

Market Forecast

Worldwide HPC Server Application Workloads Market Forecast Update, 2018-2023

Earl Joseph, Steve Conway, Bob Sorensen, and Alex Norton
June 2019

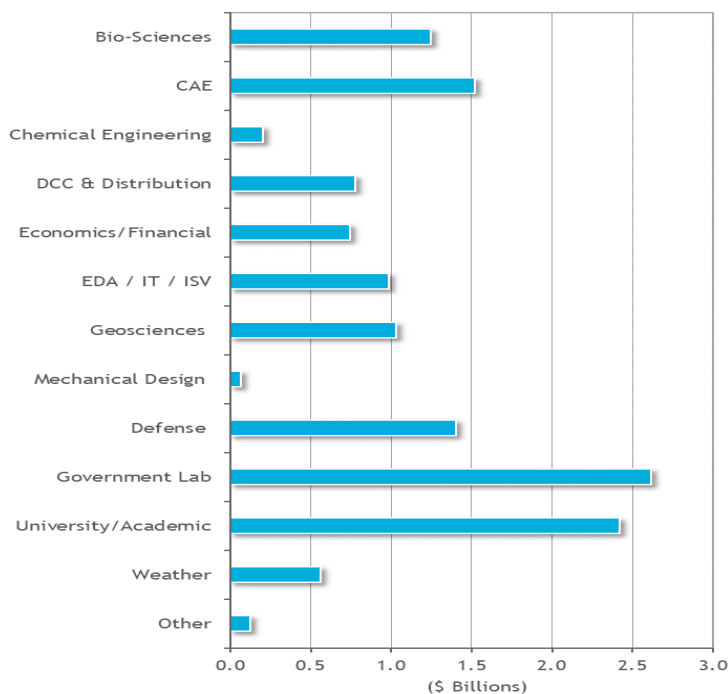
HYPERION RESEARCH OPINION

Worldwide HPC Server Application Workloads Revenue Snapshot

Hyperion Research forecasts that the worldwide HPC server application workloads, representing the split-out of the HPC server market by application segments, will expand at a 7.8% CAGR to reach \$19.9 billion in 2023, up from \$13.7 billion in 2018 (see Figure 1). The categories in Figure 1 include high performance data analysis (HPDA) sub-segments: fraud and anomaly detection, affinity marketing, business intelligence, and precision medicine. Hyperion Research provides a separate detailed forecast on these sub-segments.

FIGURE 1

2018 Revenues by the Application Segments (\$ Billions)



Source: Hyperion Research 2019

Note: This page is intentionally blank.

IN THIS REPORT

This Hyperion Research study presents our latest five-year forecast (2018-2023) for HPC server systems. Worldwide revenue for the HPC technical server market grew 15.6% from 2017 to 2018 to a record \$13.7 billion. Hyperion Research predicts the HPC technical server market will grow at a 7.8% CAGR between 2018 and 2023 to reach \$19.9 billion by 2023.

- The Supercomputer market segment for HPC systems priced at \$500,000 and up is projected to show the highest growth rate (8.6% CAGR), albeit with significant spikes in the 2021-2023 time frame as several exascale systems around the world come on line.
- The Divisional and Departmental segments will exhibit healthy growth (7.4% and 7.2% five-year CAGRs, respectively), and the Workgroup segment will continue to rebound following several years of stagnation (7.1% CAGR).

TABLE 1

Worldwide Total Technical Computer Market Revenue Forecast by Competitive Segment (\$ Billions)

	2017	2018	2019	2020	2021	2022	2023	CAGR 18-23
Supercomputer	4.4	5.4	5.7	6.3	7.1	8.1	8.1	8.6%
Divisional	2.2	2.4	2.6	2.8	3.0	3.2	3.5	7.4%
Departmental	3.5	3.9	4.1	4.4	4.8	5.1	5.5	7.2%
Workgroup	1.8	2.0	2.1	2.3	2.5	2.6	2.8	7.1%
Total	12.3	12.9	13.5	15.3	17.0	19.6	19.9	7.8%

