Market Analysis

Worldwide High-Performance Data Analysis Storage 2014–2018 Forecast

Steve Conway
Chirag Dekate, Ph.D.
Earl C. Joseph, Ph.D.

IDC OPINION

This study provides a worldwide revenue forecast (2014-2018) for technical computing (high-performance computing [HPC]) storage infrastructures that are acquired primarily to run data-intensive (Big Data) workloads. *High-performance data analysis* (HPDA) is the term IDC coined to describe the formative market for Big Data workloads that exploit HPC resources. The HPDA market represents the convergence of long-standing, data-intensive modeling and simulation (M&S) methods in the HPC industry/application segments that IDC has tracked for more than 25 years, and newer high-performance analytics methods that are increasingly employed in these segments as well as by commercial organizations that are adopting HPC for the first time. HPDA may employ either long-standing numerical M&S methods or newer methods such as large-scale graph analytics, semantic technologies, and knowledge discovery algorithms – or some combination of long-standing and newer methods. In addition:

- IDC forecasts that the HPDA storage market for data-intensive computing using established numerical modeling and simulation and high-performance analytics methods will continue to grow robustly. The adoption of newer methods will augment HPDA storage revenue so that they nearly double to about $1.7 billion by the end of the forecast period.
- With the increased emphasis on high-performance data analytics, storage infrastructure is likely to occupy an even higher profile. IDC believes that the HPDA storage market represents an important new opportunity for users and vendors alike.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

IN THIS STUDY

This study provides IDC's second worldwide revenue forecast, along with historical data, for HPC storage systems that are used primarily (>50% of cycles) for data-intensive computing (see the Definitions section). IDC calls these systems HPDA storage systems. Historical and forecast data is given for this market in total and for each of the technical computing industry/application segments that IDC tracks within the formative HPDA storage system market. IDC's HPC team has closely tracked the evolution of the HPDA market for more than five years, documenting nearly 200 in-depth use cases in the process. The knowledge gained from this scrutiny has enabled the team to characterize and quantify HPDA market segments with greater confidence.

In conjunction with the forecast, this document also provides the assumptions used in creating the forecast, relevant definitions, an overview of the HPDA market, and essential guidance for users and vendors participating or wanting to participate in this market.

Readers may find the definitions of the industry/application segments especially useful for interpreting the historical and forecast data in this document (see the Definitions section). IDC uses this same taxonomy for tracking other markets in the technical computing space.

Methodology

Each calendar quarter, IDC analysts conduct interviews with major hardware original equipment manufacturers (OEMs) in the technical computing space to gather information on each vendor's quarterly sales. IDC collects data on the number of HPC systems sold, system revenue, system average selling price (ASP), the competitive segment that a system falls into, architecture of the system, average number of processor package per system, average number of nodes for each system sold, system revenue distribution by geographical region, and system revenue distribution by operating system.

IDC uses this historical data as a primary source for creating the quantitative five-year forecasts that take into consideration worldwide technical computing market dynamics and trends, along with macroeconomic factors that may influence future funding availability and purchasing decisions.

We used IDC's worldwide HPC server market revenue forecast and storage forecast to derive the revenue forecast for HPDA storage systems that are by definition devoted primarily (>50% of cycles) to data-intensive computing (refer to Table 4). This forecast was not a straightforward mathematical exercise but instead required careful consideration of existing and projected data usage patterns in each industry/application segment and extensive end-user conversations.

The forecast tables divide the HPDA server and storage markets into two distinct parts:

- The first part, called "historical HPC," includes server and storage revenue, respectively, for both M&S and high-performance analytics in the established HPC segments that IDC has tracked for more than 25 years. Revenue in this part of the tables is already accounted for and hence is not additive to IDC's overall worldwide revenue forecast for HPC servers and HPC storage.

- The second part of the tables, labeled "new HPDA segments," captures revenue from commercial users that have been adopting HPC, many for the first time, to tackle advanced analytics problems. Revenue in this part of the tables is from new (non-historical) segments and is additive to IDC's overall worldwide revenue forecast for HPC servers and storage. Refer to Table 6 for the percentage of additional revenue IDC predicts the new segments will add to the total for the historical segments for each year in the 2014-2018 forecast period.

Note: All numbers in this document may not be exact due to rounding.

Definitions

Technical Computing, High-Performance Computing

IDC uses the terms *technical computing* and *high-performance computing (HPC)* synonymously to encompass the entire market for computer servers used by scientists, engineers, analysts, and other groups employing computationally intensive modeling and simulation methods. Technical servers range from small systems costing <$5,000 to extreme-capability machines valued at hundreds of millions of dollars each.

In addition to scientific and engineering applications, technical computing includes related markets/applications areas, including economic analysis, financial analysis, animation, server-based gaming, digital content creation and management, business intelligence modeling, and homeland security database applications. These areas are included in the technical computing market based on a combination of historical developments, applications types, computational intensity, and associations with traditional technical markets.

High-Performance Data Analysis

High-performance data analysis (HPDA) is the term IDC coined to describe the formative market for Big Data workloads that exploit HPC resources and approaches. The HPDA market represents the convergence of long-standing, data-intensive modeling and simulation (M&S) methods in the HPC industry/application segments IDC has tracked for more than 25 years, and newer high-performance analytics methods that are increasingly employed in these segments as well as by commercial organizations that are adopting HPC for the first time. HPDA may employ either long-standing numerical modeling and simulation methods or newer methods such as large-scale graph analytics, semantic technologies, and knowledge discovery algorithms – or some combination of long-standing and newer methods.

IDC defines HPDA problems broadly to include tasks involving sufficient data volumes and complexity to require HPC-based approaches. These problems can employ structured data, unstructured data, or both. They can come from traditional HPC domains in government, industry, and academia – or they can be upward extensions of commercial problems that have grown large and complex enough at the high end to require HPC capabilities. In addition, Big Data can accumulate from the multiple results of iterative problem-solving methods in sectors such as manufacturing (parametric modeling) and financial services (stochastic modeling). So, small and medium-sized enterprises (SMEs) can also encounter Big Data challenges.

SITUATION OVERVIEW

Data-intensive computing, now also called Big Data, has been a key element of the high-performance computing market for decades and is now becoming the driving force behind many HPC installations. An interesting example is climate research, which may exploit up to 100 years of heterogeneous, historical data for a single simulation analysis. It's not uncommon to encounter HPC sites with online data storage in the 10–25PB range and doubling every two to three years. For the near-term future, most HPDA work will continue to exploit established approaches based on numerical modeling and simulation. But even the longest-standing HPC domains, including climate science, bio-sciences, and energy research, are actively assessing the efficacy of newer approaches, such as large-scale graph analytics, semantic technologies, and knowledge discovery algorithms. The goal typically is to maximize insights and innovation by applying both established and newer methods to the same scientific or industrial problem, often but not always using the same HPC system. Separately, a growing number of commercial firms are adopting HPC for the first time to tackle advanced analytic problems that enterprise server technology cannot handle adequately.

In a growing number of cases, buyers are acquiring HPC systems for dedicated use to address a single mission-critical problem, such as extreme-scale fraud detection, with one or more of the newer Big Data methods. There are some HPDA applications that are exploiting these newer methods and are emerging as strong moneymakers (e.g., fraud detection and genomics). It will take more time to see which use cases develop into large markets, but some of the frontrunners are already apparent. IDC believes that the HPC data explosion is bound to drive rapid growth in HPDA usage. The HPDA market has been growing robustly, driven in part by:

- The data explosion coming from larger and more complex simulations
- Handling large data feeds
- Addressing homeland security applications with major image analysis and tracking
- New large-scale experiments
- Emerging use cases such as fraud detection and prevention, medical data management applications, and many more
- The need for a growing number of commercial companies to adopt HPC resources to address algorithmically complex problems in real time or near real time

Worldwide HPC Server System Revenue by Industry/Application Segment

HPC server system revenue is based on the sale of computer systems for use in technical computing environments (refer to Table 3). It also includes major upgrades to existing systems. A system unit consists of processors, memory, embedded disk storage, cluster interconnect hardware/software, any bundled operating system, compiler, math/statistical library, parallel computing, database, and networking software that would typically be configured when it leaves the OEM's factory floor. Note that separately acquired software is not included (e.g., most ISV application software). A server system is recognized as a shipment only when the complete system or cluster is installed and accepted. External user storage and all paid services are excluded from this revenue value. If a system is paid for over a number of quarters, for example, via service or R&D contracts, IDC determines a value for the whole system when it is finally accepted by the buyer.

