



HYPERION RESEARCH

Hyperion Research Market Update and High Growth Areas

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www.HyperionResearch.com
www.hpcuserforum.com

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Example Research Areas

(www.HyperionResearch.com & www.HPCUserForum.com)

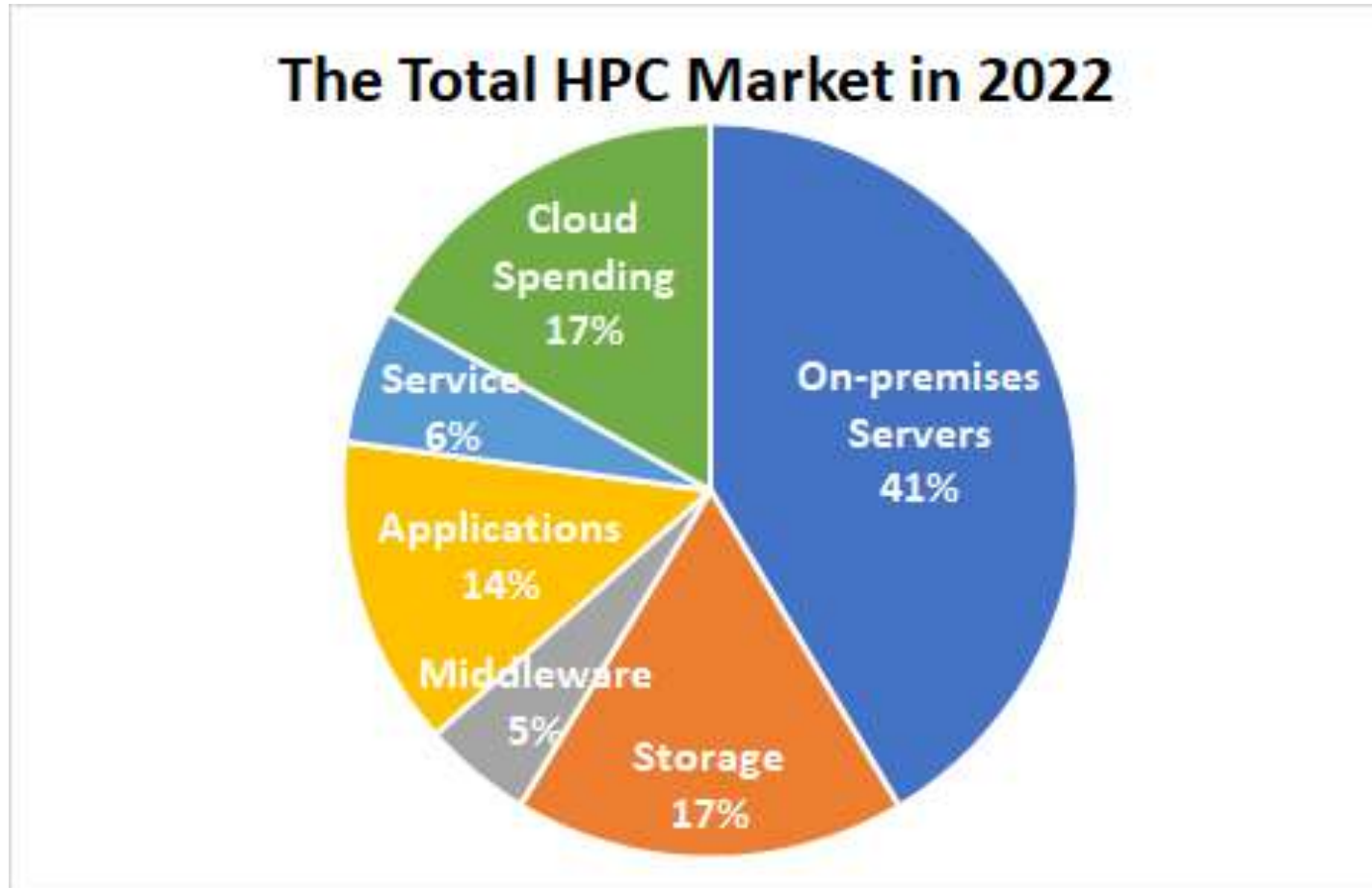
- **Traditional HPC**
- **AI, ML, DL, Graph**
- **Cloud Computing**
- **Storage & Data**
- **Interconnects**
- **Software & Applications**
- **Power & Cooling**
- **Tracking all Processor Types & Growth rates**
- **Quantum Computing**
- **R&D and Engineering -- all types**
- **Edge Computing**
- **Supply Chain Issues**
- **Sustainability**



