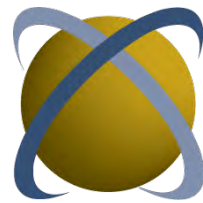
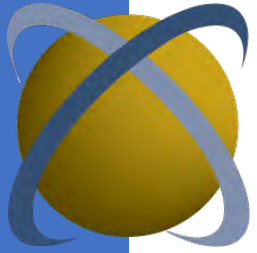


# Worldwide HPC Market 2019 Actuals, 2020-24 Forecast, Including Effects of COVID-19

August 2020



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# Upcoming HPC Market Reports

Intersect360 Research will publish full written research reports for the data in this presentation, in the following segmentations:

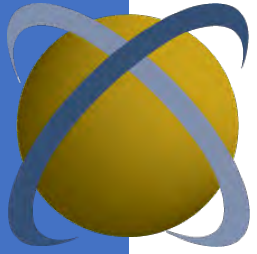
## July 2020:

- Products and Services
- Vertical Markets
- Server vendor market shares\*
- Storage vendor market shares\*

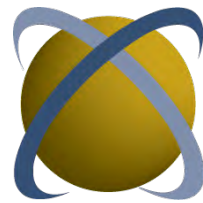
## August 2020:

- Geographic regions
- Server classes
- Software categories
- Services categories
- Cloud categories

\* Market shares for 2018-19 only, not forecast.



# Worldwide HPC Market 2019 vs. 2018

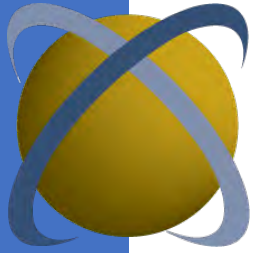


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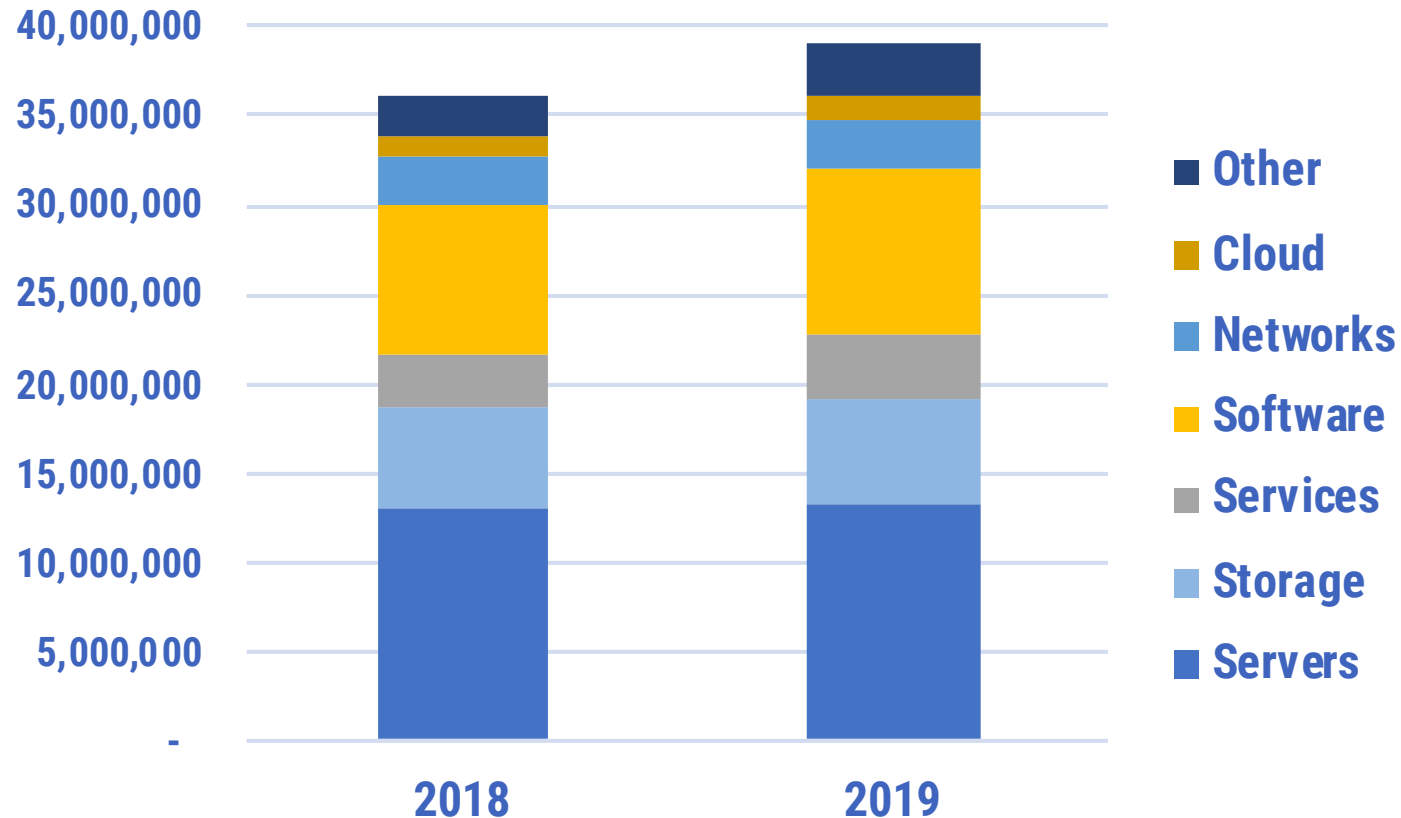


# HPC Market in 2019: Notes

- Worldwide HPC market was **\$39.0 billion in 2019**, up 8.2% from \$36.1 billion in 2018
  - This was about a point higher than our forecast
  - Government led growth in 2019, after six years of growth led by industry
- Uneven distribution by product/service segment:
  - Servers and storage each grew between 2% and 3%
  - Major growth in cloud **and cloud-like** deployments
- Top vendors declined in market share relative to others; no major changes in rank



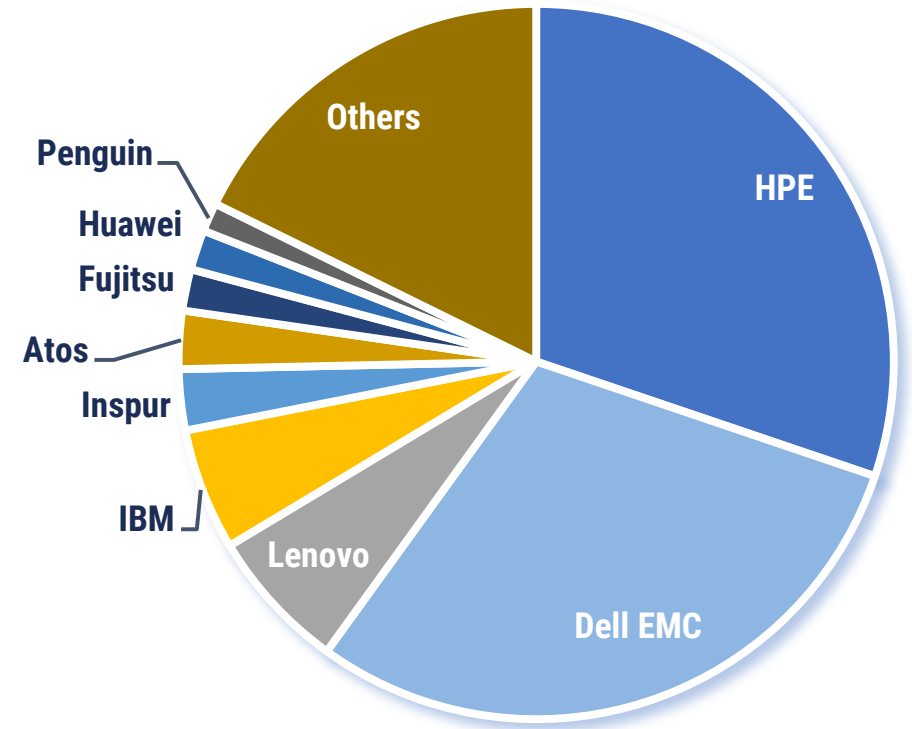
# Products and Services (\$000): 2018 vs 2019