IDC's definitions of the technical computing industry/application segments are discussed in the sections that follow. IDC assigns a server system to a specific industry/application segment if it is purchased primarily for use related to that segment. For example, a server system purchased by a university to serve a broad user community representing many disciplines would be assigned to the university/academic segment — while a server system acquired by the same university for dedicated use within a genomics institute would be assigned to the biosciences segment.

HPC Application/Industry Workload Categories

IDC identifies and tracks the following historical HPC (technical computing) workload segments using these definitions:

- **Biological sciences.** This workload centers on applications such as genomics, proteomics, pharmaceutical research, bioinformatics, drug discovery, bioanalytic portals, ASP-type service providers, and agricultural research. Computational techniques include database searching and management, molecular modeling, and computational chemistry. These workloads appear in commercial, academic, and institutional research environments. Systems that are specifically targeted for these workloads should be included; systems purchased for more general scientific and R&D environments should be counted in the university and academic, national laboratory and research center, or national defense segments.
- **Chemical engineering.** This workload centers on applications such as molecular modeling, computational chemistry, process design, and chemical analysis. It includes all chemistry applications that are not directly related to biosciences research and development. These workloads appear in commercial, academic, and institutional research environments.
- **Computer-aided design (CAD) and drafting.** This workload centers on applications such as mechanical computer-aided design; 2D, 2.5D, and 3D design and drafting; 3D wire frame; and civil engineering design. Design and drafting applications require graphics capability but are less compute intensive than design engineering and analysis applications. CAD tasks are typically done by designers and drafters. Users are found primarily in discrete manufacturing industries such as automotive, aerospace, heavy machinery, and consumer goods.
- **Computer-aided engineering and mechanical design and analysis.** This workload centers on applications such as finite element modeling and analysis, mechanical computer-aided engineering (CAE), civil engineering, structural analysis, computation fluid dynamics (CFD), crash, NVH, and solid modeling. Like CAD applications, these CAE tasks are used to design automobiles, aircraft, running shoes, ski equipment, sail boards, beer bottles, and other everyday items. Workloads include those tasks generally accomplished by engineers, not drafters.
- **Digital content creation and distribution (DCC&D).** This workload category centers on applications such as 2D and 3D animation, film and video editing and production, and multimedia authoring for both CD and Web pages that utilize sophisticated graphics content. This category also includes servers used for image rendering, content management, and distribution of finished products for areas such as film, TV, commercial animation, advertising, product styling, and industrial design, as well as servers used for large-scale games. These workloads are developed in large part in concert with scientific visualization research and technologies. In addition, the creation of special effects and animation for motion pictures requires significant amounts of computational capacity.

- **Economic and financial modeling.** This workload centers on applications such as econometric modeling, portfolio management, stock market and economic forecasting, and financial analysis. This segment includes both trader and computationally intensive nontrader tasks. In this case, we placed this workload in technical computing because of the numerically intensive applications of most applications and their association with economic modeling and simulation-based research.
- **Electronic design and analysis/IT (EDA/IT).** This workload covers all electrical/electronic tasks, including schematic capture, logic synthesis, circuit simulation, PCB routing, and system modeling. It also includes the use of technical servers within IT manufactures for R&D as well as product design and testing.
- **Geosciences and geoengineering.** This workload includes earth resources–related applications such as seismic analysis, oil services, and reservoir modeling. These applications are used in both institutional research and commercial enterprises. Geosciences can also include areas such as mining, natural resource management, geographic information systems (GIS), and mapping.
- **Government laboratories and research centers.** This workload centers on government-funded research and development institutions. These organizations are generally funded at a national or multinational level and may combine purely scientific research with research in areas of national priority (e.g., cancer research) and/or research for defense-related programs. These users are less bound by strict economic constraints than those performing applications in product development environments. These centers don't normally offer degree programs for students.
- **National defense.** This workload centers around applications such as surveillance and signal processing; encryption; command, control, communications, and intelligence (C3I); geospatial image management and analysis; defense research; weapons design; and other national security applications. In addition, we believe that national security organizations are fielding applications that work to identify and track potential security threats through database-oriented pattern-matching applications. Although these applications may not always be numerically intensive, they will be developed and used by organizations that are firmly rooted in technical computing markets. In addition, we believe that these applications will be run in conjunction with traditional security applications such as cryptography and image analysis.
- **University and academic.** This workload centers on scientific research and engineering R&D efforts conducted at public or private institutes of higher education and includes systems sold for both research and educational activities. Privately funded and/or nonprofit research institutes that have a strong academic mission (i.e., work to extend the bounds of public knowledge) are also included in this segment. Applications are typically compute or data intensive and often require high-performance graphics. These users are less bound by strict economic constraints than those performing applications in product development environments. This segment includes NSF sites that are located at universities.
- **Weather forecasting and climate modeling.** This workload centers on applications such as atmospheric modeling, meteorology, weather forecasting, and climate modeling. This segment includes systems dedicated to these tasks primarily in the government and defense segments.
- **"Other."** This segment includes any technical computing workloads not otherwise specified by the definitions in the previous bullet points. Into this category fall commercial firms that are adopting HPC technologies to address algorithmically complex problems, such as fraud detection and aspects of personalized medicine, in real time or near real time.

IDC identifies and tracks the new commercial HPDA market segments using these definitions:

- **Fraud and anomaly detection.** This "horizontal" workload segment centers around identifying harmful or potentially harmful patterns and causes using graph analysis, semantic analysis, or other high-performance analytics techniques. The patterns may point to fraud, which is the deceptive exploitation or annotation of data for wrongful or illegal personal gain, or they may point to cybersecurity crime or insider threats, significant errors, or other anomalies that may deserve further investigation.
- **Marketing.** This segment covers the use of HPDA to promote products or services, typically using complex algorithms to discern potential customers' demographics, buying preferences, and habits.
- **Business intelligence.** This workload segment uses HPDA to identify opportunities to advance the market position and competitiveness of businesses, by better understanding themselves, their competitors, and the evolving dynamics of the markets they participate in.
- **Commercial: other.** This catchall segment includes all commercial HPDA workloads other than the three segments described in the previous bullet points. Over time, IDC expects some of these workloads to become significant enough to split out of this "other" category and command their own segments. An example of such a high-potential workload is the use of HPDA to manage large IT infrastructures, ranging from on-premise datacenters to public clouds and Internet of Things (IoT) infrastructures.

FUTURE OUTLOOK

Forecast and Assumptions

IDC used the following assumptions in creating the forecast for the worldwide technical computing market for HPDA (see Tables 1 and 2):

- Through the year 2018, the overall technical computing (HPC) market will continue to benefit from the worldwide economic recovery that began in 2010 and continued in subsequent years. The pace of the recovery may fluctuate from quarter to quarter but will continue ramping up from year to year, such that by 2018, worldwide technical computing market revenue will reach about $14.7 billion compared with $10.1 billion in prerecession 2007 and $9.5 billion in midrecession 2010.
- The global race for high-end supercomputing leadership will continue to drive robust growth in the supercomputer segment for systems sold for $500,000+. The workgroup segment for systems sold for <$100,000 was hit especially hard by the economic recession and began to bounce back in 2013. The divisional and department segments will experience steady, healthy growth (CAGR).
- HPDA in the technical computing market is not limited to the largest sites employing the most powerful supercomputers. Some smaller HPC sites acquire technical server systems primarily for workloads that are more data intensive than compute intensive. In addition, substantial data volumes can accumulate from the multiple results of iterative problem-solving methods in sectors such as manufacturing (parametric modeling) and financial services (stochastic modeling), Finally, a growing number of commercial companies are adopting HPC for the first time to tackle high-performance analytics problems that enterprise server technology cannot adequately handle.

- Server revenue associated with long-standing data-intensive methods based on numerical modeling and simulation will continue to escalate. The increasing adoption of newer data-intensive methods, such as large-scale graph analytics, semantic technologies, and knowledge discovery algorithms, will augment server revenue associated with the long-standing methods.
- Many HPC sites will work to maximize insights and innovation by applying both established and newer methods to the same scientific or industrial problem, often using the same HPC system. A growing number of HPC systems will be acquired for dedicated use to address a single, mission-critical HPDA problem, such as extreme-scale fraud detection.