HPC Market Update

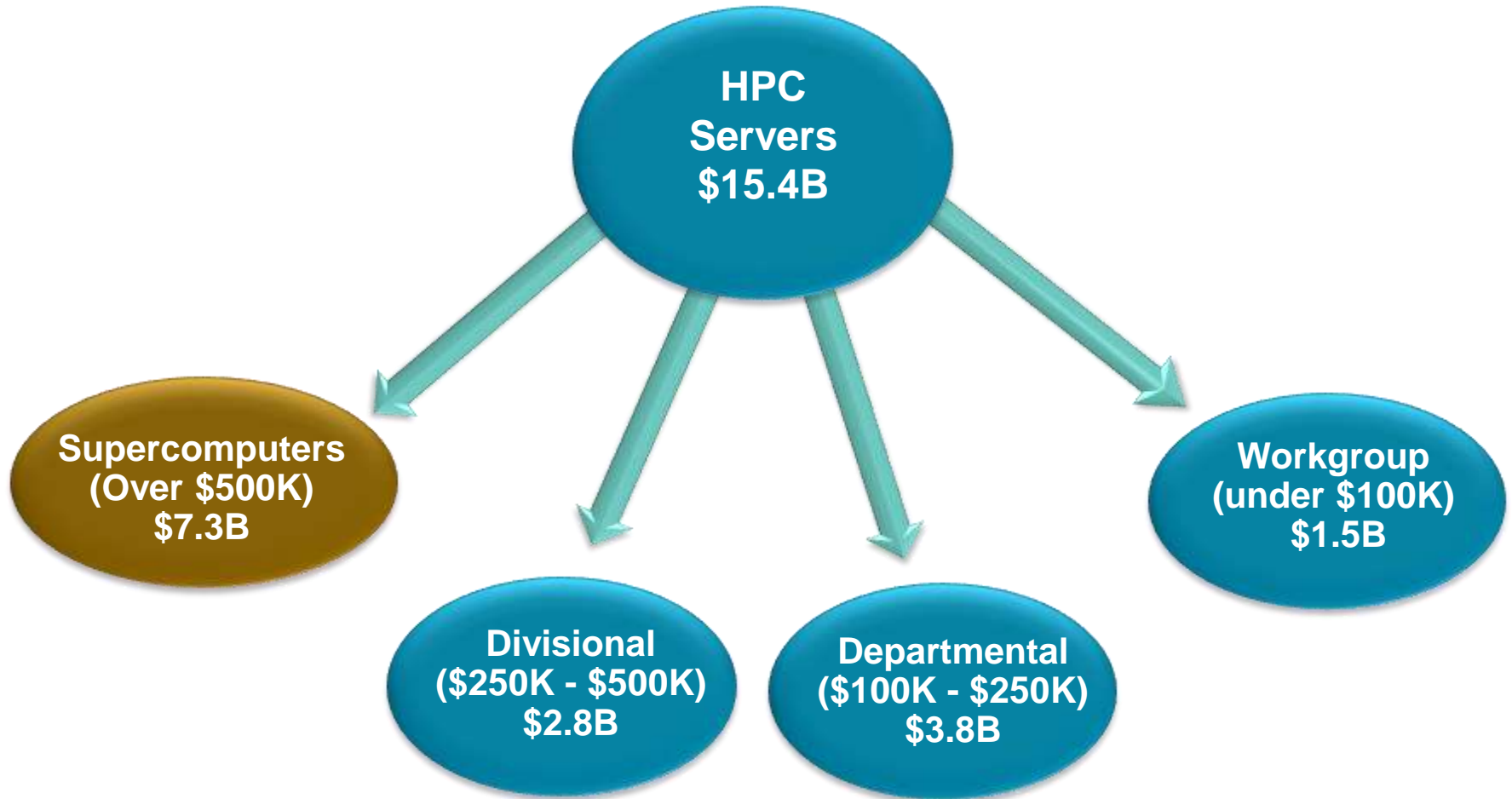
The Overall HPC Market in 2022

Looking at the overall HPC market, including servers, cloud usage, storage, software and repair services = \$37.3 billion USD



The 2022 Worldwide On-Prem HPC Server Market: \$15.4 Billion (up 4.3%)

2023 is projected to be around \$16.3 Billion



2022 WW HPC On-Prem Market by Vendor and Sector (\$ Millions)

HPC On-premises Server Market (\$M)	
Vendor	2022
HPE	\$5,137
Dell Technologies	\$3,575
Lenovo	\$1,201
Inspur	\$1,073
Sugon	\$603
IBM	\$505
Atos	\$480
Fujitsu	\$230
NEC	\$207
Penguin	\$442
Other	\$1,988
Total	\$15,441

Source: Hyperion Research, 2023

HPC On-premises Server Market (\$M)	
Sector/Vertical	2022
Bio-Sciences	\$1,449
CAE	\$1,768
Chemical Engineering	\$173
DCC & Distribution	\$826
Economics/Financial	\$757
EDA / IT / ISV	\$873
Geosciences	\$998
Mechanical Design	\$57
Defense	\$1,602
Government Lab	\$3,342
University/Academic	\$2,677
Weather	\$700
Other	\$221
Total	\$15,441

