



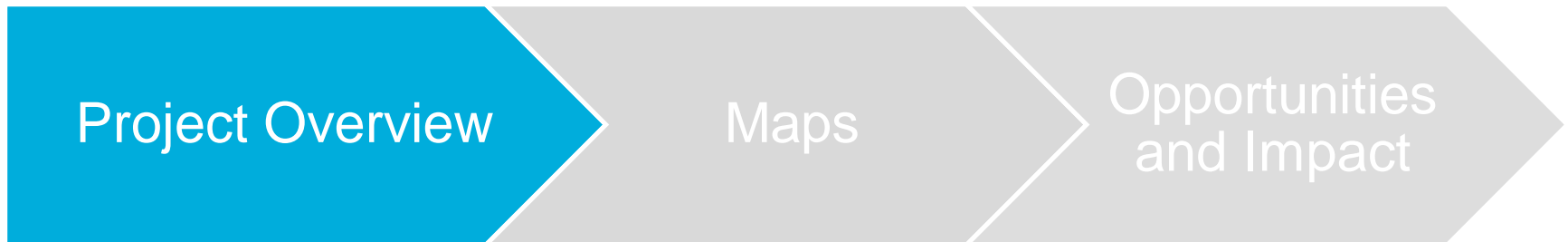
HYPERION RESEARCH

# HPC Engagement Opportunities for Government, Academia, and Industry

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# Agenda



# Project Overview

**Hyperion has created a publicly available database to help inform the administration, members of Congress, and business leaders of the importance of high performance computing (HPC) to US economic growth and global competitiveness.**

**<https://www.easymapmaker.com/map/63f3317f6947bf132ced13e6e8e8169c>**





**This will also be useful to government agencies, universities, and industry in the development of new partnerships.**

# Project Motivation:

**High performance computing (HPC) has been firmly linked to economic competitiveness as well as scientific advances**

- In one worldwide IDC study, 97% of companies that had adopted HPC said they could no longer compete without it.

**Worldwide political leaders increasingly recognize this trend:**

-  In 2016, under the U.S. National Strategic Computing Initiative, DOE launched the Exascale Computing Project to develop a leadership-class supercomputer that “will have profound effects on the lives of Americans, improving our nation’s national security, economic competitiveness, and scientific capabilities.”
-  The European Commission-led Horizon2020 initiative aims to advance HPC as “a strategic resource for Europe's future [that] allows researchers to...understand complex phenomena while allowing policy makers to make better decisions and... industry to innovate in products and services.”
-  China today has the world’s two largest supercomputers ([www.top500.org](http://www.top500.org)) and is intent on winning the global exascale race, to benefit both science and industry.
-  Japan’s post-K supercomputing initiative also aims to produce the world’s most powerful supercomputer. Japan has long, successful history of exploiting HPC in the country’s private sector.

# Potential Impact of HPC to US Industry

The economic reach of HPC into the US industrial infrastructure is impressive.

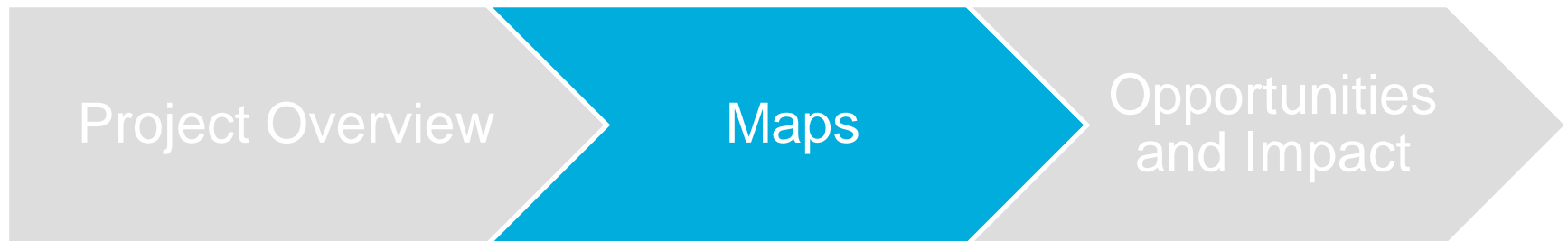
- A recent Hyperion Research study shows that HPC-reliant US economic sectors contribute almost 55% of the GDP to the US economy, encompassing \$9.8 trillion in value and accounting for over 15.2 million jobs.
- The HPC-relevant base of industrial sectors **in this study** covered \$3.3 trillion a year and 8.5 million jobs