TABLE 1

Top 3 Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Significance	Changes to This Assumption That Could Affect Current Forecast	Comments
Economy	The global economy was sluggish in 2013, with volatility in emerging markets and weaker growth in mature economies. The U.S. government shutdown dragged on the GDP in the fourth quarter, and the recoveries in Europe and Japan appeared to lose some steam. China recorded its slowest rate of growth in 14 years. 2014 will see stronger growth in mature economies including the United States, but emerging markets are vulnerable to capital flight and will be volatile again.	A down economy affects business and consumer confidence, the availability of credit and private investment, and internal funding. A global recession would cause businesses to delay IT upgrades and some new projects; a rising economy does the opposite. A crisis (perhaps triggered by more volatility in emerging markets) could create a chain of events that would drive tech spending much lower in the near term.	Macroeconomic forecasts for 2014 and 2015 have not improved that much, with users being cautious in their spending. Downside risk factors include the deterioration of the sovereign debt crisis in Europe, the impact of inflation in emerging markets (especially energy and food prices), high unemployment, lingering weakness in real estate in advanced economies, and political instability in the Middle East. The upside would be a faster-than-expected drop in unemployment, with the private sector making up for cuts in public sector jobs, as well as a stronger-than-expected rebound of investment in advanced economies.	The world economy is unstable right now. Any increased slowdown in one geographic region can ripple through to other regions.

TABLE 1

Top 3 Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Significance	Changes to This Assumption That Could Affect Current Forecast	Comments
Crisis duration/ potential relapse	2013 was a bump in the road for the global economy, with growth weaker than forecast, but the long-term recovery remains on course and in line with expectations. There are still downside risks that could trigger a relapse: debt in Europe, a hard landing in China, and capital flight from emerging economies. The long-term period of "weaker growth" still appears to be the baseline scenario.	The long duration of the global recession created pent-up demand for IT products and services, but the recession's severity created a persistent air of caution on the part of buyers. As businesses came to believe the risks were receding, they loosened their purse strings. However, this was dampened by a sense that the crisis has given way to a period of long-term weaker growth. A return of "crisis mode," perhaps triggered by events in emerging markets, could yet plunge the global economy back to square one. While the risk of relapse lingers, business confidence will remain inhibited to some degree.	The long duration of the global recession created pent-up demand for IT products and services, but the recession's severity created a persistent air of caution on the part of buyers. If businesses come to believe the worst is over and they are beginning loosen their purse strings for more long-term projects. However, this would be dampened by any sense that the crisis has given way to a period of long-term weaker growth. Even worse, a return of "crisis mode" triggered by events in Europe could cause a ripple effect throughout the worldwide economy.	IDC considers the signals still mixed as to how long the slowdown will continue.

TABLE 1

Top 3 Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Significance	Changes to This Assumption That Could Affect Current Forecast	Comments
Hardware	Capital spending on IT equipment was weak in 2013, but this has helped create a certain level of pent-up demand for infrastructure investment. The slowdown in emerging markets has also contributed to lower overall growth, and a rebound is likely if those economies continue to stabilize. We expect capital spending to accelerate in 2014 as businesses look to "fix the roof while the sun is shining."	Hardware spending, about 40% of total IT spending, also drives downstream spending in software and services.	The upside would be a continued strong willingness by businesses to invest in infrastructure, the buildout of cloud services, and consumer enthusiasm for new devices including smartphones and tablets; the downside would be tied to an economic picture worse than that assumed, perhaps triggered by events in Ukraine.	Different parts of the world will recover from the recession at different rates. There will be some emerging countries that will have stronger-than-average growth rates.

Source: IDC, 2014

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Macroeconomic trends				
Economy	The global economy was sluggish in 2013, with volatility in emerging markets and weaker growth in mature economies. The U.S. government shutdown dragged on the GDP in the fourth quarter, and the recoveries in Europe and Japan appeared to lose some steam. China recorded its slowest rate of growth in 14 years. 2014 will see stronger growth in mature economies including the United States, but emerging markets are vulnerable to capital flight and will be volatile again.	**Moderate.** A down economy affects business and consumer confidence, the availability of credit and private investment, and internal funding. A global recession would cause businesses to delay IT upgrades and some new projects; a rising economy does the opposite. A crisis (perhaps triggered by more volatility in emerging markets) could create a chain of events that would drive tech spending much lower in the near term.	↔	★★★☆☆
Crisis duration/ potential relapse	2013 was a bump in the road for the global economy, with growth weaker than forecast, but the long-term recovery remains on course and in line with expectations. There are still downside risks that could trigger a relapse: debt in Europe, a hard landing in China, and capital flight from emerging economies. The long-term period of "weaker growth" still appears to be the baseline scenario.	**Moderate.** The long duration of the global recession created pent-up demand for IT products and services, but the recession's severity created a persistent air of caution on the part of buyers. As businesses came to believe the risks were receding, they loosened their purse strings. However, this was dampened by a sense that the crisis has given way to a period of long-term weaker growth. A return of "crisis mode," perhaps triggered by events in emerging markets, could yet plunge the global economy back to square one. While the risk of relapse lingers, business confidence will remain inhibited to some degree.	↓	★★★★☆

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Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Hardware	Capital spending on IT equipment was weak in 2013, but this has helped create a certain level of pent-up demand for infrastructure investment. The slowdown in emerging markets has also contributed to lower overall growth, and a rebound is likely if those economies continue to stabilize. We expect capital spending to accelerate in 2014 as businesses look to "fix the roof while the sun is shining."	**High.** Hardware spending, about 40% of total IT spending, also drives downstream spending in software and services.	↑	★★★★☆
Profits	Corporate profits have been stable if unspectacular in most countries and are likely to remain so in 2014. Businesses have come to terms with an economy that has settled into a long-term period of subdued growth, and they have positioned themselves accordingly. Profits are unlikely to surprise on the upside or the downside in 2014 and are therefore unlikely to disrupt IT spending plans.	**Moderate.** If profits are more subdued than expected, this could delay new investments including project-based IT spending. In an upside scenario, if profits begin to accelerate again in 2014, this will drive businesses to tap into their cash reserves.	↔	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Inflation	Inflationary pressures are currently a moderate concern in developed economies but retain the potential to disrupt economic growth in emerging markets because of currency devaluation in countries such as India. In particular, any rise in energy prices could have a severe impact on vulnerable economies. Cost-of-living increases in many countries are still outpacing income growth. In Japan, the government is actively seeking to drive inflation by loosening monetary policies to force a solution to deflation.	**High.** Low inflation keeps interest rates low and leads to more capital spending, including spending on ICT. High inflation can dampen investment and can also raise the cost of IT products and component imports. Currency devaluation raises import prices, pressurizing profit margins at a time when businesses can least afford to pass this inflationary effect on to pessimistic consumers.	↓	★★★☆☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Cloud	Cloud is a new paradigm of computing that will shape IT spending over the next several decades — the logical evolution of what IDC called "dynamic IT" for years. It entails shared access to virtualized resources over the Internet. IDC estimates that cloud services spending will continue to grow at double-digit rates for the next few years, gradually accounting for a larger proportion of all IT spending. In the short term, this will have a negative impact on some IT vendors, pressuring profit margins and increasing competition while allowing some end users to lower their overall spending on certain solutions. In the long term, however, we believe that cloud will have a positive overall impact on industry growth as more users adopt more advanced computing solutions at a faster rate.	**Moderate.** The key advantage to cloud services should be the ability of IT organizations to shift IT resources from maintenance to new initiatives. This in turn could lead to new business revenue and competitiveness as well as create new opportunities for IT vendors in SMB and emerging markets. The benefits may be offset to some extent by cannibalization in the short term, resulting in shorter service engagements, price model disruption, and some hardware commoditization, but a strong economy would see most organizations shift resources to new IT development and adoption areas in the long term. We see cloud adoption as an IT spending driver overall, despite these cannibalization effects in the next two to three years. Many HPC workloads are not easily partitionable to run on today's cloud architectures. As clouds become more capable of supporting HPC jobs, cloud adoption will accelerate.	↑	★★★☆☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Demographics	The aging of the workforce in the developed world and growth of the workforce in lower-cost geographies will affect both the supply of and the demand for IT. These may be long-term trends, but they are already manifesting in the globalization of the workforce and the slow ICT market growth in places such as Western Europe. The center of ICT supply will migrate toward Asia and Eastern Europe but, in general, will also diversify. IDC also expects renewed FDI and VC funding for emerging markets such as China and India. ICT consumption will migrate to large population geographies as the center of gravity for IT shifts from the PC to the mobile phone.	**High.** Many sites report great difficulty in finding enough people with the right qualifications, especially algorithm developers, parallel programmers, system administrators, and individuals whose knowledge spans the science and the technology.	↓	★★★★☆
Application availability	ISVs lag in developing multithreaded applications to take advantage of multicore processors.	**Moderate.** This will accelerate the Linux adoption trend.	↑	★★★★☆
Overall HPC market trends				
Economic impacts on HPC	The recovery of the global economy will continue to have a positive impact on overall IT markets, IT server spending, and HPC server spending.	**High.** HPC server sales will continue to grow following the decline in 2013, after the positive momentum in 2010, 2011, and 2012. Pent-up demand at the low end should fuel growth as the global economy rebounds. IDC forecasts growth for all HPC competitive segments.	↑	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
High-end HPC supercomputer sector	The high-end "supercomputer" segment will stay a bright spot as the petascale/exascale race intensifies across the globe. Funding will likely increase for large-scale HPC procurements. 2012 was an exceptionally strong year for the supercomputer sector and as we predicted 2013 saw a substantial decline from that historical high. We believe the supercomputer segment will continue to grow at a robust, more moderate rate.	**Moderate.** This "lumpy" segment will remain subject to major swings on a quarter-to-quarter basis due to the relatively small number of large transactions that occur in this segment. Annual swings can also happen, especially if one or more anticipated fourth-quarter large sales slip into the following year, or conversely if one or more large sales accepts in the fourth quarter instead of the following first quarter.	↑	★★★★☆
Mainstream midrange HPC market	The midrange HPC market revenue profile will see healthy growth in the forecast period as macroeconomic conditions improve.	**Moderate.** 1Q13 showed the first sign of strong recovery, with a healthy increase in HPC server spending. 2013 results increased our belief that the midrange HPC segment is back on a growth track.	↑	★★★★☆
Mainstream low-end HPC market	The low-end HPC market resumed revenue growth in 2013. During the forecast period, as the macroeconomic condition improves, discretionary budgets will slowly come back and the low-end market will expand again at a healthy rate.	**High.** We expect the CAGR during the forecast period to be very robust as the improving economy taps demand pent up during the most difficult period of the recession and as more small and medium-sized organizations appreciate the value of HPC.	↑	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
HPC buyer segment trends				
HPC sales in government and academic sectors	Government and university HPC purchasing will remain a bright spot in HPC during the recovery period. The government stimulus funding will flow into specific areas for the development of certain technologies and applications. Some of these funds will be used to purchase HPC systems. There is uncertainty in funding levels for HPC in many areas of the world as governments evaluate trade-offs with other national priorities. Government buyers will increasingly demand ROI arguments to augment established rationales based on scientific advancement and national security.	**Moderate.** Government and university HPC purchases have longer sales cycles and budgets change more slowly, so the impact will not be consistent from quarter to quarter. One or two very large system sales can affect revenue for a given year (e.g., the $500 million for RIKEN in 2012 made the year exceptionally strong at the high end). No sale of that size occurred in 2013.	↑	★★★★☆
National security and homeland defense	National security and homeland defense operations will continue to develop additional requirements for HPC systems. New applications areas for HPC may be developed based on database and pattern matching requirements.	**Moderate.** Requirements will lead to increased demand through the forecast period.	↑	★★★☆☆