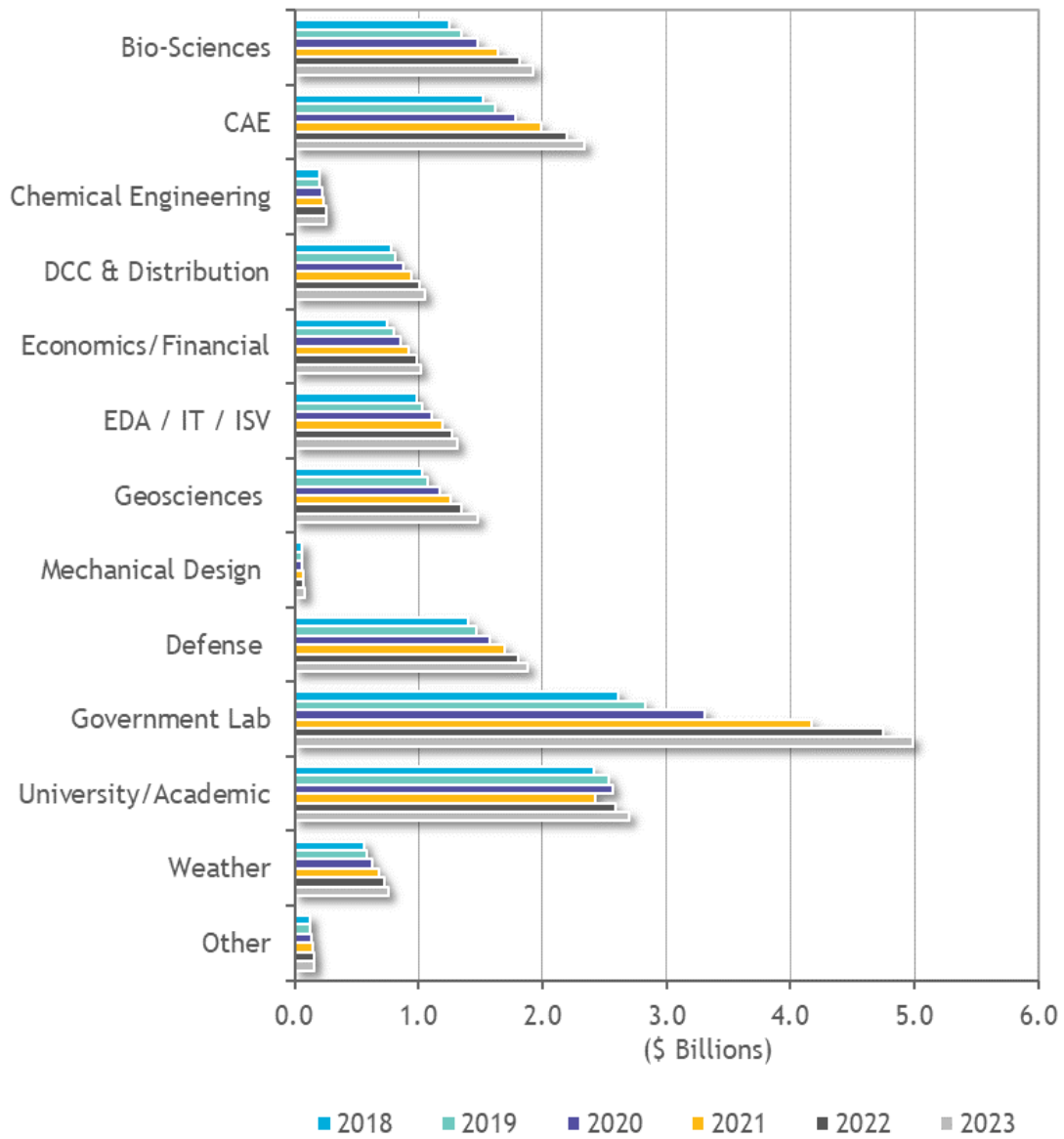
Source: Hyperion Research, 2019

THE HPC APPLICATIONS WORKLOADS FORECAST

Figure 2 shows the five-year forecast (2018-2023) for the server application workload segments in the global HPC market. For 2018, the three biggest server application sectors were government, university/academic, and CAE. Hyperion Research projects the fastest growth in the government (13.8% CAGR), bio-sciences (9.1% CAGR) and CAE (8.9% CAGR) sectors between 2018 and 2023, as seen in Table 2.

FIGURE 2

2018-2023 Revenues by the Application Segments (\$ Billions)



Source: Hyperion Research 2019

TABLE 2**Revenues by the Application Segments (\$ Billions)**

	2017	2018	2019	2020	2021	2022	2023	CAGR 18-23
Bio-Sciences	1.08	1.25	1.35	1.48	1.65	1.81	1.92	9.1%
CAE	1.32	1.52	1.62	1.78	1.99	2.20	2.34	8.9%
Chemical Engineering	0.18	0.21	0.21	0.22	0.24	0.25	0.26	4.8%
DCC & Distribution	0.67	0.78	0.82	0.88	0.95	1.01	1.05	6.1%
Economics/Financial	0.65	0.75	0.80	0.86	0.92	0.99	1.02	6.5%
EDA / IT / ISV	0.85	0.98	1.03	1.10	1.19	1.27	1.32	6.0%
Geosciences	0.89	1.03	1.08	1.17	1.26	1.35	1.48	7.6%
Mechanical Design	0.05	0.06	0.06	0.06	0.07	0.07	0.08	4.0%
Defense	1.21	1.40	1.46	1.57	1.69	1.81	1.88	6.0%
Government Lab	2.26	2.62	2.83	3.31	4.17	4.75	4.99	13.8%
University/Academic	2.09	2.42	2.54	2.57	2.43	2.59	2.70	2.2%
Weather	0.48	0.56	0.59	0.63	0.68	0.73	0.75	6.1%
Other	0.11	0.13	0.12	0.13	0.14	0.15	0.16	4.3%
Total Revenue	11.85	13.71	14.49	15.78	17.38	18.98	19.95	7.8%