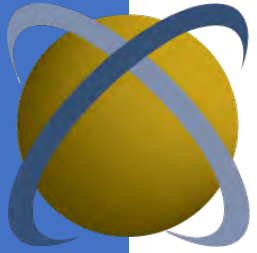




# HPC Server Revenue Market Share

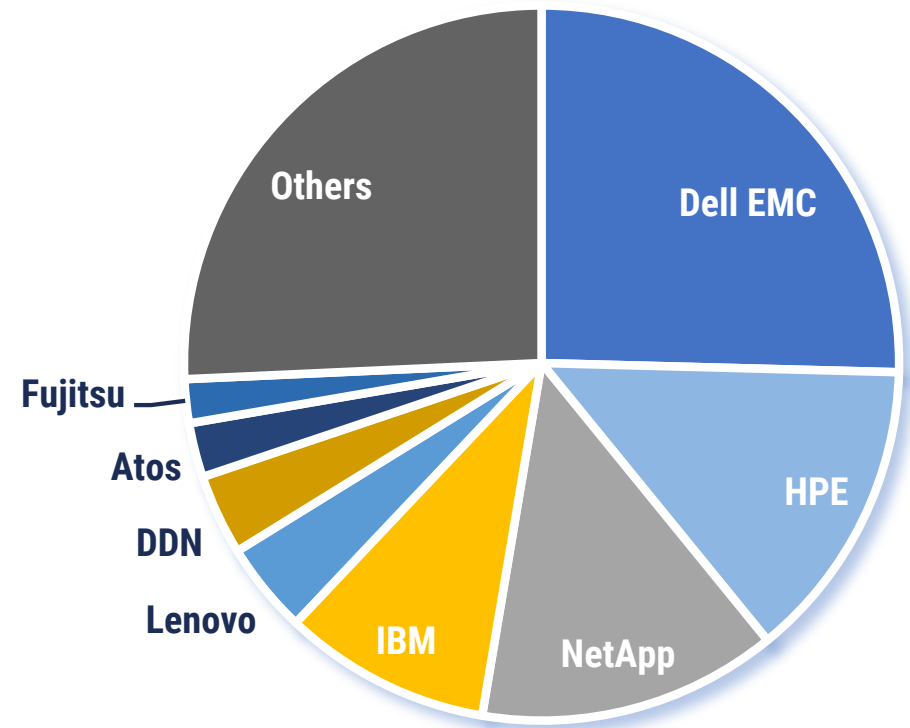
- Leaders HPE, Dell both slightly down in 2019; still 60% share combined
- Virtual tie for #1; HPE leads by less than half a percentage point
- HPE revenue includes Cray revenue post acquisition, completed in September 2019; Cray revenue prior to acquisition is in “Others”
- Lenovo largest vendor with year-over-year growth
- IBM failed to sustain growth from 2018
- Double-digit growth for **Atos**, Penguin, Inspur, and Fujitsu
- Huawei strong internationally despite trade and political issues with U.S.
- Notable “Others”: NEC, **NVIDIA**, Sugon, Supermicro

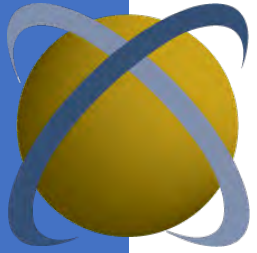




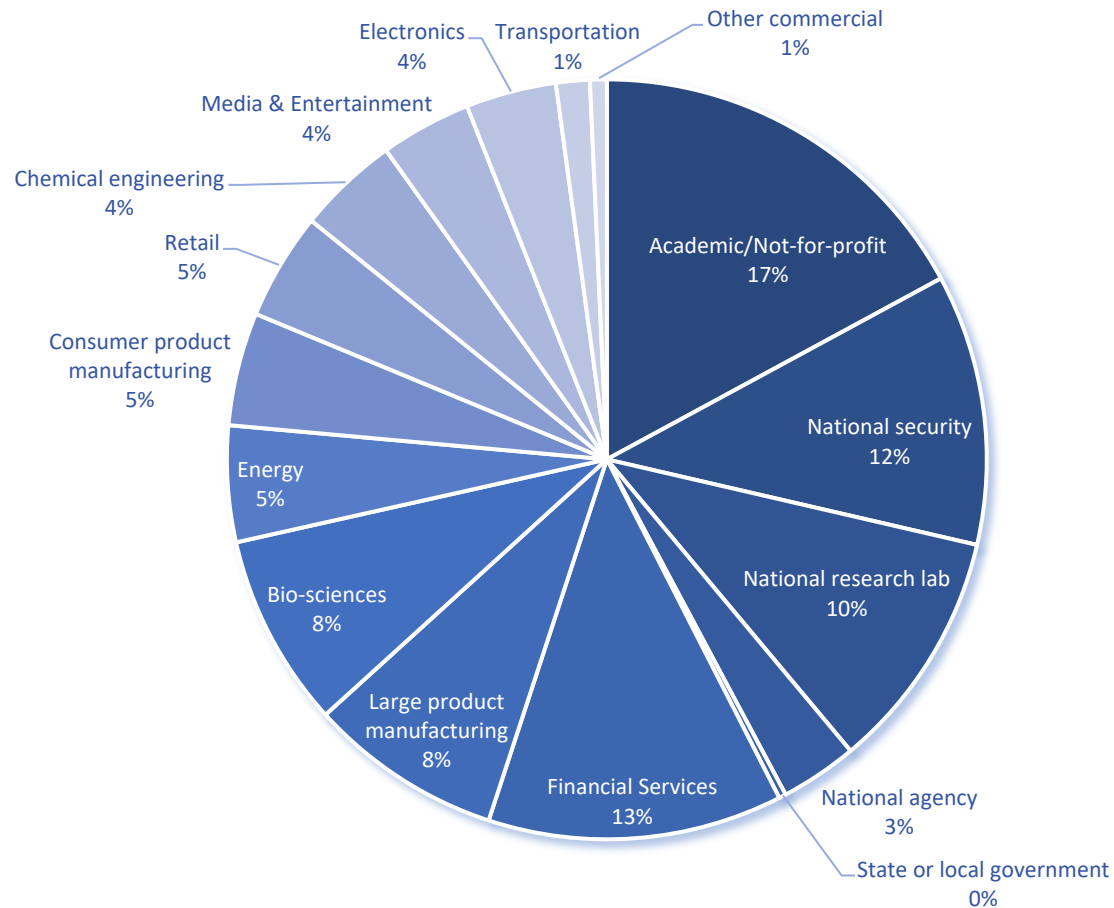
# HPC Storage Revenue Market Share

- Top four vendors all lost revenue from 2018; still combine for over 60% share
- HPE, Dell, IBM all slightly down in 2019
- NetApp fell from #2 to #3 with a poor year
- Revenue is assigned to seller; NetApp partnership with Lenovo moved some revenue from the former to the latter
- Double-digit growth for **Atos**, **DDN**, and Fujitsu
- Some of Atos' growth is resale of DDN product; DDN true growth rate is even higher
- HDS has been moved to "Others" due to lack of focus on HPC. HDS had 5.0% share in 2018
- Notable "Others": HDS, Huawei, Inspur, **Intel**, Panasas, Quantum, Qumulo, Spectra, WekaIO