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Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
Energy sectors	Worldwide demand for oil has picked up with the economic recovery and with the expanding economies of China and the other BRIC countries. As a result, the cost of energy will continue to go up. This increased demand will help spur sales for systems for seismic analysis and reservoir modeling, along with HPC systems for alternative energy sources.	**High.** R&D for alternative energy sources, nuclear, and coal and in oil/gas is expected to be a strong growth segment.	↑	★★★★☆
Gaming, digital content, and entertainment sectors	The use of HPC to create better large-scale games, digital content, animation, and more interesting videos/movies is expected to grow at a healthy rate.	**Moderate.** This will lead to an increase in demand for technical servers.	↑	★★★☆☆
Automotive segment	The crisis in the auto industry put some HPC procurements on hold starting in early 2008. Because of the auto industry recovery in 2012 and 2013, we are seeing renewed momentum as automakers strive to compete globally for renewed consumer demand.	**Moderate.** The automotive industry is creating strategies for employing HPC to a greater extent during the continuing recovery.	↑	★★★☆☆
Worldwide finance segment	As the economic recession subsides, IDC foresees increased investment in HPC, especially to support new high-frequency trading (HFT) algorithms. HPDA applications will cause strong growth.	**High.** Many new HPC procurements will be used for running new algorithms faster and more accurately.	↑	★★★☆☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
HPC technology trends				
Petascale/exascale initiatives	Petascale/exascale initiatives around the world will continue to increase momentum in IDC's supercomputer segment. Despite the current uncertainty surrounding exascale development in the United States, IDC expects the United States to compete strongly with European and Asian exascale initiatives.	**High.** A number of nations are in the race to develop petascale and exascale systems, some of which are already $100 million per system. This will stimulate global revenue expenditures at the high end of the HPC market.	↑	★★★★☆
Coprocessors	x86 base processors will remain dominant during the period. Coprocessors and accelerators, especially NVIDIA GPGPUs and Intel Xeon Phi, will see increased traction in 2014–2016. Low-power processors, such as ARM and Atom, will begin finding their place in the HPC ecosystem.	**High.** Coprocessors and accelerators are rapidly gaining momentum in the HPC community today, and mainstream adoption is largely dependent on the programming models and application readiness.	↑	★★★★★
High-performance data analysis (Big Data needing HPC)	Data-intensive computing has long been a part of HPC, but newer analytical methods using Hadoop and other methods (e.g., graph analytics) will grow the Big Data market in HPC. In addition, the data explosion in HPC will drive larger system and storage purchases. In the long term, Big Data will shift HPC architectures away from their current extreme compute centrism.	**High.** We expect many buyers to purchase the same systems for traditional HPC and newer Big Data uses, but the new methods will increase average system sizes. More commercial firms will migrate to HPC for the first time to handle advanced analytics.	↑	★★★★☆

TABLE 2

Key Forecast Assumptions for the Worldwide High-Performance Data Analysis Storage Market, 2014–2018

Market Force	IDC Assumption	Impact	Accelerator/ Inhibitor/ Neutral	Certainty of Assumption
HPC leadership	Europe has already committed a major increase in funding for HPC. China and Japan will compete heavily for global leadership and will increase funding during the forecast period. Russia is increasing funding for HPC. We also expect South Korea to increase funding, and HPC is growing in Brazil and Latin America in general. The wild card is how the United States will respond to this increased competition.	**High.** Governments around the world are increasingly recognizing the importance of HPC not only for scientific advances but also for industrial innovation and economic competitiveness.	↑	★★★★★

Legend: ★☆☆☆☆ very low, ★★☆☆☆ low, ★★★☆☆ moderate, ★★★★☆ high, ★★★★★ very high

Source: IDC, 2014

IDC forecasts that in 2018, the largest industry/application segments by revenue in the worldwide technical computing server market will be university/academic, government lab, CAE, biosciences, and defense (see Table 3).

TABLE 3

Worldwide HPC Server Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
Biosciences	1,159.5	1,278.6	1,249.9	1,200.0	1,195.1	1,319.0	1,446.0	1,558.3	1,665.5	1,772.8	8.2
CAE	906.8	1,052.1	1,095.2	1,164.5	1,158.1	1,286.7	1,420.6	1,559.4	1,668.2	1,777.0	8.9
Chemical engineering	188.1	204.5	192.6	182.0	185.1	199.5	213.8	227.8	243.5	259.1	7.0
DCC and distribution	478.5	545.9	568.6	585.7	603.6	663.5	725.1	789.4	843.9	898.4	8.3
Economics/ financial	204.9	264.2	279.2	316.4	323.9	358.1	393.3	426.9	456.2	485.6	8.4
EDA/IT/ISV	565.0	630.1	662.0	624.7	686.3	760.5	837.0	916.5	979.1	1,041.6	8.7
Geosciences	571.4	618.4	653.4	707.9	654.5	706.5	758.0	808.9	862.7	916.5	7.0
Mechanical design	71.8	72.4	63.2	55.5	63.6	67.8	71.6	75.2	81.0	86.7	6.4
Defense	884.9	947.8	1,005.1	1,129.2	990.4	1,074.7	1,158.9	1,237.8	1,322.0	1,383.6	6.9
Government lab	1,412.7	1,525.9	2,079.4	2,396.8	1,993.8	2,138.6	2,278.6	2,409.1	2,569.4	2,729.7	6.5
University/ academic	1,718.6	1,837.1	1,901.1	2,058.8	1,861.8	2,001.0	2,137.1	2,274.4	2,429.9	2,585.4	6.8
Weather	368.8	410.4	453.8	486.5	436.2	468.5	500.0	536.4	572.2	608.0	6.9
Other	83.3	110.9	96.5	189.8	146.4	136.7	123.4	125.3	134.0	165.3	2.5
Total	8,614.1	9,498.3	10,300.1	11,097.7	10,298.8	11,181.0	12,063.1	12,945.3	13,827.5	14,709.7	7.4

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: Data-Intensive HPC Storage Revenue Compared with All HPC Server Revenue

Table 4 shows all HPC server and storage revenue represented by HPDA server and storage revenue (i.e., by HPC servers and storage purchased primarily to run data-intensive workloads). The HPDA proportions are shown as dollar amounts and separately as percentages of all HPC server and storage revenue. Table 4 includes historical data for 2009–2013 and forecast data for 2014–2018.