Source: Hyperion Research 2019

MARKET CONTEXT: MARKET GROWTH DRIVERS

Hyperion Research predicts the HPC technical server market will grow at a 7.8% CAGR between 2018 and 2023 to reach \$19.9 billion in 2023. Several factors are driving strong growth rates across all segments of the HPC sector and that growth will continue to outpace the growth rate projected for the general-purpose enterprise IT server sector:

- The worldwide exascale race will likely result in multiple, \$300 million plus exascale-class supercomputers and several large, \$100 million plus supercomputers being installed during the forecast period.
- New and rapidly growing opportunities are emerging to support the continued migration and expansion of enterprise HPC workloads to HPC on premise, private cloud and other cloud-

based ecosystems. A key development going forward is the emergence of so-called containers that orchestrate computing, networking, and storage infrastructure on behalf of user workloads between on-prem and cloud HPC platforms.

- The seemingly endless roll-out of new algorithms, applications and use cases in machine and deep learning will continue to drive interest in HPCs that can provide fast, capable performance for even the most aggressive training, inferencing and decision support tasks.
- The continued expansion of HPCs in the traditional modeling and simulation environment as more commercial and government users turn to advanced computing to meet their toughest computational requirements for larger problem sizes, higher modeling fidelity, and more aggressive iteration methods, all operating under the requirement for faster turnaround time.
- The growing proliferation of IoT devices that will drive some HPC computing to the edge and at the same time place new demands on HPC centers to process the vast amounts of collected IoT data will also add to HPC workloads everywhere. This IoT infrastructure will grow in tight synchronization with the global proliferation of 5G high-speed telecommunications networks.
- Despite the extreme nascent state of quantum computing development today, activity in the highly visible quantum computing sector will create additional markets for HPCs to be used as quantum simulators to help development of quantum computing algorithms. In addition, quantum algorithm development will increasingly require HPC capability to validate and verify new or emergent quantum algorithms.

MARKET SEGMENT DEFINITIONS

HPC Application/Industry Workload Categories

Hyperion Research identifies and tracks the following technical computing workload segments:

- **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 laboratories and research centers, 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 engineering (CAE) and mechanical design and analysis.** This workload centers on applications such as finite element modeling and analysis, mechanical computer-aided engineering, 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, sailboards, 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. The segment includes both trader and computationally intensive non-trader 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 area 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, system development and testing, application development, software development, and other product design and testing.
- **Geosciences and geengineering.** 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 both 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.

- **HPDA - commercial analytics.** This category includes analytics workloads that are too complex and too time-critical for enterprise servers to handle well alone.
- **"Other."** This segment includes any technical computing workloads not otherwise specified by the previous definitions.

METHODOLOGY

The forecasts in this study are based on a number of Hyperion Research information sources, including our technical computing systems quarterly census database, vendor results for the historical years, discussions with vendors and users on future business directions and expectations, end-user studies, and in-depth interviews with users.

The forecasts were developed based on Hyperion Research's technical computing systems forecast model, which targets compute servers. This model initially considers competitive segments (supercomputers, technical divisional servers, technical departmental servers, and technical workgroup servers), forecasting system unit shipments, revenue, and average sales price by industry/application segment. The forecasts include estimates for second-tier and new-entrant vendors selling into the HPC server market space.

The forecasts provided in this study include only server systems used in technical computing applications. Systems sold into commercial (nontechnical) applications and desktop technical computers are not included in this study.

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

About Hyperion Research, LLC

Hyperion Research provides data-driven research, analysis and recommendations for technologies, applications, and markets in high performance computing and emerging technology areas to help organizations worldwide make effective decisions and seize growth opportunities. Research includes market sizing and forecasting, share tracking, segmentation, technology and related trend analysis, and both user and vendor analysis for multi-user technical server technology used for HPC and HPDA (high performance data analysis). We provide thought leadership and practical guidance for users, vendors and other members of the HPC community by focusing on key market and technology trends across government, industry, commerce, and academia.

Headquarters

365 Summit Avenue
St. Paul, MN 55102
USA

612.812.5798

www.hpcuserforum.com and www.HPCatHyperion.com

Copyright Notice

Copyright 2019 Hyperion Research LLC. Reproduction is forbidden unless authorized. All rights reserved. Visit www.hpcuserforum.com or www.HyperionResearch.com to learn more. Please contact 612.812.5798 and/or email info@hyperionres.com for information on reprints, additional copies, web rights, or quoting permission.