Source: Hyperion Research, 2023

The HPC Market Should Grow in 2023

AI and cloud spending are growing quickly

- **2023 is forecasted to reach an all-time high of around US \$17 billion in on-prem HPC servers with US \$33 billion in total on-premises HPC spending**
- **But there are a number of issues:**
 - The overall economy is putting pressure on many buyers
 - The supply chain issues are getting more difficult (e.g., GPUs)
 - The lower end of the on-premises market continues to struggle
- **Growth drivers include:**
 - New use cases especially in AI/LLMs/Generative AI are providing many new areas for users to advance their research
 - Countries and companies around the world continue to recognize the value of being innovative and investing in R&D to advance society, grow revenues, reduce costs, and become more competitive
 - Cloud computing is becoming more useful to a larger set of HPC workloads

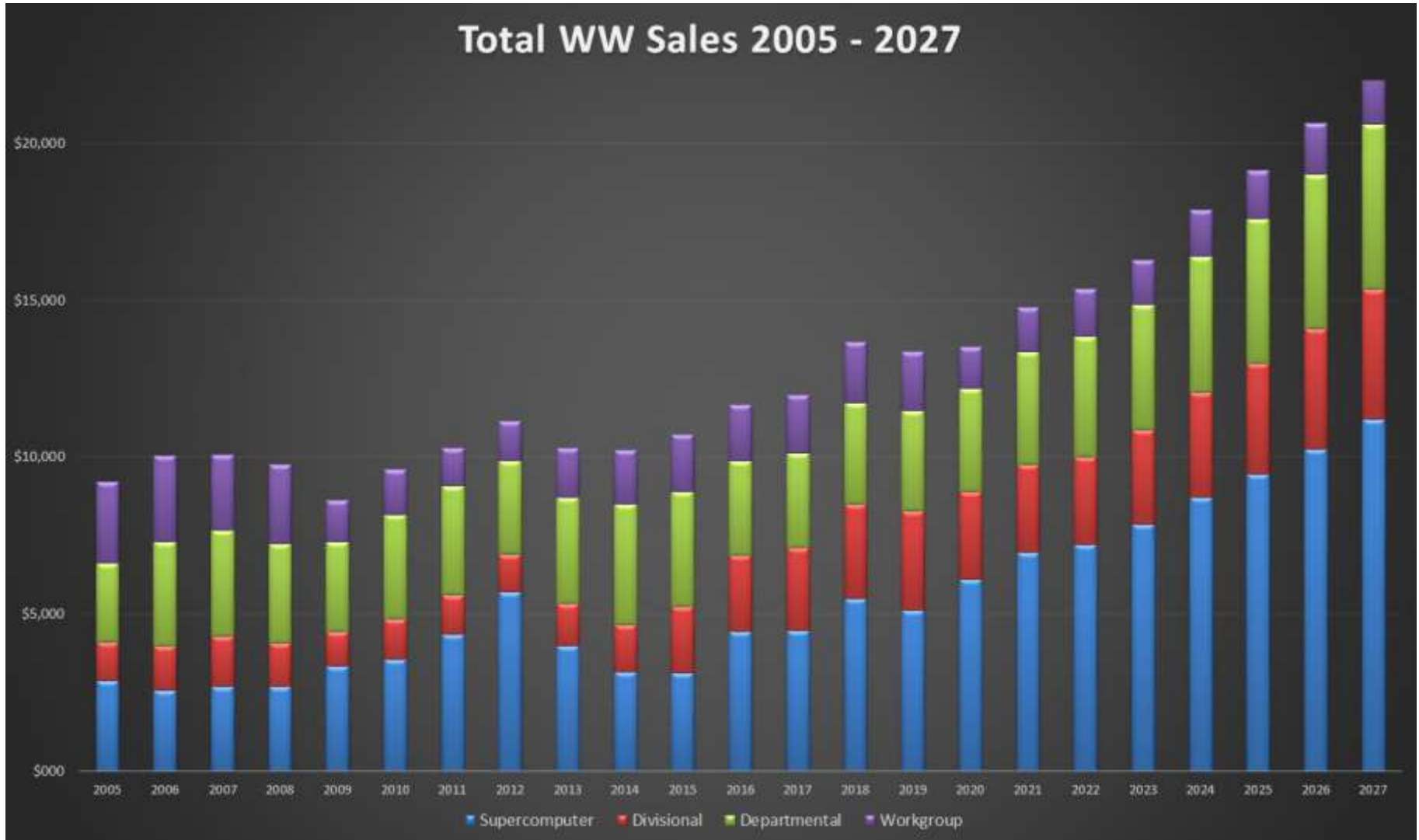
5-Year On-Prem HPC Server Forecast

7.7% yearly average growth over the next 5 years

Worldwide HPC Market Revenue Forecast by Competitive Segment

(\$M)	2021	2022	2023	2024	2025	2026	2027	CAGR 22-27
Supercomputer	\$6,971	\$7,219	\$7,859	\$8,729	\$9,458	\$10,261	\$11,219	9.2%
Divisional	\$2,783	\$2,805	\$3,029	\$3,329	\$3,536	\$3,848	\$4,131	8.0%
Departmental	\$3,614	\$3,826	\$3,970	\$4,342	\$4,602	\$4,919	\$5,270	6.6%
Workgroup	\$1,412	\$1,519	\$1,423	\$1,488	\$1,533	\$1,606	\$1,686	2.1%
Total	\$14,781	\$15,369	\$16,281	\$17,889	\$19,129	\$20,634	\$22,306	7.7%
<i>Source: Hyperion Research</i>								