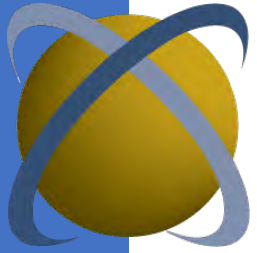


# HPC Vertical Markets: 2019

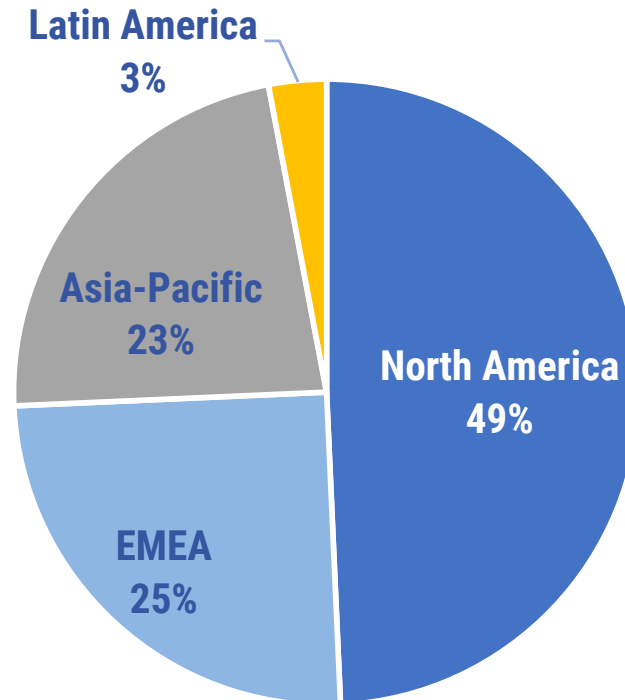


- Academia, 17.1%
- Government, 25.4%
- Industry, 57.5%
- Government led HPC in growth in 2019, after six years of growth led by industry.
- No major shakeups in 2019; these will come in 2020 with forecast adjusted for COVID-19.
- Manufacturing is the largest commercial segment if *large product manufacturing* (auto/aero) and *consumer product manufacturing* are combined; otherwise, *financial services* is largest

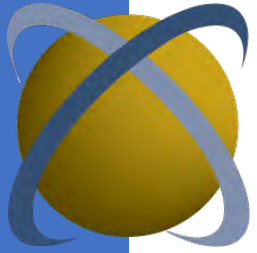




# HPC Global Regions: 2019

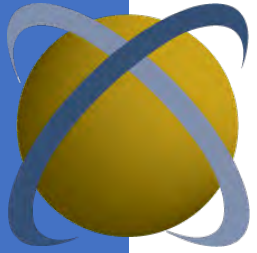


- All regions grew year-over-year; growth was higher outside the U.S.
- Asia-Pacific led in growth with strength region-wide, including China, Japan, Australia, etc.
- North America (U.S. plus Canada) is now less than half the market, and declining