IDC forecasts that revenue for HPDA servers will grow robustly (23.5% CAGR) during the 2013-2018 period, increasing from $934 million in 2013 to about $2.7 billion in 2018. Within these numbers, the new HPDA workload segments will grow even more robustly (roughly a 30% CAGR) during the forecast period, expanding from $148 million in 2013 to $548 million in 2018.

IDC forecasts that revenue for HPDA storage systems will grow even more robustly (26.5%) during the forecast period to reach about $1.7 billion in 2018.

TABLE 4

Worldwide HPC and HPDA Server and Storage Revenue, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
HPC server	8,614.1	9,498.3	10,300.1	11,097.7	10,298.8	11,181.0	12,063.1	12,945.3	13,827.5	14,709.7	7.4
HPDA (HPC Big Data) server	535.1	602.9	655.2	836.3	933.8	1,095.5	1,440.9	1,816.5	2,259.8	2,681.1	23.5
Share of HPC server (%)	6.2	6.3	6.4	7.5	9.1	9.8	11.9	14.0	16.3	18.2	
HPC external storage	3,015.0	3,467.8	3,664.5	4,058.9	3,841.1	4,279.4	4,693.8	5,037.0	5,531.0	5,898.6	9.0
Share of HPC server (%)	35.0	36.5	35.6	36.6	37.3	38.3	38.9	38.9	40.0	40.1	
HPDA (HPC Big Data) external storage	262.2	301.5	334.1	434.9	513.6	634.3	863.2	1,093.6	1,380.8	1,664.9	26.5
Share of HPDA server (%)	49.0	50.0	51.0	52.0	55.0	57.9	59.9	60.2	61.1	62.1	

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: Worldwide HPDA Storage Revenue by Industry/Application Segment

Table 5 shows IDC's forecast for HPDA storage revenue by industry/application segment. IDC projects that in 2018, the largest segments for data-intensive storage revenue will be university/academic ($311 million) and government lab ($299 million), followed by defense ($219 million) and biosciences ($181 million). IDC projects that the fastest-growing segment during the forecast period will be the weather segment (49.8%) as it is growing from a smaller base. The next fastest-growing segments during the forecast period will be business intelligence (36.8% CAGR), fraud and anomaly detection (35.7%), economic/financial modeling (30.8%), defense (30.7%), and marketing (28.2%). Note that three of the highest-growth areas are new commercial segments whose revenue is additive to the storage revenue from historical HPC market segments.

TABLE 5

Worldwide HPDA Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
HPDA from historical HPC											
Biosciences	51.1	59.2	66.2	72.1	84.6	97.6	123.1	143.6	165.6	181.0	16.4
CAE	17.5	21.3	24.2	28.0	32.8	40.3	54.4	68.1	84.8	100.7	25.1
Chemical engineering	4.4	5.0	5.4	5.5	6.5	7.5	9.6	11.3	13.2	14.6	17.6
DCC and distribution	12.7	15.2	17.0	18.8	22.0	26.4	34.8	42.5	51.5	59.6	22.0
Economics/ financial	5.7	7.8	9.0	10.3	12.1	15.6	22.0	28.9	37.5	46.4	30.8
EDA/IT/ISV	4.9	5.8	6.4	7.0	8.2	9.6	12.2	14.3	16.7	18.5	17.7
Geosciences	5.0	5.6	6.2	6.6	7.8	9.6	12.9	16.1	20.1	23.8	25.1
Mechanical design	2.2	2.4	2.5	2.6	3.0	3.5	4.4	5.2	6.0	6.6	17.0
Defense	35.6	40.1	44.4	48.9	57.4	73.9	104.2	136.3	176.8	218.5	30.7
Government lab	58.5	66.3	72.7	80.1	94.1	116.3	157.9	199.2	249.6	298.6	26.0
University/ academic	60.8	68.3	75.1	82.8	97.2	120.4	163.7	206.9	259.7	311.1	26.2
Weather	3.3	3.8	4.3	4.8	5.6	8.9	14.7	21.9	31.4	42.4	49.8
Other	0.6	0.8	0.7	0.8	0.9	1.1	1.5	1.9	2.3	2.8	25.1
Subtotal	262.2	301.5	334.1	368.2	432.2	530.8	715.5	896.2	1,115.2	1,324.5	25.1

TABLE 5

Worldwide HPDA Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
New HPDA segment											
Fraud and anomaly detection	–	–	–	25.0	29.4	38.2	56.5	77.1	104.8	135.1	35.7
Marketing	–	–	–	12.9	18.3	22.7	31.1	39.9	50.9	63.6	28.2
Business intelligence	–	–	–	17.7	20.7	26.6	38.0	52.6	74.2	99.3	36.8
Commercial: other	–	–	–	11.0	13.0	15.9	22.2	27.8	35.7	42.4	26.7
Subtotal	–	–	–	66.6	81.4	103.5	147.7	197.3	265.5	340.4	33.1
Total	262.2	301.5	334.1	434.9	513.6	634.3	863.2	1,093.6	1,380.8	1,664.9	26.5

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: HPDA Storage Revenue as a Percentage of Each Segment

Table 6 shows the percentage of all HPDA storage revenue represented by each industry/application segment. The figures for historical HPC segments total 100% (of all HPDA storage revenue). The figures for the newer, nonhistorical segments are shown as adding to the 100% historical totals to produce grand totals exceeding 100% (year 2012 onward). We deliberately structured Table 6 this way to make the supplementary contributions of these newer segments stand out more clearly. Table 6 includes historical data for 2009–2013 and forecast data 2014–2018.

In 2013, HPDA segment storage revenue was the highest, as a percentage of all HPDA storage revenue, in the university/academia (22.5%), government lab (21.8%), biosciences (19.6%), and defense (13.3%) segments.

IDC projects that in 2018, the university/academia, government lab, biosciences, and defense segments will remain the highest-revenue HPDA storage segments, and the university/academia segment will make up the highest percentage (23.5%) of all HPDA storage revenue. IDC forecasts that the highest-revenue HPDA storage segments in 2018 will be university/academia (23.5% of all HPDA storage revenue), government lab (22.5%), defense (16.5%), and biosciences (13.7%).

Figure 1 shows the HPDA storage revenue (in million dollars) generated by each industry/application segment in 2013 and displays IDC's forecast revenue figures for these segments in 2018.

TABLE 6

Worldwide HPDA Storage Revenue as a Percentage of Overall Historical HPDA Revenue by Industry/Application, 2009–2018 (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
HPDA from historical HPC										
Biosciences	19.5	19.6	19.8	19.6	19.6	18.4	17.2	16.0	14.8	13.7
CAE	6.7	7.0	7.2	7.6	7.6	7.6	7.6	7.6	7.6	7.6
Chemical engineering	1.7	1.7	1.6	1.5	1.5	1.4	1.3	1.3	1.2	1.1
DCC and distribution	4.8	5.0	5.1	5.1	5.1	5.0	4.9	4.7	4.6	4.5
Economics/ financial	2.2	2.6	2.7	2.8	2.8	2.9	3.1	3.2	3.4	3.5
EDA/IT/ISV	1.9	1.9	1.9	1.9	1.9	1.8	1.7	1.6	1.5	1.4
Geosciences	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Mechanical design	0.8	0.8	0.7	0.7	0.7	0.7	0.6	0.6	0.5	0.5
Defense	13.6	13.3	13.3	13.3	13.3	13.9	14.6	15.2	15.9	16.5
Government lab	22.3	22.0	21.8	21.8	21.8	21.9	22.1	22.2	22.4	22.5
University/ academic	23.2	22.6	22.5	22.5	22.5	22.7	22.9	23.1	23.3	23.5
Weather	1.3	1.3	1.3	1.3	1.3	1.7	2.1	2.4	2.8	3.2
Other	0.2	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Subtotal	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE 6