HPC Historic & Forecasted Revenues



The Broader On-Prem Market

2022 total HPC spending reached \$32.4 B
2027 is projected to reach \$44 B

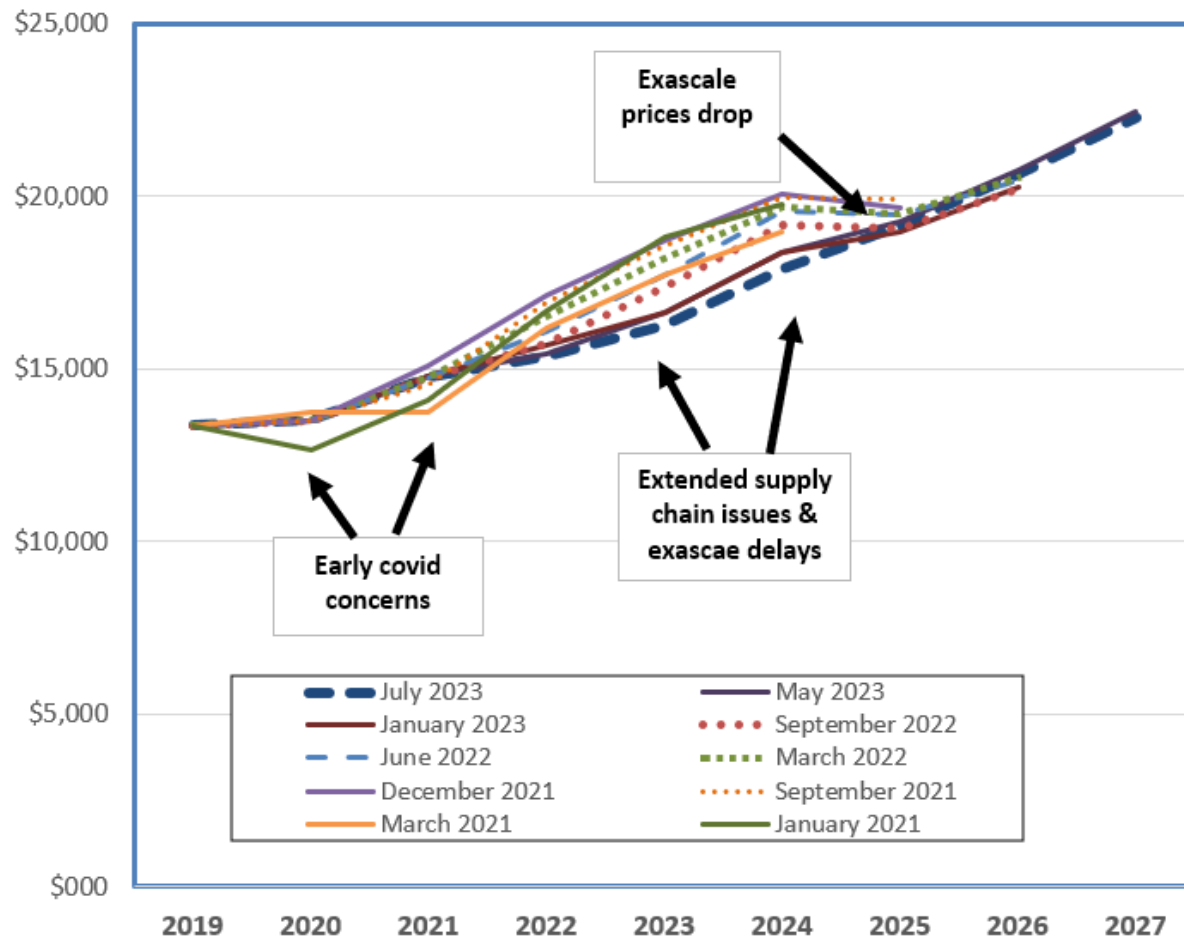
Revenues by the Broader HPC Market Areas								
(\$M)	2021	2022	2023	2024	2025	2026	2027	CAGR 22-27
Server	\$14,781	\$15,369	\$16,281	\$17,889	\$19,129	\$20,634	\$22,306	7.7%
Storage	\$5,985	\$6,380	\$6,838	\$7,663	\$8,329	\$9,048	\$9,883	9.1%
Middleware	\$1,733	\$1,781	\$1,863	\$2,024	\$2,133	\$2,287	\$2,472	6.8%
Applications	\$4,960	\$5,069	\$5,254	\$5,658	\$5,970	\$6,367	\$6,849	6.2%
Service	\$2,272	\$2,214	\$2,192	\$2,258	\$2,294	\$2,315	\$2,477	2.3%
Total Revenue	\$29,731	\$30,813	\$32,429	\$35,491	\$37,856	\$40,651	\$43,987	7.4%