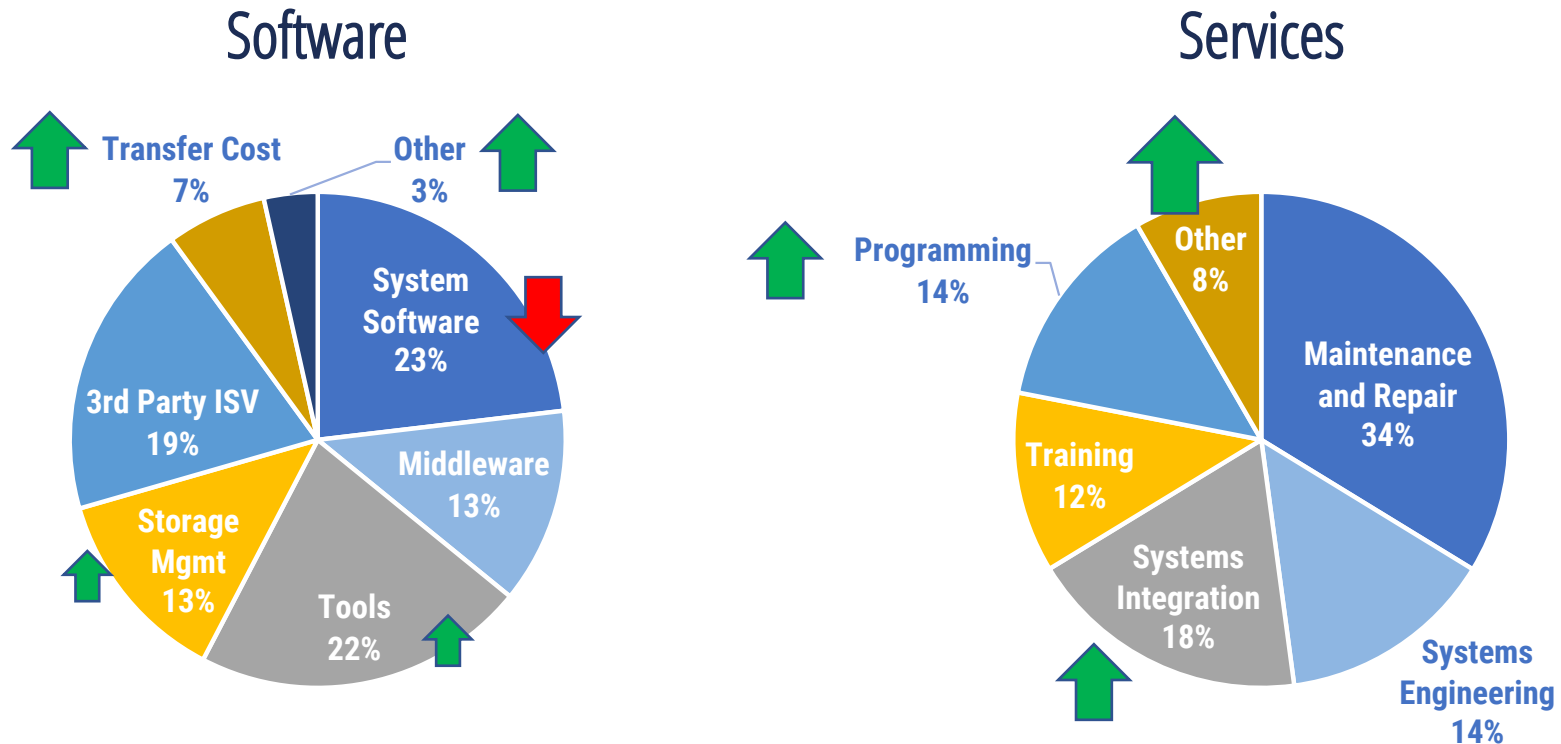


# HPC Server Classes (\$000): 2019





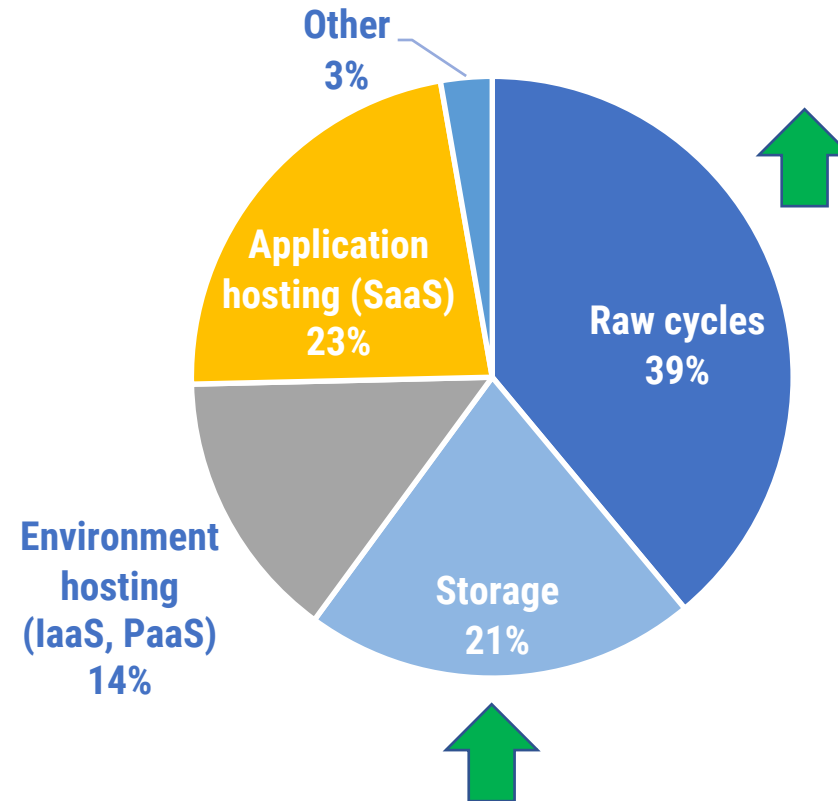
# HPC Software and Services Categories: 2019

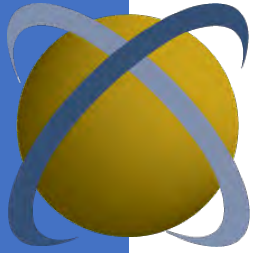


“Other” categories, especially *Services: Other*, showed growth from “cloud-like” deployments.

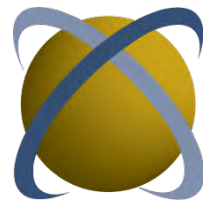


# HPC Cloud Categories: 2019





# Worldwide HPC Market Forecast Five-Year Forecast, 2020 to 2024



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# HPC Market Forecast to 2024: Notes

- Worldwide HPC market will grow to **\$55.0 billion in 2024**, 7.1% CAGR from 2019.
- **Cloud will continue to grow at over 20% CAGR** and have a major effect on the market.
- The government sector will have the highest CAGR over the next five years.
- HPC server revenue growth will continue to concentrate in larger configurations
  - Fueled in part by Exascale computing
  - Lower-end systems have higher replacement by cloud computing

The global COVID-19 pandemic will have a dramatic effect on HPC market revenue in 2020-2023, including lost revenue. By 2024, the HPC market will be back to its original growth curve. There is no effect on CAGR.



# The Hazards of Forecasting

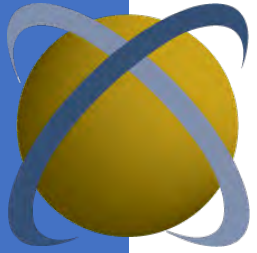
“

*When you make a forecast,  
it has to be bound by what's realistic.*

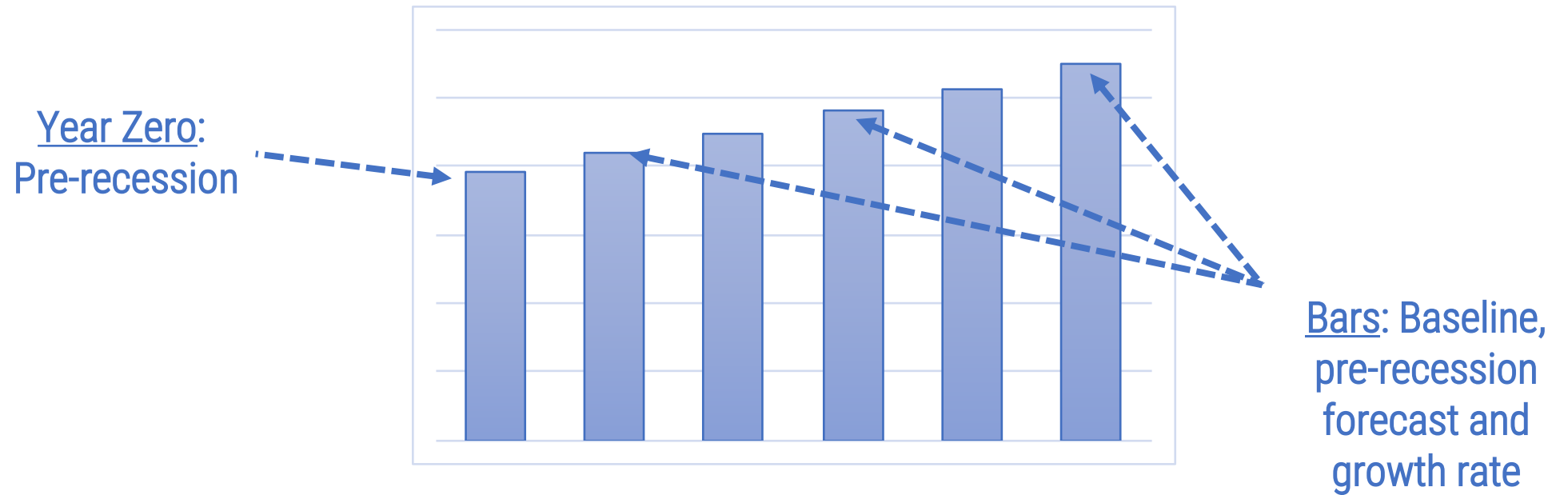
*Reality has no such restriction.*

”

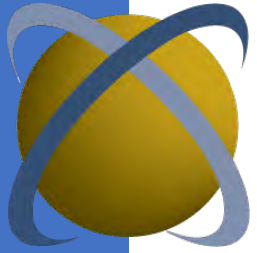
Christopher G. Willard, Ph.D.  
Intersect360 Research Co-Founder