# Secondary Impact of HPC on the US Economy

**HPC-Reliant US Economic Sectors**

Sector	Estimated Value \$Billion	Jobs	% GDP
Aerospace and Defense	1,096.59	1,700,000	6.08%
Oil and Gas Industry	115.43	180,200	0.64%
Automotive Industry	586.17	909,700	3.25%
Pharmaceutical & Medical Mfg	182.16	283,920	1.01%
Financial Services	3720.83	5,775,240	20.63%
Engineering Services	598.80	931,540	3.32%
Chemical Manufacturing	523.04	811,210	2.90%
Computer & Electronic Products Mfg	676.35	1,050,350	3.75%
Delivery Services	126.25	632,420	0.70%
Motion Picture & Sound Recording	283.17	439,590	1.57%
Colleges, Universities	1937.07	3,007,390	10.74%
<b>TOTALS</b>	<b>9,845.86</b>	<b>15,281,970</b>	<b>54.59%</b>

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US HPC Industry Users (589 Sites)  
and Providers (168 Sites)

<https://www.easymapmaker.com/map/63f3317f6947bf132ced13e6e8e8169c>

# US HPC Centers of Activity (CoA): Industry HPC User Sites



A total of 589 industry user sites



# US HPC Centers of Activity: Academia/Government Provider Sites



A total of 168 academic/government provider sites