Source: Hyperion Research

5-year HPC Server Forecast Changes

Updating quarterly due to covid & supply chain issues

Worldwide HPC On-Premises Server Market Revenues



High Growth Areas

The Exascale Market (System Acceptances)

Over 45 systems and over \$13 billion in value

Exascale and Near-Exascale Leadership System Acceptances (2020 to 2027)								
Year Accepted	China	Europe	Japan	US	Other Countries*	Total Systems	Total Value	
2020			1 near-exascale system ~\$1.1B			1	\$1.1B	
2021	2 exascale ~\$350M each	1 pre-exascale system ~\$180M	--	1 pre-exascale system ~\$200M	--	4	\$1.1B	
2022	1 exascale ~\$350M	2 pre-exascale systems ~\$390M total	--	1 exascale system ~\$600M (2/3 accepted 2022)	--	4	\$1.1B	
2023	1 exascale system ~\$350M	1 or 2 pre-exascale systems ~\$150M each	1 near-exascale system ~\$150M	1 exascale system ~\$600M + remaining 1/3 of Frontier system	--	5-6	\$1.5B - \$1.6B	
2024	1 exascale system ~\$350M	1 exascale ~\$350M, plus 1 exascale (or pre) system ~\$200M	?	1 exascale system ~\$600M	1 pre-exascale system ~\$125M	5	~\$1.6B	
2025	1 or 2 exascale systems ~\$300M each	2 or 3 exascale systems ~\$350M each	1 exascale system ~\$200M	1 or 2 exascale systems ~\$350M each	1 near-exascale system ~\$125M	6-9	\$1.7B - \$2.7B	
2026	2 exascale systems ~\$300M each	2 or 3 exascale systems ~\$325M each	?	1 or 2 exascale systems ~\$325M each	1 or 2 exascale systems ~\$150M each	6-9	\$1.7B - \$2.5B	
2027	2 exascale systems ~\$275M each	2 or 3 exascale systems ~\$300M	1 exascale system ~\$150M	1 or 2 exascale systems ~\$275M each	2 or 3 exascale systems ~\$130M each	8-11	\$1.8B - \$2.5B	
2028	2 exascale systems ~\$250M each	2 or 3 exascale systems ~\$275M	1 or 2 exascale systems ~\$150M each	1 or 2 exascale systems ~\$275M each	2 or 3 exascale systems ~\$125M each	8-12	\$1.7B - \$2.6B	
Total	12-13	14-19	5-6	8-12	7-10	47-61	\$13.4B - \$16.8B	

* Includes S. Korea, Singapore, Australia, Russia, Canada, India, Israel, Saudi Arabia, etc.

Note: After 2023, many exascale systems will be 2-10 exascale.

Source: Hyperion Research, August 2023

94.3% of Sites Have Accelerators in Their Largest System Today

Up from 82.7% in 2021

In Mid 2021

In Late 2022

How many co-processors or accelerators are in your largest HPC technical server?

	Responses	Percent
None	23	17.3%
Less than 32	28	21.1%
32 to less than 64	18	13.5%
64 to less than 100	19	14.3%
100 to less than 500	18	13.5%
500 to less than 1,000	11	8.3%
1,000 to less than 5,000	10	7.5%
5,000 to less than 10,000	4	3.0%
10,000 or more	2	1.5%
n = 133		
Source: Hyperion Research, 2021		