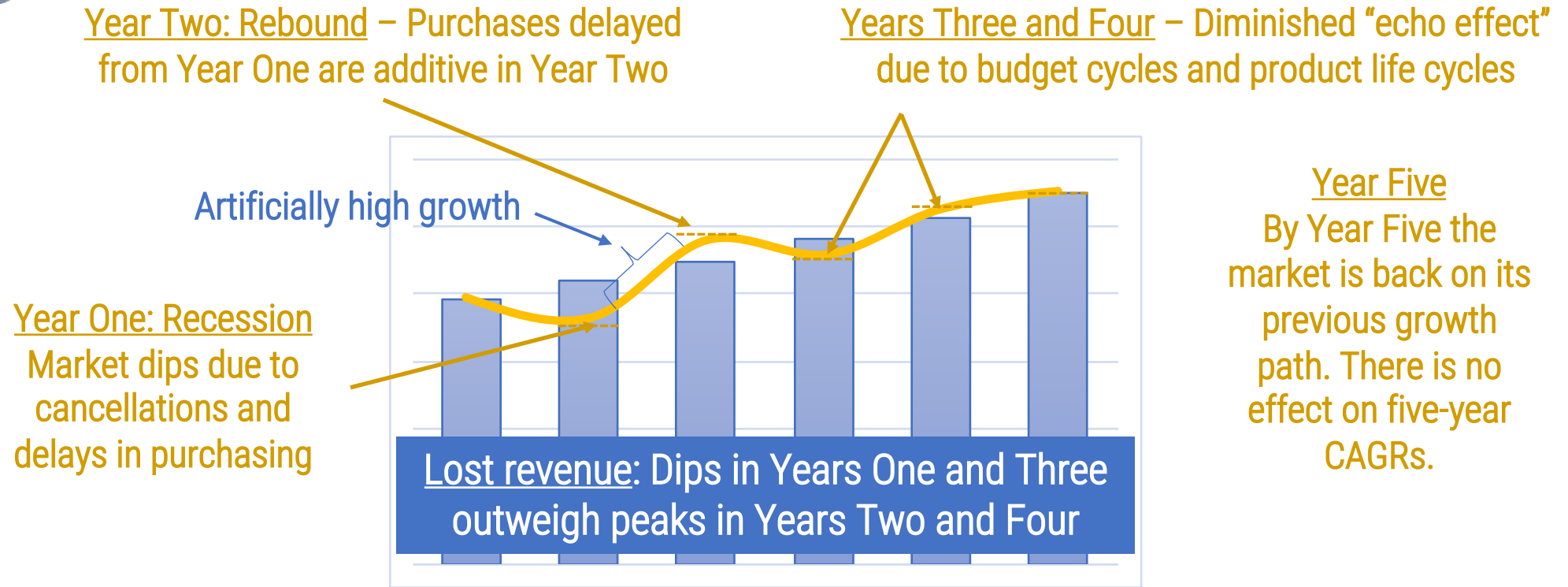
# The Shape of an HPC Recession



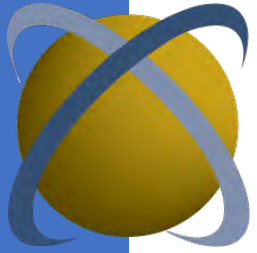




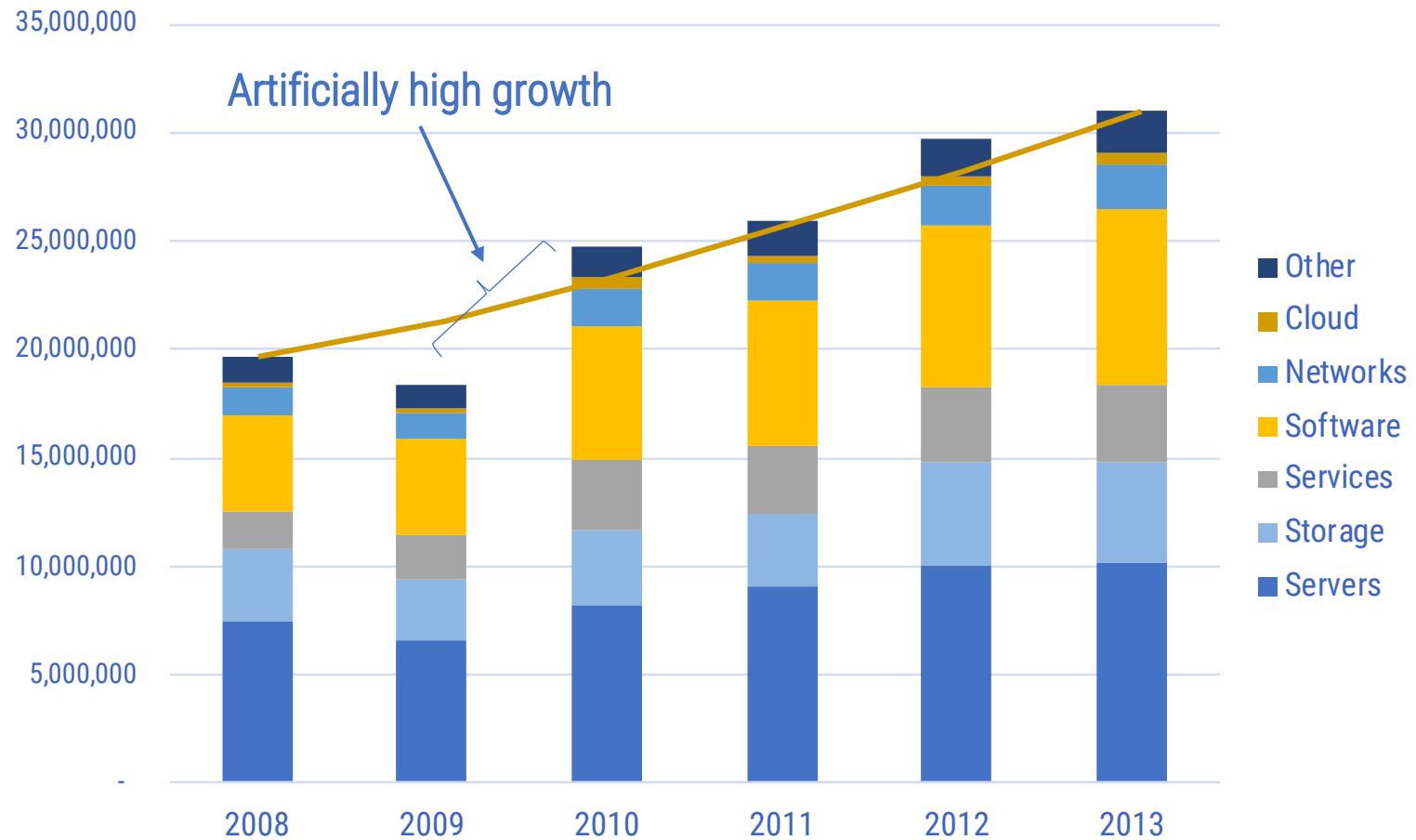
# The Shape of an HPC Recession

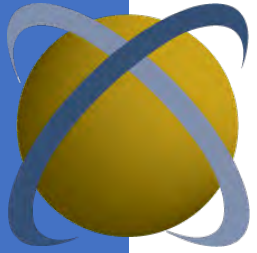


The HPC market followed this pattern in 2009-15 after recession in 2009.  
HPC Storage also followed this pattern after supply chain disruptions due to flooding in Southeast Asia in 2011.



# HPC Market History: 2009 Recession





# Forecasting the Effect of COVID-19

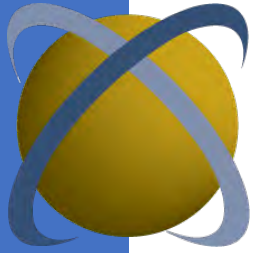
1. Complete forecast as normal, using pre-pandemic budget expectations and trends.
2. Model expected multi-year effect by **vertical market**. This is the primary consideration.
3. Create secondary multi-year models by product segment, regions, and sub-categories.
  - Ensure consistency between models.
  - Rectify totals to correspond with vertical market analysis.
4. Calculate total loss (or gain) by segment; translate into revised forecast.

