software sector will grow to $4.8 billion in 2018, from the $3.3 billion level of 2013.

## 9. Cloud Computing Will Experience Steady Growth and Influence in HPC

IDC projects that cloud computing will show steady growth and influence in HPC, noting that the proportion of sites exploiting cloud computing for some HPC workloads rose from 13.8% in 2011 to 23.5% in 2013, while HPC cloud use could double in 2015, especially as cloud-based virtualization

becomes more HPC friendly. Currently, cloud participation is shared equally between public and private platforms, but IDC expects to see hybrid clouds quickly gaining ground as cloud users increasingly seek to balance in-house versus contract cloud computer resources with an eye toward better performance, lower cost, ease of provisioning, and better response time to varying user demands.

IDC notes that today, most public clouds are best suited for so-called "embarrassing parallel" (EP) workloads – data parallel jobs that use numerous instances, work on different data with infrequent synchronization, and run with a high degree of throughput. Such EP workloads represent a major segment of overall commercial workloads, particularly within the community of new commercial HPC users. IDC expects, however, that there will be an upswing in cloud providers that will assemble and offer cloud services targeted toward non-EP jobs, and they will be offering more dedicated hardware, particularly in high-speed interconnect options, to attract new customers.

Overall, IDC sees the near-term, main cloud use cases being a combination of EP jobs, capacity uptake for surges in workloads, smaller and less formal R&D projects, and usage by SMBs that lack on-premise HPC systems. Despite a generally optimistic outlook for HPC in the cloud, IDC research confirms that data security/data loss remains the primary public cloud concern for HPC users, particularly in the areas of privacy and IP protection.

## 10. Striking the Right Balance Between Commodity and Custom Is Getting Harder

IDC sees striking the proper balance between commodity and custom technology inclusion as becoming a much more daunting task. HPC vendors still must be able to adequately differentiate their products with innovative and proprietary developments, but such efforts involve additional cost and can significantly cut into financial margins.

Despite this, IDC believes that the HPC sector writ large is in an era of rich technical innovation, driven by a vibrant mix of contributions from large and small companies, as well as government and academia. Several factors will combine to sustain rich innovation:

- Strong HPC market growth makes it increasingly attractive for vendors.
- The HPC market is exploiting more commercial baseline technologies, driving down costs, but offering more opportunities for unique architectures and related systems configurations.
- Exascale funding will induce vendors to tackle the large and diverse set of exascale challenges, ensuring a spate of new ideas needed to continue the HPC sector's impressive and decades-long delivery of ever-increasing performance.
- Innovation for exascale systems will invariable flow down, benefiting smaller HPC systems and perhaps creating whole new classes of HPC system and application spaces.

## In Summary

- The HPC market is projected to return to growth in 2015 after a drop in 2014.
  - Growing recognition of HPC's strategic value is helping drive high-end sales.
  - Low-end buyers are back into a growth mode.
- HPC vendor market share positions will shift greatly in 2015.
- Recognition of HPC's strategic/economic value will drive the exascale race, with 100PF systems in the second half of 2015 and more in 2016.

    - Full-up 20/30MW exascale systems will wait until 2022–2024.
- The HPDA market will continue to expand opportunities for vendors.

## ESSENTIAL GUIDANCE

Based in large part on the HPC sector predictions, IDC offers the following guidance for both HPC buyers/users and vendors:

### For HPC Buyers/Users

- Competition for your business will heat up, especially as a major new vendor, Lenovo, has entered the arena. In addition, ODM/white-box suppliers may significantly change the price/performance landscape and will be applying significant downward price pressure on some of the premium HPC suppliers. Indeed, IDC will be closely monitoring the potential for an x86 server price war happening in 2015. Finally, despite this shakeup in the sector, IDC sees that, from a buyer's perspective, actual choices for HPC servers will not increase materially as IBM's x86 line is gone and not everyone can buy from Lenovo.
- Faced with increasing choices for HPC configurations, users will need to more carefully understand their specific workload environments and follow through with HPC procurements that represent the optimal mix of HPC resources, including the right technologies/vendors for processors, coprocessors, storage, and interconnects. Along the way, users and buyers will be faced with balancing the traditional – yet increasingly less important – emphasis on raw computational capability – so called machoflops – with the need to address real issues such as time to solution and overall HPC ROI.
- Additional challenges here center on a lack of good standard benchmarks to facilitate cross-vendor or cross-systems comparisons as well as the ability to baseline in-house needs with smaller, more manageable test suites. Finally, more and more users will be making tough technical and budget decisions on issues such as balancing private, hybrid, or public clouds, and other outsourcing options.

### For HPC Vendors

- The HPC market is slated for robust growth but is not for the faint of heart. The IBM-Lenovo transition creates temporary opportunities for poaching accounts and competition will be fierce. Meanwhile, the rapidly growing – and relatively unstructured – HPDA market is creating new opportunities everywhere, but vendors will be dealing with a raft of new users, many of which do not have any significant history or expertise in the traditional HPC sector. The vendors that can best educate those customers will hold a critical competitive advantage. As such, vendors should not be afraid to tout their HPC credentials as a way to distinguish themselves in a market that could seem to offer only limited product differentials. For the near term, IDC expects most early HPDA wins to be from established HPC suppliers.
- Although IDC is closely monitoring the profusion of new processor and coprocessor options, especially those of ARM, IBM's Power, and various Chinese developments, x86 will lead for the foreseeable future. On a related note, IDC sees an upswing in the number of nations, particularly in the EU and Asia, accelerating their efforts in indigenous hardware and software development as a way to gather revenue in a fast-growing market and secure a steady source of critical technology supply free from political or related international economic entanglements and as a spark plug for other domestic innovation activities.
- Successful HPC vendors will be able to support clear and compelling ROI messaging to both established and new HPC users, which will increasingly be looking for economic or

competitive justification for HPC procurements at almost every price point, but especially at the high end. Simple demonstrations of raw computational capabilities will no longer be sufficient, replaced instead by careful and measured bottom-line financial arguments made not to technical experts but LOB managers.