Largest System Accelerator Count

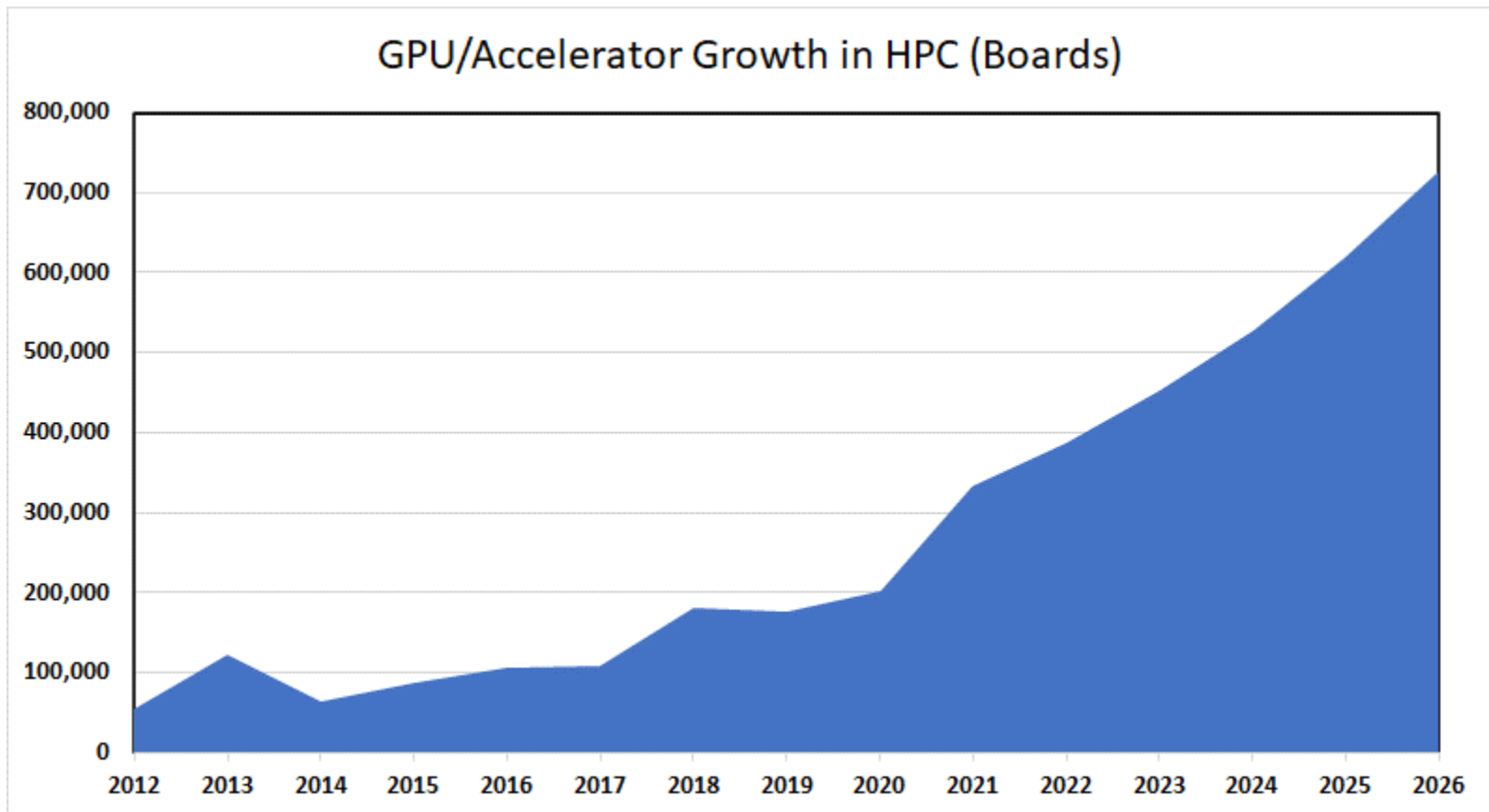
Q: How many compute-oriented accelerators/co-processors are in your largest on-premises HPC technical server?

	Overall Percent
None	5.7%
Less than 32	24.4%
32 to less than 64	15.3%
64 to less than 100	12.5%
100 to less than 500	13.1%
500 to less than 1,000	7.4%
1,000 to less than 5,000	7.4%
5,000 to less than 10,000	2.8%
10,000 to less than 50,000	2.3%
50,000 to less than 100,000	4.0%
100,000 to less than 250,000	3.4%
250,000 to less than 500,000	0.6%
750,000 to less than 1,000,000	0.6%
1,000,000 to less than 5,000,000	0.6%
n = 176; 104; 20; 52	
Source: Hyperion Research, 2023	

11.5%

GPU/Accelerator Forecast

Anticipated high growth for accelerators over next 5 years



The HPC Cloud Market Will See Strong Growth in 2023

The growth will build on the fundamental changes in buying behavior seen in 2021

- **In 2021 HPC & AI buyers around the world revealed for the first time that HPC buyers are planning to shift some of their on-premises budgets to spending in the cloud**
- **End user spending on public cloud resources to run HPC workloads is projected to grow substantially at a rate of 18% over the next five years, and will reach US \$11.6 billion in 2026**
 - This strong growth reflects the heavy work that the cloud service providers (CSPs) have done to make clouds more HPC friendly
 - Users have also gone through extensive work to profile and evaluate where clouds make the most sense
- **This major shift in buying behavior doesn't mean that on-premises HPC systems are going away**
 - The on-premises HPC server market is anticipated to exhibit healthy growth, 7%-8% a year, over the forecast period