For additional information on methodology, see:  
*Worldwide High Performance Computing Market Forecast:  
Pre-Announce Guidance Related to the Effects of COVID-19, March 2020.*



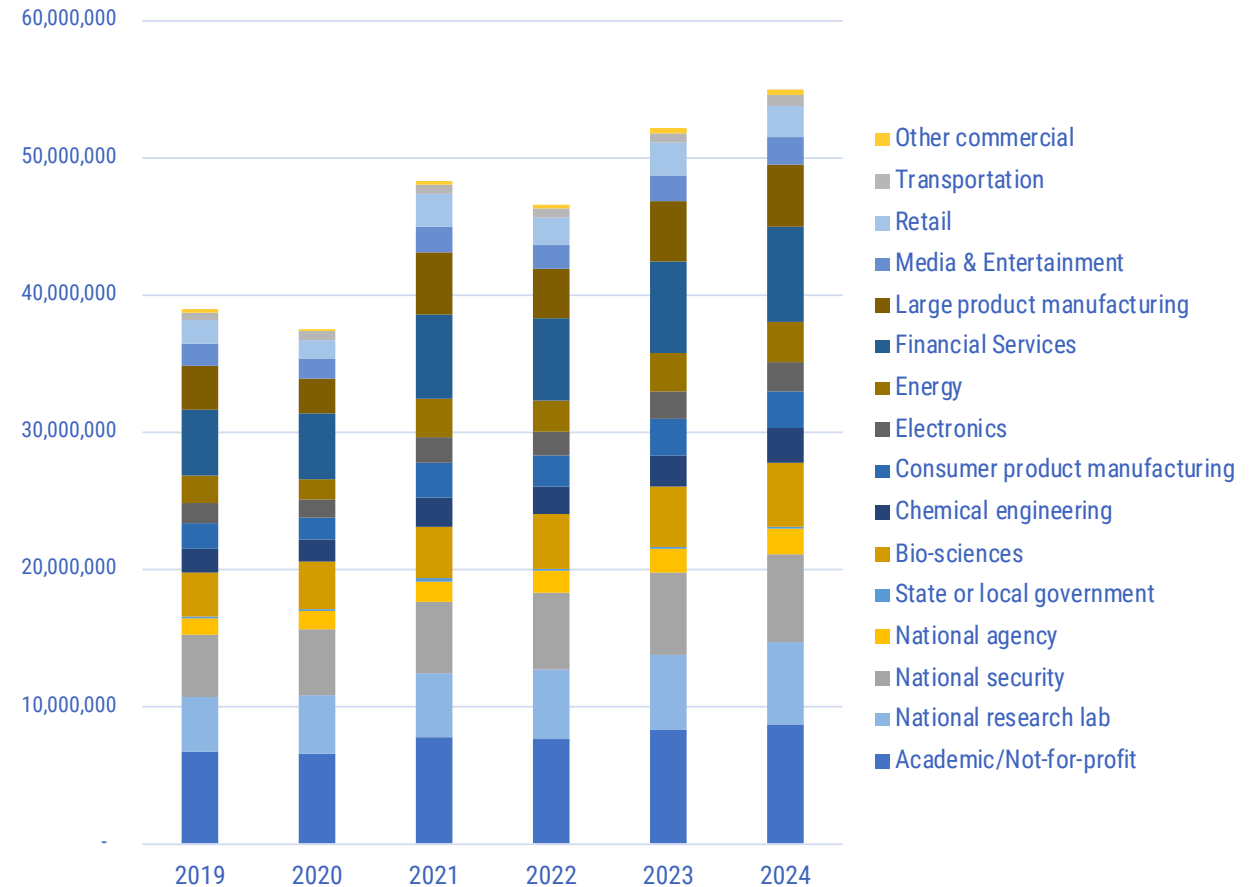
# HPC Market Forecast: COVID-19 Adjustment

- Worldwide HPC market will fall **10.1% below baseline forecast for 2020**
  - Translates to **\$4.2 billion** below baseline forecast
  - Nullifies previously forecasted growth; now **3.7% decline year-over-year**
  - Forecasting first year of HPC market decline since 2009
- Most revenue is delayed, not lost. 2021 will be a rebound year: **8.0% above baseline forecast**
- Echo effects in 2022 (2.8% below baseline forecast) and 2023 (1.6% above baseline forecast)
- Return to “normal” in 2024; five-year CAGR still 7.1%; significant adjustment to segments
- COVID-19 adjustment translates to total **\$1.2 billion revenue loss** over the five-year forecast: shortfalls in 2020 and 2022 outweigh gains in 2021 and 2023
- **Significant forecast risk:** How long does COVID-19 last as an economic damper?



# HPC Forecast: Vertical Markets (\$000)

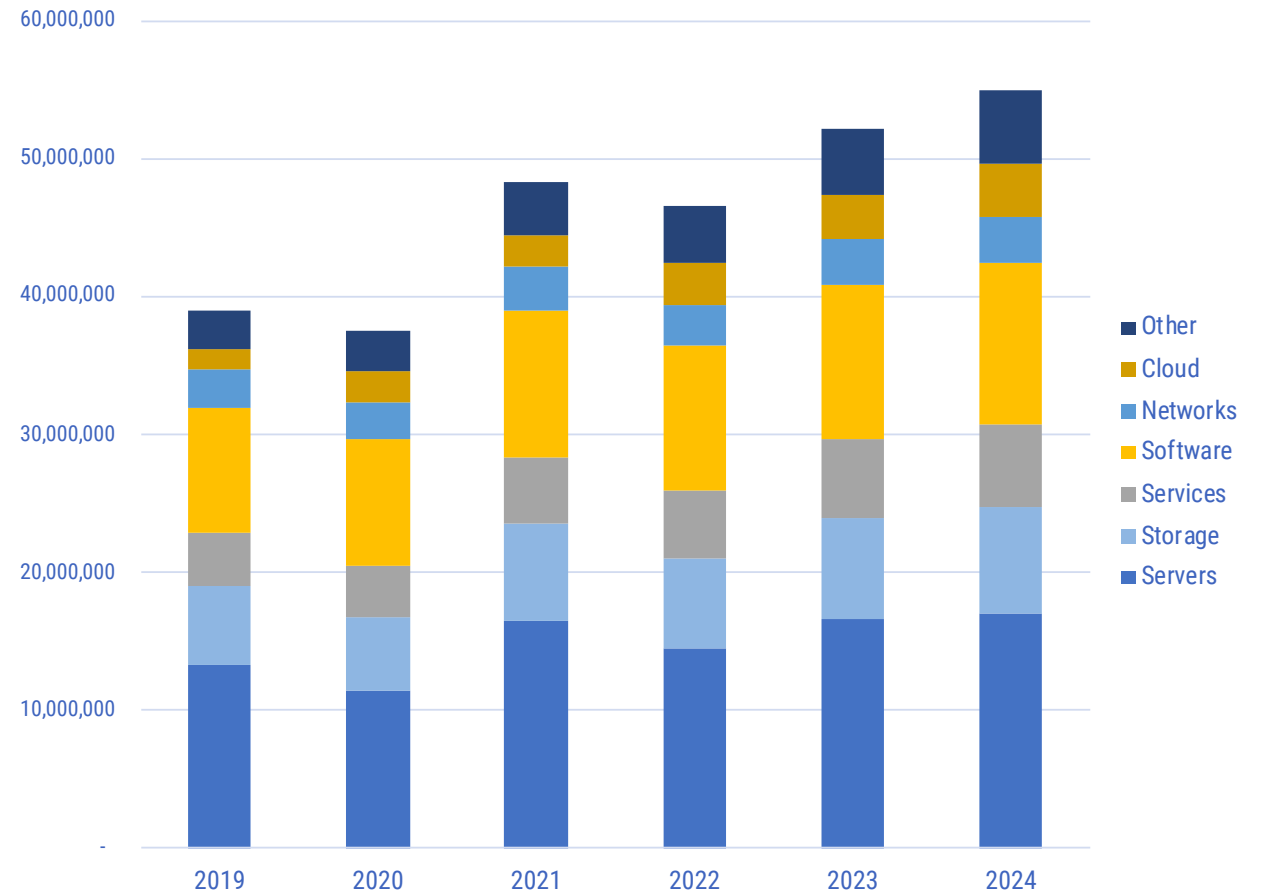
- This is the primary segmentation for COVID-19 adjustments to forecast
- Hardest hit vertical markets in 2020 (with 2021 rebound):
  - Energy
  - Retail
  - Large product manufacturing
- Bio-sciences has slight increase over 2020 baseline
- National research labs, national agencies, and national security also stable