Worldwide HPDA Storage Revenue as a Percentage of Overall Historical HPDA Revenue by Industry/Application, 2009–2018 (%)

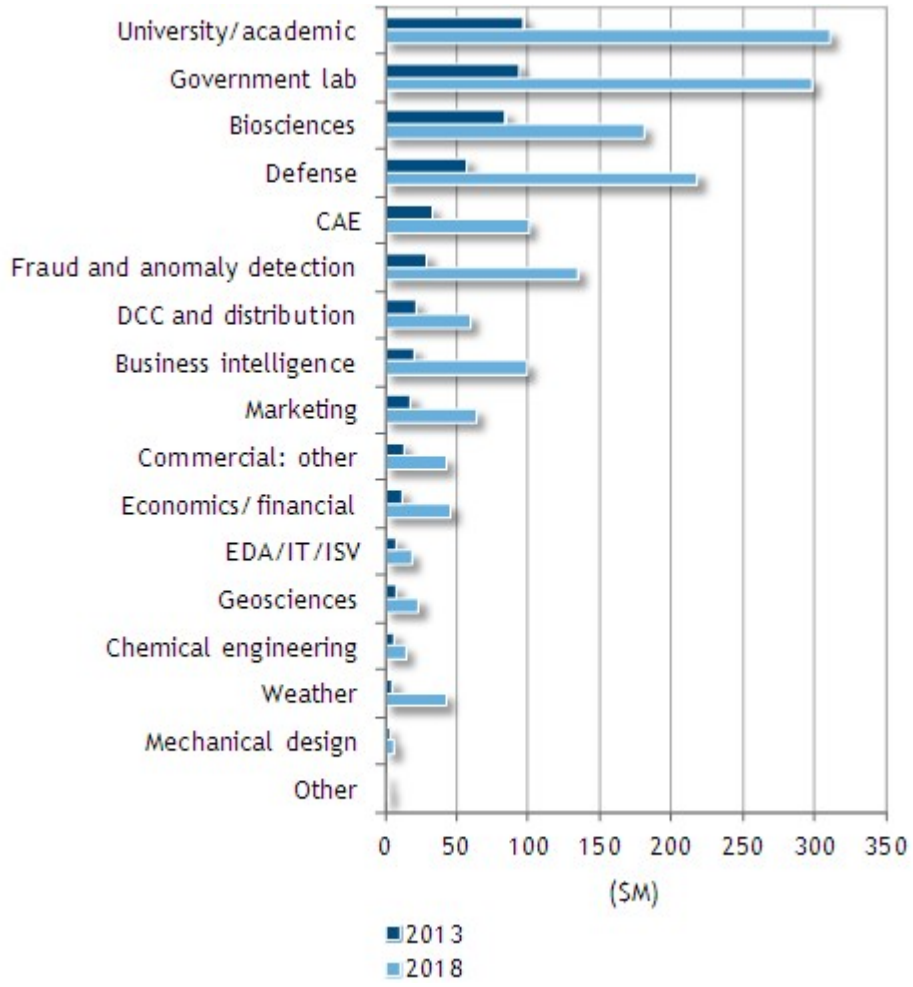
	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
New HPDA segment										
Fraud and anomaly detection	–	–	–	6.8	6.8	7.2	7.9	8.6	9.4	10.2
Marketing	–	–	–	3.5	4.2	4.3	4.3	4.5	4.6	4.8
Business intelligence	–	–	–	4.8	4.8	5.0	5.3	5.9	6.7	7.5
Commercial: other	–	–	–	3.0	3.0	3.0	3.1	3.1	3.2	3.2
Subtotal	–	–	–	18.1	18.8	19.5	20.7	22.0	23.8	25.7
Total	100.0	100.0	100.0	118.1	118.8	119.5	120.7	122.0	123.8	125.7

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

FIGURE 1

Worldwide HDPA Storage Revenue by Industry/Application, 2013 and 2018



Source: IDC, 2014

Forecast: HPDA Modeling and Simulation Storage Revenue as a Percentage of Each HPDA Segment

As noted previously, IDC's definition of HPDA spans data-intensive modeling and simulation and high-performance (advanced) analytics. For each industry/application segment, Tables 7 and 8 show the percentage of HPDA revenue that is devoted to M&S and high-performance analytics, respectively. Hence, for 2013, Table 7 indicates that 57% of biosciences HPDA revenue was associated with M&S workloads, and Table 8 indicates that the remaining 43% of biosciences HPDA revenue was related to high-performance analytics. Table 7 includes historical data for 2009-2013 and forecast data for 2014-2018.

In 2013, the M&S workload share (as opposed to the high-performance analytics share) was highest in the EDA/IT/ISV (89%), chemical engineering (88%), CAE (83%), geosciences (80%), weather (78%), and government lab (72%) segments. Not surprisingly, M&S share was lowest in the new HPDA segments that are predominantly oriented toward high-performance analytics methods.

IDC forecasts that the M&S HPDA workload share in 2018 will be highest in the EDA/IT/ISV (85%), chemical engineering (80%), geosciences (78%), CAE, weather (75%), and government lab (70%) segments. Overall, M&S will grow but will play a smaller part in 2018 than it did in 2013 due to faster growth in high-performance analytics.

TABLE 7

Worldwide HPDA Modeling and Simulation Storage Revenue as a Percentage of Each Segment by Industry/Application, 2009–2018 (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
HPDA from historical HPC										
Biosciences	70.0	65.0	63.0	60.0	57.0	53.0	50.0	46.0	43.0	43.0
CAE	95.0	90.0	87.0	85.0	83.0	81.0	79.0	77.0	75.0	75.0
Chemical engineering	95.0	94.0	93.0	90.0	88.0	86.0	84.0	82.0	80.0	80.0
DCC and distribution	50.0	49.0	47.0	45.0	42.0	38.0	35.0	31.0	28.0	28.0
Economics/ financial	39.0	38.0	37.0	35.0	34.0	33.0	32.0	31.0	30.0	30.0
EDA/IT/ISV	93.0	92.0	91.0	90.0	89.0	88.0	87.0	86.0	85.0	85.0
Geosciences	84.0	83.0	82.0	80.0	80.0	79.0	79.0	78.0	78.0	78.0
Mechanical design	73.0	72.0	71.0	70.0	69.0	68.0	67.0	66.0	65.0	65.0
Defense	37.0	36.0	35.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0
Government lab	78.0	76.0	75.0	73.0	72.0	72.0	71.0	71.0	70.0	70.0
University/ academic	77.0	71.0	70.0	67.0	65.0	64.0	62.0	61.0	59.0	59.0
Weather	85.0	82.0	81.0	79.0	78.0	77.0	77.0	76.0	75.0	75.0
Other	19.0	18.0	17.0	15.0	14.0	14.0	13.0	13.0	12.0	12.0
New HPDA segment										

TABLE 7

Worldwide HPDA Modeling and Simulation Storage Revenue as a Percentage of Each Segment by Industry/Application, 2009–2018 (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Fraud and anomaly detection	–	–	–	13.0	12.0	11.0	11.0	10.0	9.0	9.0
Marketing	–	–	–	17.0	16.0	15.0	13.0	12.0	11.0	11.0
Business intelligence	–	–	–	12.0	11.0	10.0	10.0	9.0	8.0	8.0
Commercial: other	–	–	–	9.0	8.0	6.0	5.0	3.0	2.0	2.0

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: HPDA High-Performance Analytics Revenue as a Percentage of Each Segment

For each HPDA segment, Table 8 shows the share (percentage) of all HPDA work handled by high-performance analytics. Table 8 includes historical data for 2009–2013 and forecast data for 2014–2018.

In 2013, high-performance analytics workload share was highest (not counting the commercial "other" segment) in the business intelligence (89%) and fraud and anomaly detection (88%) segments. IDC forecasts that the high-performance analytics workload share in 2018 will be highest in the business intelligence (92%), fraud and anomaly detection (91%), and marketing (89%) segments.