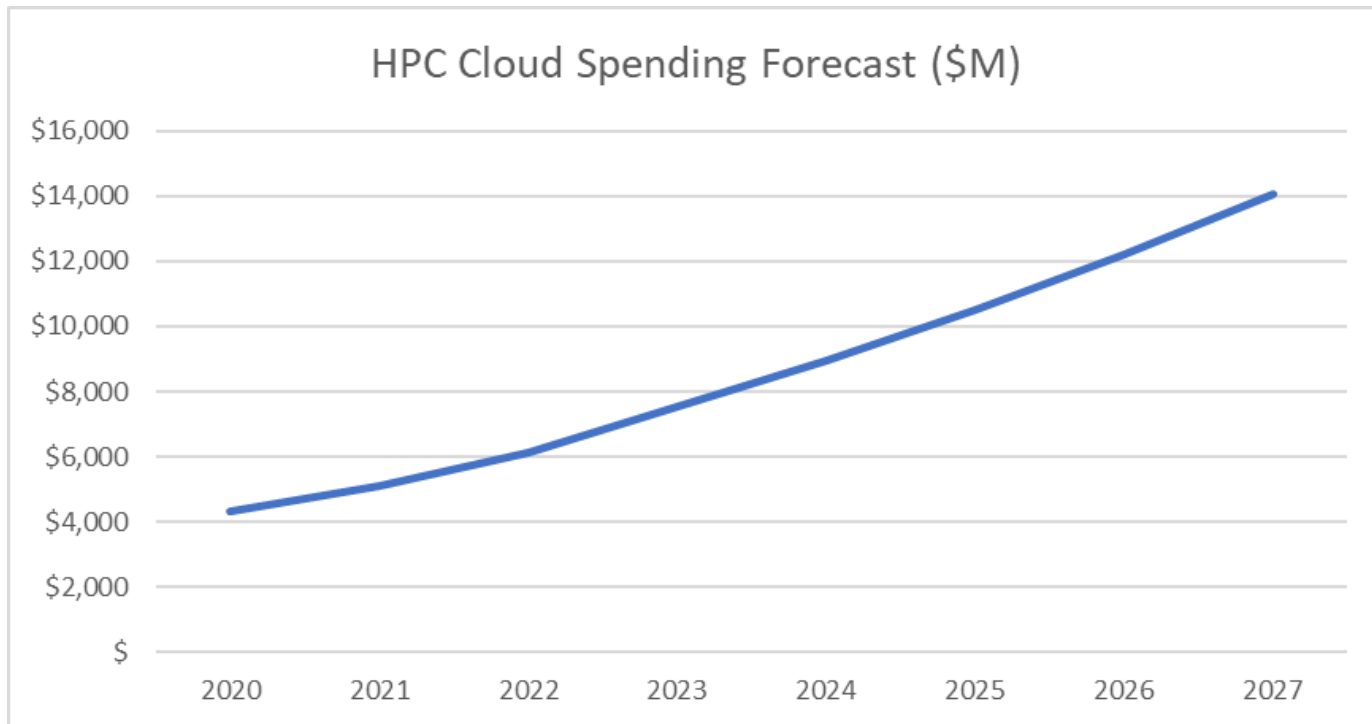
HPC Cloud Usage Forecast

18.1% growth over the next 5 years

HPC Cloud Spending (\$M)

	2020	2021	2022	2023	2024	2025	2026	2027	CAGR 22-27
HPC Cloud Spending	\$4,300	\$5,100	\$6,132	\$7,516	\$8,931	\$10,510	\$12,197	\$14,069	18.1%