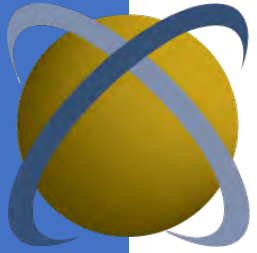




# HPC Forecast: Products and Services (\$000)

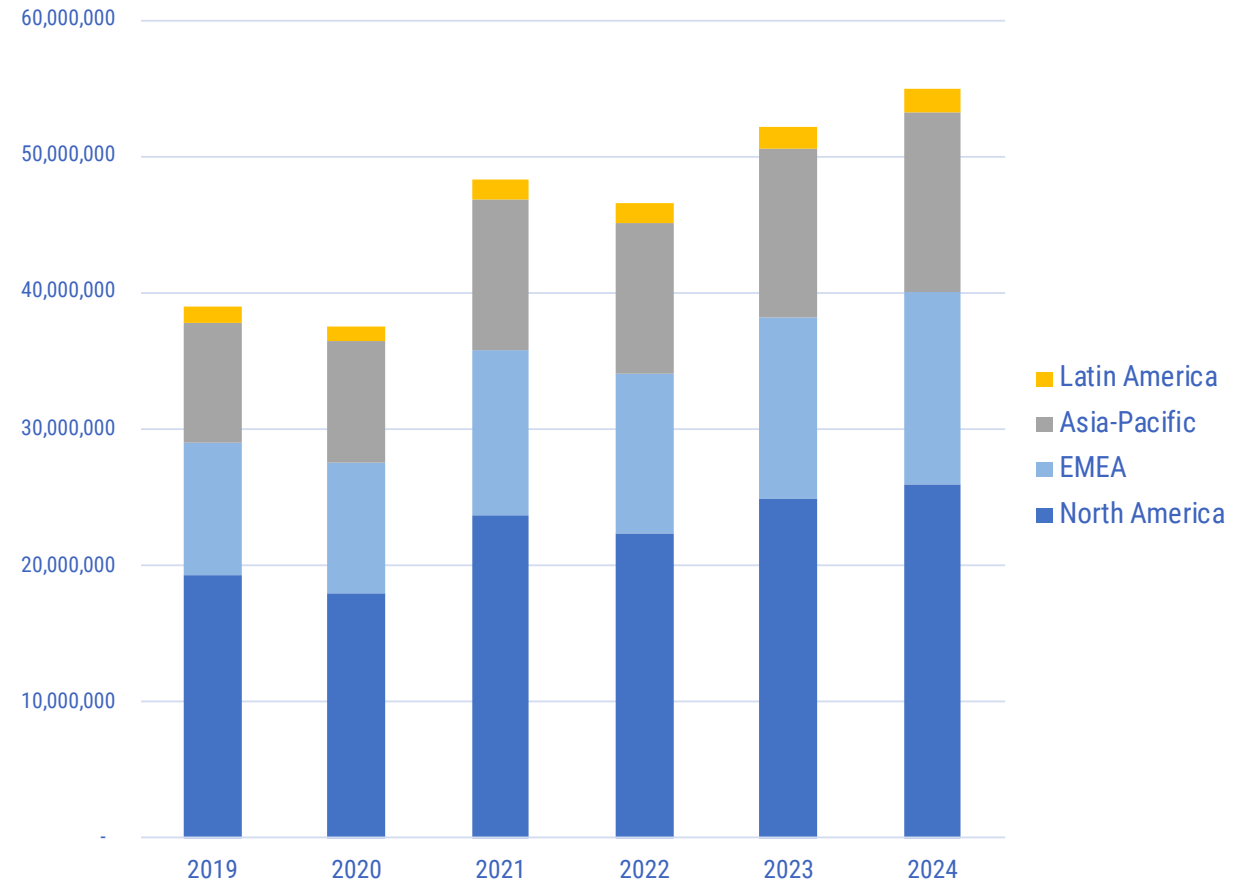
- Servers hardest hit in 2020
- Cloud has dramatic increase
  - Cloud goes up when on-premise acquisitions are constrained
  - Cloud handles uncertainty well
  - Continues >20% CAGR
- Continued growth in Services and Other, related to managed services and other utility-based cloud-like deployments