TABLE 8

Worldwide HPDA High-Performance Analytics Storage Revenue as a Percentage of Each Segment by Industry/Application, 2009–2018 (%)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
HPDA from historical HPC										
Biosciences	30.0	35.0	37.0	40.0	43.0	47.0	50.0	54.0	57.0	57.0
CAE	5.0	10.0	13.0	15.0	17.0	19.0	21.0	23.0	25.0	25.0
Chemical engineering	5.0	6.0	7.0	10.0	12.0	14.0	16.0	18.0	20.0	20.0
DCC and distribution	50.0	51.0	53.0	55.0	58.0	62.0	65.0	69.0	72.0	72.0
Economics/ financial	61.0	62.0	63.0	65.0	66.0	67.0	68.0	69.0	70.0	70.0
EDA/IT/ISV	7.0	8.0	9.0	10.0	11.0	12.0	13.0	14.0	15.0	15.0
Geosciences	16.0	17.0	18.0	20.0	20.0	21.0	21.0	22.0	22.0	22.0
Mechanical design	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	35.0
Defense	63.0	64.0	65.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
Government lab	22.0	24.0	25.0	27.0	28.0	28.0	29.0	29.0	30.0	30.0
University/ academic	23.0	29.0	30.0	33.0	35.0	36.0	38.0	39.0	41.0	41.0
Weather	15.0	18.0	19.0	21.0	22.0	23.0	23.0	24.0	25.0	25.0
Other	81.0	82.0	83.0	85.0	86.0	86.0	87.0	87.0	88.0	88.0
New HPDA segment										
Fraud and anomaly detection	–	–	–	87.0	88.0	89.0	89.0	90.0	91.0	91.0
Marketing	–	–	–	83.0	84.0	85.0	87.0	88.0	89.0	89.0
Business intelligence	–	–	–	88.0	89.0	90.0	90.0	91.0	92.0	92.0
Commercial: other	–	–	–	91.0	92.0	94.0	95.0	97.0	98.0	98.0

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: HPDA Modeling and Simulation Storage Revenue in Each Workload Segment

Tables 9 and 10 translate the percentages for M&S workloads (refer back to Table 7) and high-performance analytics workloads (refer back to Table 8) into dollar revenue figures.

Table 9 shows the M&S storage revenue for each of the HPDA application segments. Table 9 includes historical data for 2009–2013 and forecast data for 2014–2018.

In 2013, M&S HPDA storage revenue was highest in the government lab ($67.7 million) segment, followed by university/academia ($63.2 million), biosciences ($48.2 million), CAE ($27.3 million), defense ($17.2 million), DCC and distribution ($9.3 million), and EDA/IT/ISV ($7.3 million) segments. IDC forecasts that the M&S HPDA revenue in 2018 will be highest in the government lab ($209 million) segment, followed by university/academia ($183.5 million), biosciences ($77.8 million), CAE ($75.5 million), defense ($65.6 million), and weather ($31.8 million) segments.

TABLE 9

Worldwide HPDA Modeling and Simulation Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
HPDA from historical HPC											
Biosciences	35.7	38.5	41.7	43.2	48.2	51.7	61.6	66.1	71.2	77.8	10.1
CAE	16.6	19.1	21.1	23.8	27.3	32.7	43.0	52.4	63.6	75.5	22.6
Chemical engineering	4.2	4.7	5.0	5.0	5.7	6.5	8.1	9.3	10.5	11.7	15.4
DCC and distribution	6.3	7.4	8.0	8.5	9.3	10.0	12.2	13.2	14.4	16.7	12.5
Economics/ financial	2.2	3.0	3.3	3.6	4.1	5.2	7.1	8.9	11.2	13.9	27.6
EDA/IT/ISV	4.6	5.3	5.9	6.3	7.3	8.4	10.6	12.3	14.2	15.8	16.6
Geosciences	4.2	4.7	5.1	5.3	6.2	7.5	10.2	12.6	15.7	18.6	24.5
Mechanical design	1.6	1.7	1.8	1.8	2.1	2.4	3.0	3.4	3.9	4.3	15.6
Defense	13.2	14.4	15.5	14.7	17.2	22.2	31.3	40.9	53.0	65.6	30.7

TABLE 9

Worldwide HPDA Modeling and Simulation Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
Government lab	45.6	50.4	54.5	58.5	67.7	83.8	112.1	141.4	174.7	209.0	25.3
University/ academic	46.8	48.5	52.6	55.5	63.2	77.1	101.5	126.2	153.2	183.5	23.8
Weather	2.8	3.1	3.5	3.8	4.4	6.9	11.3	16.6	23.6	31.8	48.6
Other	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	21.3
Subtotal	184.0	201.0	218.1	230.0	262.8	314.5	412.0	503.6	609.6	724.4	22.5
New HPDA segment											
Fraud and anomaly detection	–	–	–	3.3	3.5	4.2	6.2	7.7	9.4	12.2	28.1
Marketing	–	–	–	2.2	2.9	3.4	4.0	4.8	5.6	7.0	19.0
Business intelligence	–	–	–	2.1	2.3	2.7	3.8	4.7	5.9	7.9	28.3
Commercial: other	–	–	–	1.0	1.0	1.0	1.1	0.8	0.7	0.8	-4.0
Subtotal	–	–	–	8.6	9.8	11.2	15.2	18.1	21.7	27.9	23.4
Total	184.0	201.0	218.1	238.5	272.5	325.7	427.1	521.7	631.3	752.4	22.5

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

Forecast: HPDA High-Performance Analytics Storage Revenue in Each Workload Segment

Table 10 shows the HPDA storage revenue for high-performance analytics in each of the HPDA application segments. Table 10 includes historical data for 2009–2013 and forecast data for 2014–2018. For 2009–2011, no figures are given for the four new HPDA segments because HPDA use outside of historical HPC segments was still too small to track and classify properly.

In 2013, high-performance analytics HPDA workload revenue was highest in the defense ($40.2 million) segment, followed by biosciences ($36.4 million), university/academia ($34.0 million),

government lab (26.3 million), fraud and anomaly detection ($25.9 million), business intelligence ($18.5 million), and marketing ($15.4 million) segments. IDC forecasts that high-performance analytics HPDA revenue in 2018 will be highest in the defense ($153 million), university/academia ($127.5 million), fraud and anomaly detection ($122.9 million), biosciences ($103.2 million), business intelligence ($91.4 million), and government lab ($89.6 million) segments.

TABLE 10

Worldwide HPDA High-Performance Analytics Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
HPDA from historical HPC											
Biosciences	15.3	20.7	24.5	28.8	36.4	45.9	61.6	77.6	94.4	103.2	23.2
CAE	0.9	2.1	3.1	4.2	5.6	7.7	11.4	15.7	21.2	25.2	35.1
Chemical engineering	0.2	0.3	0.4	0.6	0.8	1.1	1.5	2.0	2.6	2.9	30.2
DCC and distribution	6.3	7.7	9.0	10.3	12.8	16.4	22.6	29.3	37.1	42.9	27.4
Economics/ financial	3.5	4.8	5.7	6.7	8.0	10.5	15.0	19.9	26.2	32.5	32.4
EDA/IT/ISV	0.3	0.5	0.6	0.7	0.9	1.1	1.6	2.0	2.5	2.8	25.2
Geosciences	0.8	1.0	1.1	1.3	1.6	2.0	2.7	3.5	4.4	5.2	27.5
Mechanical design	0.6	0.7	0.7	0.8	0.9	1.1	1.5	1.8	2.1	2.3	19.8
Defense	22.4	25.6	28.8	34.2	40.2	51.7	72.9	95.4	123.8	153.0	30.7
Government lab	12.9	15.9	18.2	21.6	26.3	32.6	45.8	57.8	74.9	89.6	27.7
University/ academic	14.0	19.8	22.5	27.3	34.0	43.4	62.2	80.7	106.5	127.5	30.3
Weather	0.5	0.7	0.8	1.0	1.2	2.1	3.4	5.2	7.9	10.6	53.7
Other	0.5	0.7	0.6	0.7	0.8	1.0	1.3	1.6	2.1	2.4	25.7
Subtotal	78.2	100.5	116.1	138.2	169.4	216.4	303.5	392.6	505.6	600.1	28.8

TABLE 10

Worldwide HPDA High-Performance Analytics Storage Revenue by Industry/Application, 2009–2018 ($M)

	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2013–2018 CAGR (%)
New HPDA segment											
Fraud and anomaly detection	–	–	–	21.8	25.9	34.0	50.3	69.4	95.4	122.9	36.6
Marketing	–	–	–	10.7	15.4	19.3	27.0	35.1	45.3	56.6	29.7
Business intelligence	–	–	–	15.6	18.5	23.9	34.2	47.9	68.2	91.4	37.7
Commercial: other	–	–	–	10.1	11.9	15.0	21.1	26.9	35.0	41.5	28.3
Subtotal	–	–	–	58.1	71.6	92.2	132.6	179.3	243.9	312.5	34.3
Total	78.2	100.5	116.1	196.3	241.1	308.6	436.1	571.9	749.5	912.5	30.5

Note: See Table 1 for top 3 assumptions and Table 2 for key forecast assumptions.