Source: Hyperion Research, 2023



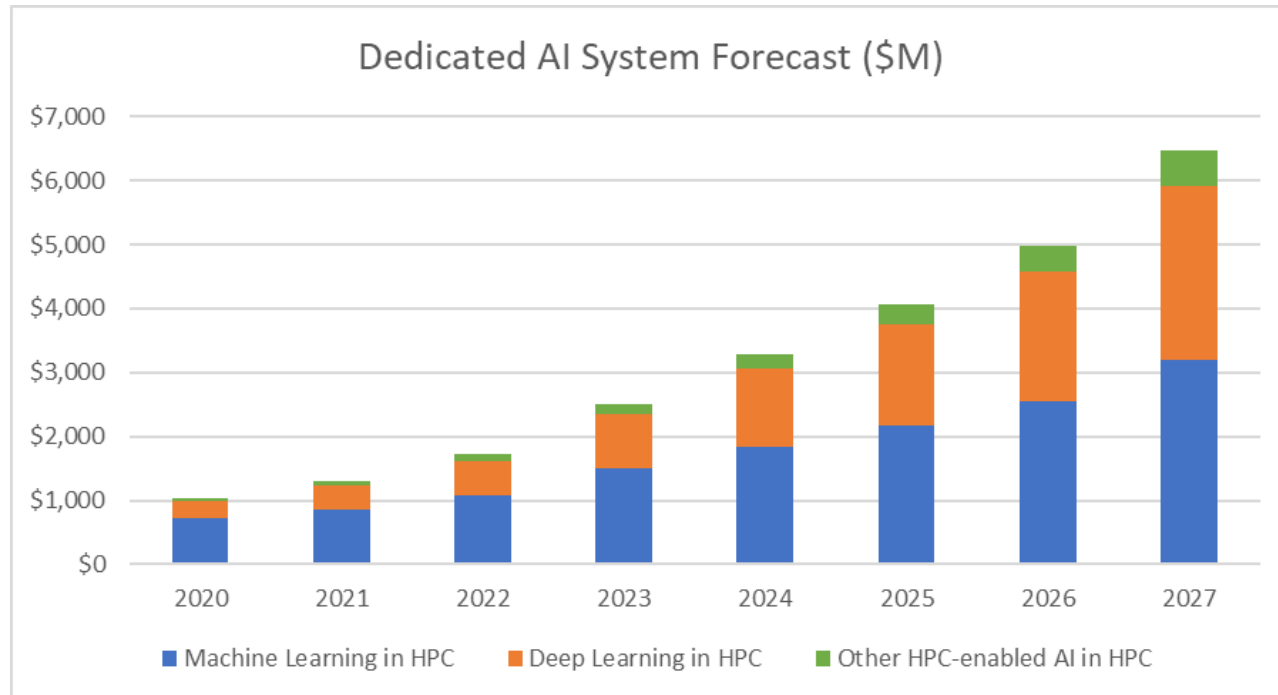
AI Forecast

30.4% growth over the next 5 years

Worldwide HPC-Enabled AI Forecast (ML, DL & Other AI) Server Revenue (\$M)

	2020	2021	2022	2023	2024	2025	2026	2027	CAGR 22-27
ML in HPC	\$719	\$867	\$1,081	\$1,500	\$1,841	\$2,166	\$2,553	\$3,191	24.2%
DL in HPC	\$263	\$366	\$532	\$855	\$1,216	\$1,584	\$2,016	\$2,727	38.6%
Other AI in HPC	\$57	\$75	\$104	\$160	\$230	\$312	\$401	\$548	39.4%
Total HPC-Enabled AI Server Revenue	\$1,039	\$1,309	\$1,718	\$2,514	\$3,286	\$4,062	\$4,970	\$6,466	30.4%

Source: Hyperion Research, 2023



Conclusions

- **2022 was a soft growth year with a 4.3% increase**
 - 2023 is expected to be a moderate growth year
 - GPUs, cloud, AI/ML/DL/LLM are high growth areas
- **New technologies are showing up large numbers:**
 - Generative AI and LLMs is fueling a new level of growth
 - Processors, AI hardware & software, memories, new storage approaches, etc.
 - Quantum
- **The cloud has become a viable option for many HPC workloads**
 - HPC in the cloud is lifting the sector writ large
- **Storage will likely see major growth driven by AI, big data and the need for much larger data sets**
- **There are still concern about the supply chain and growing concerns around power & talent**
- **Diversity in HPC needs to be addressed**

A Concern: HPC Expertise Shortage

The growing scarcity of HPC experts to implement new technologies is the number one roadblock for many HPC sites

- **Two major trends:**
 - 1) A shrinking HPC workforce
 - 2) A massive increase in system complexity
- **HPC experts are an aging workforce**
 - The pipeline of new HPC staff entering the workforce does not adequately match the outflow of retirees
 - Competition for HPC staff will intensify
- **Increasingly complex workloads are more difficult to manage**
 - Increasing HPC systems per site
 - Augmenting traditional modeling/simulation with AI and big data
 - Incorporating multiple processor types, co-processors, accelerators, and other specialized hardware
 - Balancing on-prem and cloud
 - And Enterprise IT users are entering HPC space, and need HPC expertise
- **HPC users will need major improvements in ease-of-use, ease-of-selection, & ease-of-optimization**

Thanks for joining us today!



**We welcome questions,
comments and suggestions**

**Please contact us at:
info@hyperionres.com**

Next On The Agenda

- **HPC Market Update, Earl Joseph, Hyperion Research**
(Session Leader: Rupak Biswas, NASA)
- **8:15 - 11:45 am New Advances in Using HPC & AI Combined: Examples and Successes Using AI, Generative AI and Large Language Models**
 - **8:15-8:40 am Generative AI Design of Peptide Therapeutics, Nicholas Nystrom, Peptilogics**
 - **8:40-9:05 am HPC+AI for Earth Sciences at NERSC, Peter Harrington, LBL**
 - **9:05-9:35 am Artificial Intelligence: Disrupting Law, Gary Marchant, Arizona State University**
 - **9:35-9:55 am New Research on How LLMs are Evolving, Bob Sorensen, Hyperion Research**
 - **Break at 9:55 to 10:10 am**

About Hyperion Research



(www.HyperionResearch.com & www.HPCUserForum.com)

Hyperion Research mission:

- Hyperion Research helps organizations make effective decisions and seize growth opportunities
 - *By providing research and recommendations in high performance computing and emerging technology areas*

HPC User Forum mission:

- To improve the health of the HPC/AI/QC industry
 - *Through open discussions, information sharing and initiatives involving HPC users in industry, government and academia along with HPC vendors and other interested parties*