## LEARN MORE

## Related Research

- *Newest ARM Development Targeted for the Enterprise Data Center* (IDC #lcUS25533715, April 2015)
- *Total S.A. Retakes the Lead in Energy Sector Supercomputer Race* (IDC #lcUS25528815, March 2015)
- *The HPC Arms Race Escalates in the Energy Sector* (IDC #lcUS25511215, March 2015)
- *HPC Interconnects: New Options Emerging from a Sector in Transition* (IDC #255184, March 2015)
- *IDC's Worldwide HPC (Technical Server) Taxonomy, 2015* (IDC #255159, March 2015)
- *Worldwide HPC Server 2015–2019 Forecast* (IDC #255147, March 2015)
- *IBM's HPC Efforts: Navigating a Renewed Emphasis on POWER Technology Within the OpenPOWER World* (IDC #253005, December 2014)
- *NEC's HPC Vision: Bringing Vector Supercomputing to a Broader Data-Intensive User Base* (IDC #252884, December 2014)
- *PayPal Says More Fortune 2000 Firms Could Benefit from HPC for Big Data Analytics* (IDC #252836, December 2014)
- *Bull Launches an Exascale Program for 2020, But the Vision Extends to Big Data and Beyond* (IDC #252771, December 2014)
- *Japan's Extreme Computing Efforts: System Plans Moving Forward, But Critical Applications Set the Way* (IDC #252706, November 2014)
- *HPC Fabric Wars Are Heating Up* (IDC #lcUS25269814, November 2014)
- *DOE Goes All in on IBM-NVIDIA for 300 Petaflops System* (IDC #lcUS25250414, November 2014)
- *Technologies and Applications of High-Performance Computing in the Cloud: HPC User Forum, September 15–17, 2014, Seattle, Washington* (IDC #251974, October 2014)
- *Emerging and Disruptive Technologies in High-Performance Computing: HPC User Forum, September 15–17, 2014, Seattle, Washington* (IDC #251970, October 2014)
- *Emergent Use Cases in High-Performance Data Analysis: HPC User Forum, September 15–17, 2014, Seattle, Washington* (IDC #251976, October 2014)
- *Experiences with Accelerators and Coprocessors in High-Performance Computing: HPC User Forum, September 15–17, 2014, Seattle, Washington* (IDC #251973, October 2014)
- *Lenovo Completes Acquisition of IBM's x86 Server Business* (IDC #lcUS25176214, September 2014)
- *USPS Touts Benefits of HPC for Big Data* (IDC #lcUS25123014, September 2014)
- *Worldwide Broader HPC 2014–2018 Forecast: Servers, Storage, Software, Middleware, and Services* (IDC #248835, June 2014)

- *Perspectives on High-Performance Data Analysis: The Life Sciences* (IDC #248348, May 2014)
- *Worldwide HPC Public Cloud Computing 2014-2017 Forecast* (IDC #247846, April 2014)
- *Micron Demonstrates Technologies to Address Emerging Challenges in Big Data Applications* (IDC #244843, December 2013)
- *China Eyes 10,000-Fold Data Reduction for Internet of Things* (IDC #IcUS24392513, October 2013)
- *High-Performance Data Analysis in the Life Sciences: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243774, October 2013)
- *Worldwide High-Performance Data Analysis 2013-2017 Forecast* (IDC #241315, June 2013)

## Synopsis

This IDC study presents a list of 10 key predictions for the high-performance computing (HPC) market for 2015.

"In 2015, IDC expects that the HPC server market will return to growth after two slow years, and for 2015, IDC projects7-8% growth over 2014 and is projecting a CAGR of 6.4% for the years 2015-2018. IDC believes that the bottom half of the HPC server market will continue to come on strong, and that lower-end HPC use will continue to proliferate among small and medium-sized businesses. Meanwhile, the global exascale race will rocket higher, but considerable challenges remain, some technical, others political and economic. The high-performance data analysis market will grow and diversify, powered by users from the HPC modeling and simulation sector that are looking to augment their development efforts with HPDA and users of big data and analytics – such as in the financial and related business sectors – and by new commercial adopters needing HPC to run advanced analytics." – Earl C. Joseph, program vice president, Technical Computing

## About IDC

International Data Corporation (IDC) is the premier global provider of market intelligence, advisory services, and events for the information technology, telecommunications and consumer technology markets. IDC helps IT professionals, business executives, and the investment community make fact-based decisions on technology purchases and business strategy. More than 1,100 IDC analysts provide global, regional, and local expertise on technology and industry opportunities and trends in over 110 countries worldwide. For 50 years, IDC has provided strategic insights to help our clients achieve their key business objectives. IDC is a subsidiary of IDG, the world's leading technology media, research, and events company.

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