Source: IDC, 2014

ESSENTIAL GUIDANCE

For Users

- **HPDA is becoming a key deciding factor in more user buying decisions.** Many HPC buyers will continue to acquire the same types of HPC systems they were planning to acquire all along – which means systems that typically are larger and more powerful than the buyers' previous systems. HPDA buyers will often run Hadoop, graph analysis, and other, newer high-performance analytics workloads on these systems rather than acquiring separate systems for this purpose. In these cases, HPDA is not altering what *compute* systems the organizations buy – only how they use the systems. A key beneficiary even in these "steady state" cases will be storage, however, since both forms of HPDA (M&S and high-performance analytics) will boost the need for storage. IDC is also seeing many examples of HPC and commercial organizations acquiring HPC systems, including HPDA appliances that are dedicated to high-performance analytics. We expect more organizations to follow these examples.
- **Most HPDA work is suited to standard clusters, but the long-term trend favors growth of more tightly coupled systems with large global memories.** HPC users should not assume that a standard cluster will be best for every HPDA situation. Many data-intensive jobs today are easily partitionable and can be run efficiently on standard clusters with memories that are

physically and logically distributed. Problems that are less uniform and more communications dependent need logically shared, global memory spaces as well as turbo-charged interconnects. IDC observes that procurements for the most daunting fraud detection work, for example, are frequently being awarded to more capable systems of this kind. These kinds of high-performance analytics workloads are some of the fastest-growing workloads in the HPDA market and will become more important as the market increasingly moves from today's static, query-based searches to the emerging era of higher-value, dynamic pattern discovery. These emerging use cases require hardware-level data management capabilities that are beyond the capabilities offered by today's standard cluster installations.

- **HPC architectures will begin a long-term shift away from compute centrism.** The HPC market is entering a kind of perfect storm. For years, HPC architectures have tilted farther and farther away from optimal balance between processor speed, memory access, and I/O speed. As successive generations of HPC systems have upped peak processor performance without corresponding advances in per-core memory capacity and speed, the systems have become increasingly compute centric and the well-known "memory wall" has gotten worse. Now comes the HPC Big Data era that will require superb memory and I/O capabilities, sometimes with little need for computing prowess. Emerging data-intensive problems are exposing more limitations of established HPC architectural designs — not just in the memory wall itself but also the way existing, compute-centric architectures handle data movement throughout the system. It's important to make advances here, or data movement for emerging high-performance data analysis problems could become frustratingly slow and expensive.
- **Data management continues to be a major pain point.** Tools such as Hadoop and MapReduce can effectively expedite searches through the large data sets that characterize some of the newer Big Data problems, and IDC research shows that MR/Hadoop is already being used by nearly one-third of HPC sites worldwide today. Scientific users tell IDC that these tools can be great for retrieving and moving through complex data, but they do not allow researchers to take the next step and pose intelligent questions. In addition, the going gets tough when data sets cross the 100TB threshold. Sophisticated tools for data integration and analysis on this scale are largely lacking today. Users in HDPA are looking beyond conventional vanilla techniques to more scalable approaches involving algorithmic innovations geared to manage each use case. In some cases, IDC is observing an increasing number of graph analytics-based approaches to managing complexity in large data sets.

For Vendors

- **HPDA will drive some sales and help decide others.** Most HPDA work will be run on systems purchased not solely for this purpose, but IDC is already seeing robust procurements for HPC systems dedicated to high-performance analytics, especially in the life sciences, for fraud protection across massive databases, for advanced business intelligence and marketing, and increasingly in the social sciences and other humanities fields. Even in cases where HPDA is not the sole application, IDC expects HPDA capabilities to be an important purchase criterion in a growing number of HPC procurements.
- **Storage and data movement are the largest pain points for many HPC/HPDA users today.** Advances in storage access density have substantially lagged behind storage capacity progress for some time, and online storage is expensive. Vendors that can address access density, storage reliability/resiliency, storage costs, and other pain points stand to benefit from the robust growth that IDC forecasts for the HPDA storage market.

- **Most HPDA procurements will go to clusters — but not all.** As stated previously (see the For Users section), procurements addressing the most daunting HPDA problems are often being awarded to systems that may still be clusters architecturally but that have enhanced interconnects and memory subsystems.
- **Not all HPDA problems involve analytics.** Analytics may be at the heart of many HPDA opportunities in the new enterprise HPDA segments, but high-end analytics represent only one horizontal use case in HPC. The other major use case, of course, is data-intensive M&S, and advanced visualization provides important analytical capabilities for many HPDA tasks. Vendors that focus entirely on analytics will miss a substantial number of opportunities in the HPC market.
- **There are opportunities to create tools for very large data sets.** As noted previously, effective tools for data integration and analysis on data sets of 100TB and beyond are largely absent today — although data sets on this scale are becoming increasingly common. Vendors that create tools for use at this scale can use them as a lever to seize market leadership positions in HPDA. Users with extreme-scale data sets may also need help in deciding what to keep and what to discard.

LEARN MORE

Related Research

Additional research from IDC in the high-performance data analysis program includes the following documents:

- *Worldwide High-Performance Data Analysis 2014-2018 Forecast* (IDC #248789, May 2014)
- *Perspectives on High-Performance Data Analysis: The Life Sciences* (IDC #248348, May 2014)
- *Perspectives on High-Performance Data Analysis: Government Applications* (IDC #248349, May 2014)
- *NVIDIA Unveils Technologies That Can Address HPDA Market Needs* (IDC #247780, April 2014)
- *IDC's Worldwide High-Performance Computing Predictions 2014* (IDC #WC20140211, February 2014)
- *Micron Demonstrates Technologies to Address Emerging Challenges in Big Data Applications* (IDC #244843, December 2013)
- *HPDA Pulse: 2013 Software and Consulting Market Analysis* (IDC #244513, November 2013)
- *HPDA Pulse Results: 2013 Hardware and Storage Market Analysis* (IDC #244493, November 2013)
- *Catalyst Supercomputer Heralds Shift to More Balanced Architectures* (IDC #lcUS24437513, November 2013)
- *China Eyes 10,000-Fold Data Reduction for Internet of Things* (IDC #lcUS24392513, October 2013)

- *High-Performance Data Analysis in the Life Sciences: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243774, October 2013)
- *High-Performance Data Analysis – PayPal Breaks New Ground: HPC User Forum, September 2013, Boston, Massachusetts* (IDC #243772, October 2013)
- *European Conference Underscores Movement of Enterprise Big Data Analytics to HPC Capabilities* (IDC #243618, October 2013)
- *HPDA: Importance of Hardware in Effective Big Data Solutions* (IDC #243495, September 2013)
- *eBay Deploys Innovative Green Power-Efficient Datacenter Technologies* (IDC #IcUS24350013, September 2013)
- *Worldwide High-Performance Data Analysis 2013–2017 Forecast* (IDC #241315, June 2013)
- *Changing Market Dynamics: HPC Meeting Big Data and IDC's Projected Evolution of the Market* (IDC #240365, March 2013)
- *High-Performance Data Analysis: HPC Meets Big Data* (IDC #DR2013_LSIS1_SC_CD, March 2013)
- *High-Performance Data Analysis: The Visible Human Project* (IDC #238253, December 2012)
- *High-Performance Data Analysis at NASA JPL* (IDC #238254, December 2012)

Synopsis

This IDC study centers on IDC's worldwide revenue forecast for HPDA storage infrastructure. HPDA activity may employ either long-standing methods based on numerical modeling and simulation or newer methods such as large-scale graph analytics, semantic technologies, and knowledge discovery algorithms – or some combination of long-standing and newer methods. IDC forecasts that revenue for HPDA storage will grow robustly (at a 26.5% CAGR) from 2013 to 2018, increasing from $514 million in 2013 to $1.7 billion in 2018.

According to Steve Conway, IDC HPC research vice president, "The goal of HPDA activity is typically to maximize innovation and competitiveness by extracting valuable information from large data sets, typically using complex algorithms in near real time. Commercial buyers are increasingly turning to HPC resources to attack business problems that enterprise technologies cannot effectively address. IDC believes that the HPC data explosion is bound to drive rapid growth in HPDA usage. Nearly all HPC industry/application segments, along with a growing number of commercial first-time HPC adopters, have potential use cases for HPDA."

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.

Global Headquarters

5 Speen Street
Framingham, MA 01701
USA
508.872.8200
Twitter: @IDC
idc-insights-community.com
www.idc.com