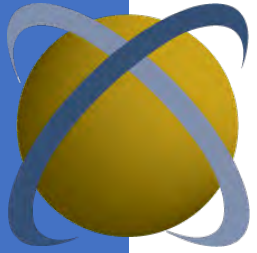




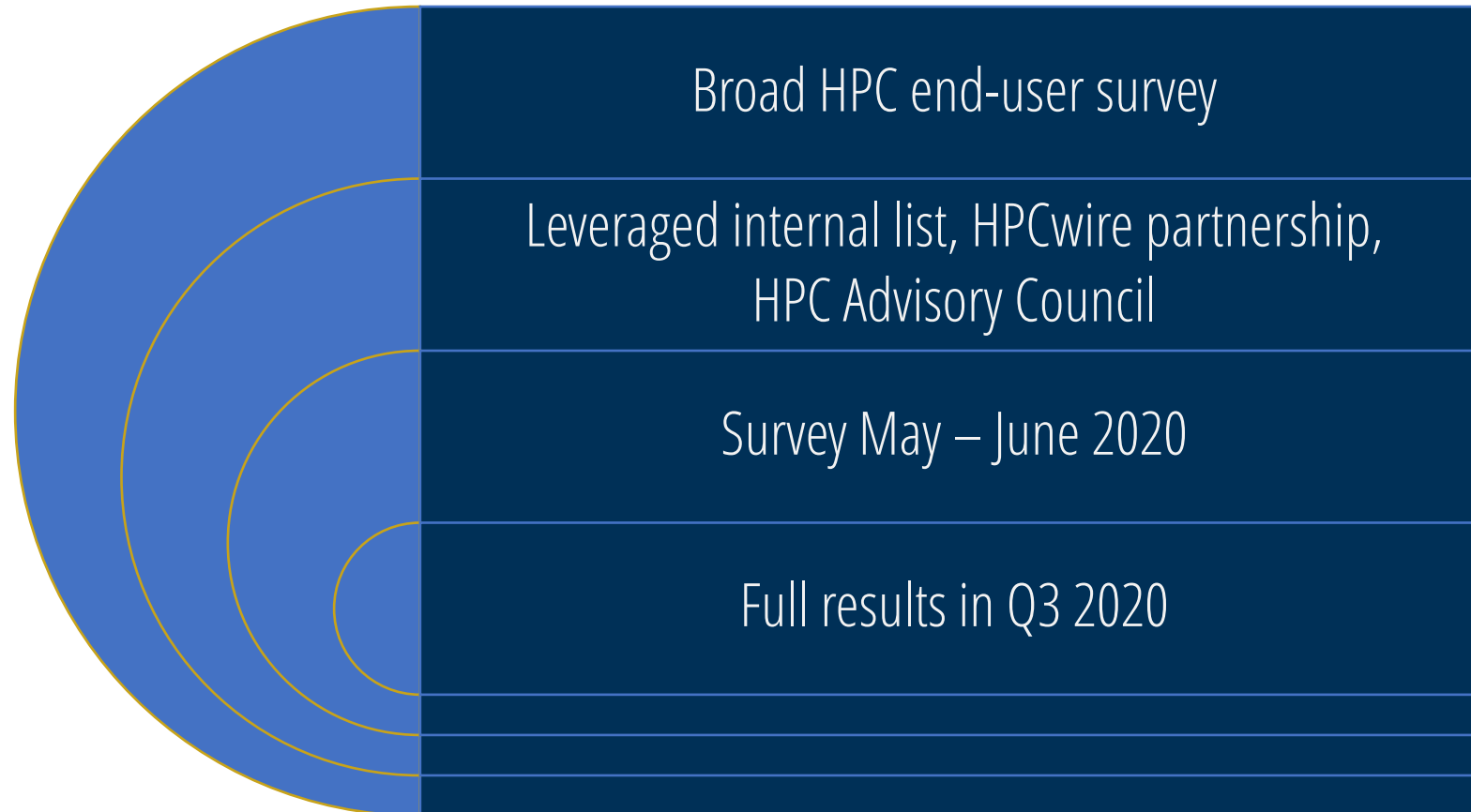
# HPC Forecast: Regions (\$000)

- North America (U.S./Canada) will have biggest 2020 loss: **6.8% decline in 2020**
- Other regions relatively flat year-over-year (still negates previously forecast growth)
- This is **opposite** of how things looked in March when we first released guidance: originally Europe and Asia appeared worse

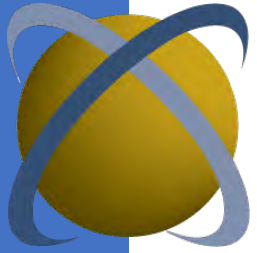




# Additional Research: User Vendor Ratings



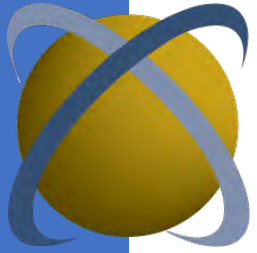




*Which vendors have the best impression and satisfaction in the user community, both in segment and overall?*

*How does satisfaction relate to loyalty and willingness to buy again?*

*Which vendors are likely to see shifts in HPC market share (up or down) in the next two years?*



# Vendors in Four Modules

## Processor Vendors (8)

AMD: EPYC CPUs  
AMD: Radeon GPUs  
Fujitsu: A64fx ARM  
Intel: Xeon (x86) CPUs  
Intel: All other (FPGAs, GPU, neural, etc.)  
IBM: POWER CPUs  
Marvell ThunderX1/X2/X3 ARM CPUs  
NVIDIA: GPUs for HPC and AI

## Server Vendors (11)

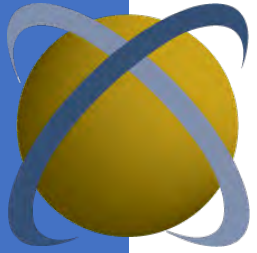
Atos/Bull	Huawei
Cray	IBM
Dell EMC	Inspur
Fujitsu	Lenovo
HPE (not including Cray)	Penguin
	Supermicro

## Storage Vendors (10)

DDN	Panasas
Dell EMC	Quantum
HPE	Qumulo
IBM	VAST
Netapp	WekaIO

## Cloud Vendors (11)

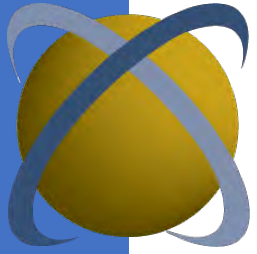
Alibaba Cloud	Oracle (OCI)
AWS	Penguin (POD)
Google GCP	R Systems
IBM Cloud	Rescale
Microsoft Azure	UberCloud
Nimbix	



# Where We'll Be Next

- HPC-AI Advisory Council
  - Australia, NCI: Sept. 1-2  
(Aug. 31 – Sept. 1 in California)
  - UK, STFC DiRAC: October 13-14
- HPC + AI Wall Street: September 14-15
- SC20: November 16-19





# Another “Grand Challenge Problem”



*Special Panel Video Episode:*

## Racism and HPC

Panelists:

Tony Baylis, Lawrence Livermore National Laboratory

Dr. Jesse Bemley, Joint Educational Facilities

William Burke, George Washington University

Jim Ganthier, Dell Technologies

Dr. Valerie Taylor, Argonne National Laboratory

Moderator: Addison Snell, Intersect360 Research

Podcast by:  Intersect360  
RESEARCH

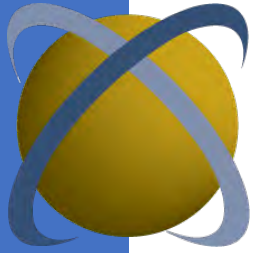
Distributed by:  HPC WITC

This Week in HPC  
is available on:  

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- Can HPC help solve this problem?
- How can we do better?
- Why we need to do better
- [https://www.intersect360.com/podcast\\_racism\\_and\\_hpc](https://www.intersect360.com/podcast_racism_and_hpc)





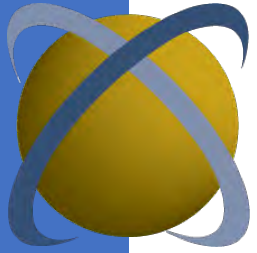
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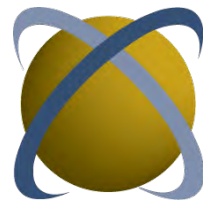
# Conclusions

- Demand for high-performance computing endures. HPC is a long-term, stable growth market.
- Regardless of COVID-19, dynamics were shifting toward:
  - Increase in cloud computing, or other cloud-like deployments
  - Increase in government spending
- COVID-19 accelerates both of these trends.
- HPC vendors should expect purchases to be delayed in 2020, followed by a boom year in 2021 as sales cycles come back in. However, not all lost revenue is recaptured.
- **There is significant risk in this forecast.** Two significant factors are: 1) How long COVID-19 persists as an economic damper. 2) The health of HPC vendors and their ability to ride out the market instability.



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August 2020



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