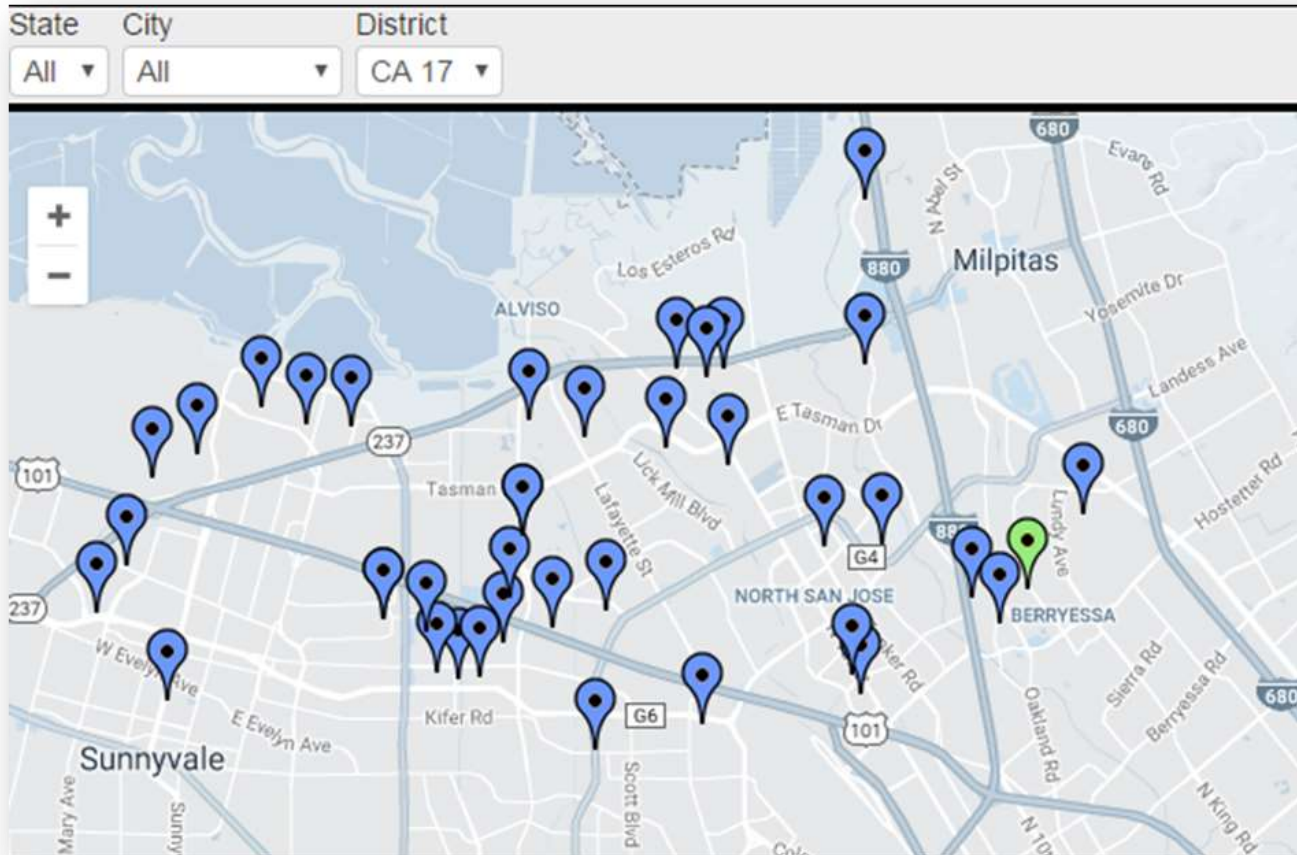
# Total US HPC Centers of Activity



Blue = Industry User Site, Green = Academia/Govt Provider Site

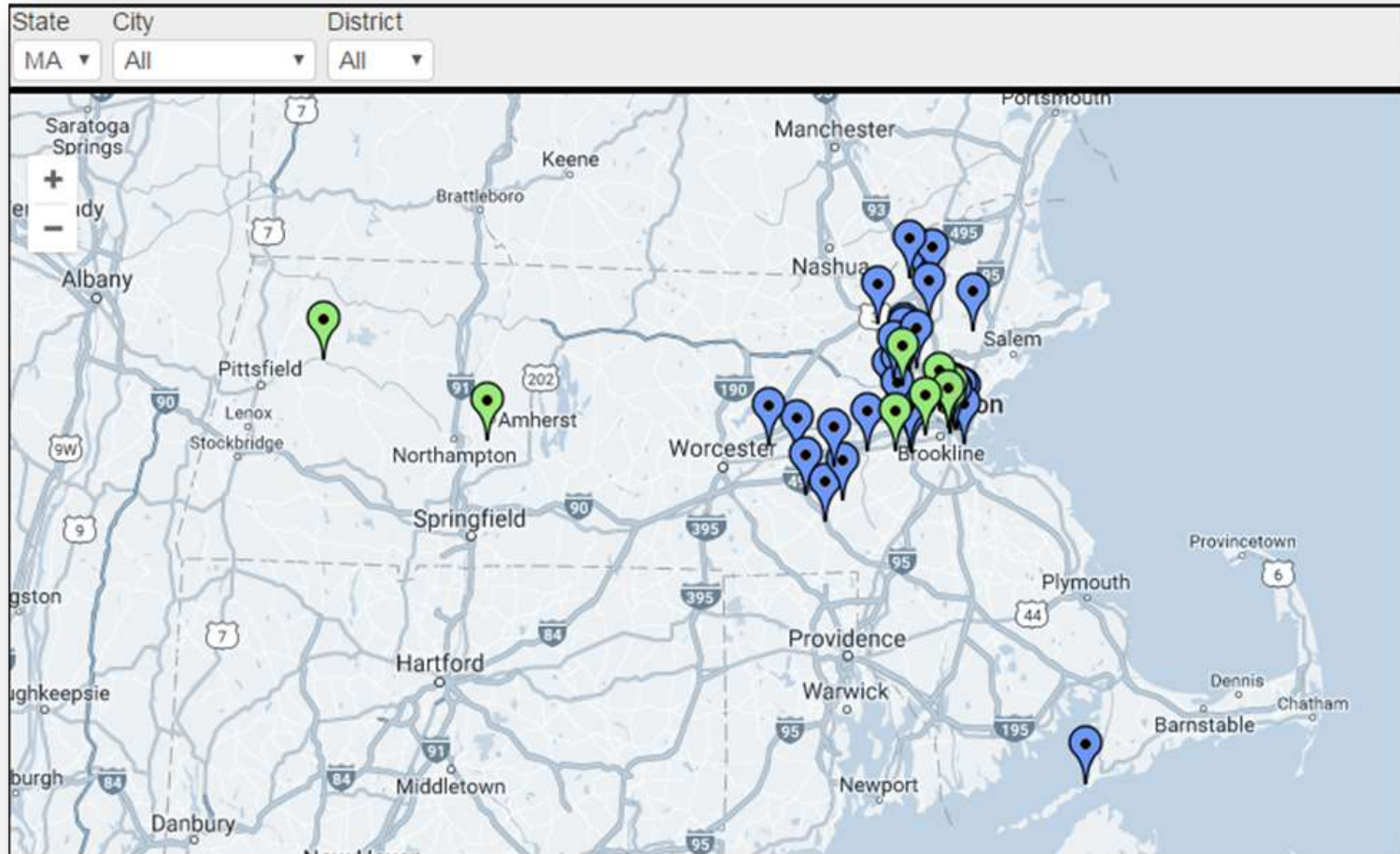
A total of 759 unique sites

# Example of Congressional District Information : The California 17<sup>th</sup> District



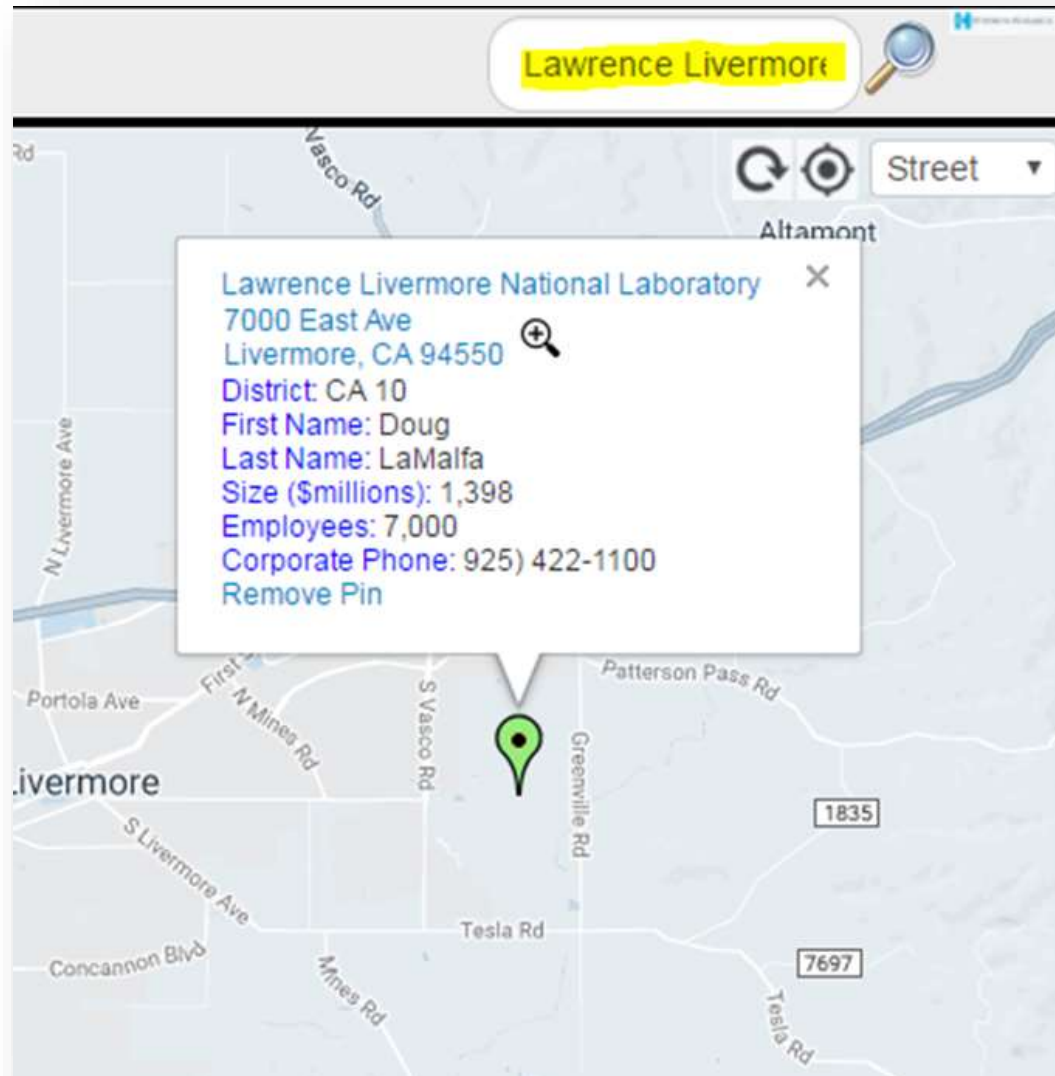
Blue = Industry User Site, Green = Academia/Govt Provider Site

# Example of State-based Information : Massachusetts



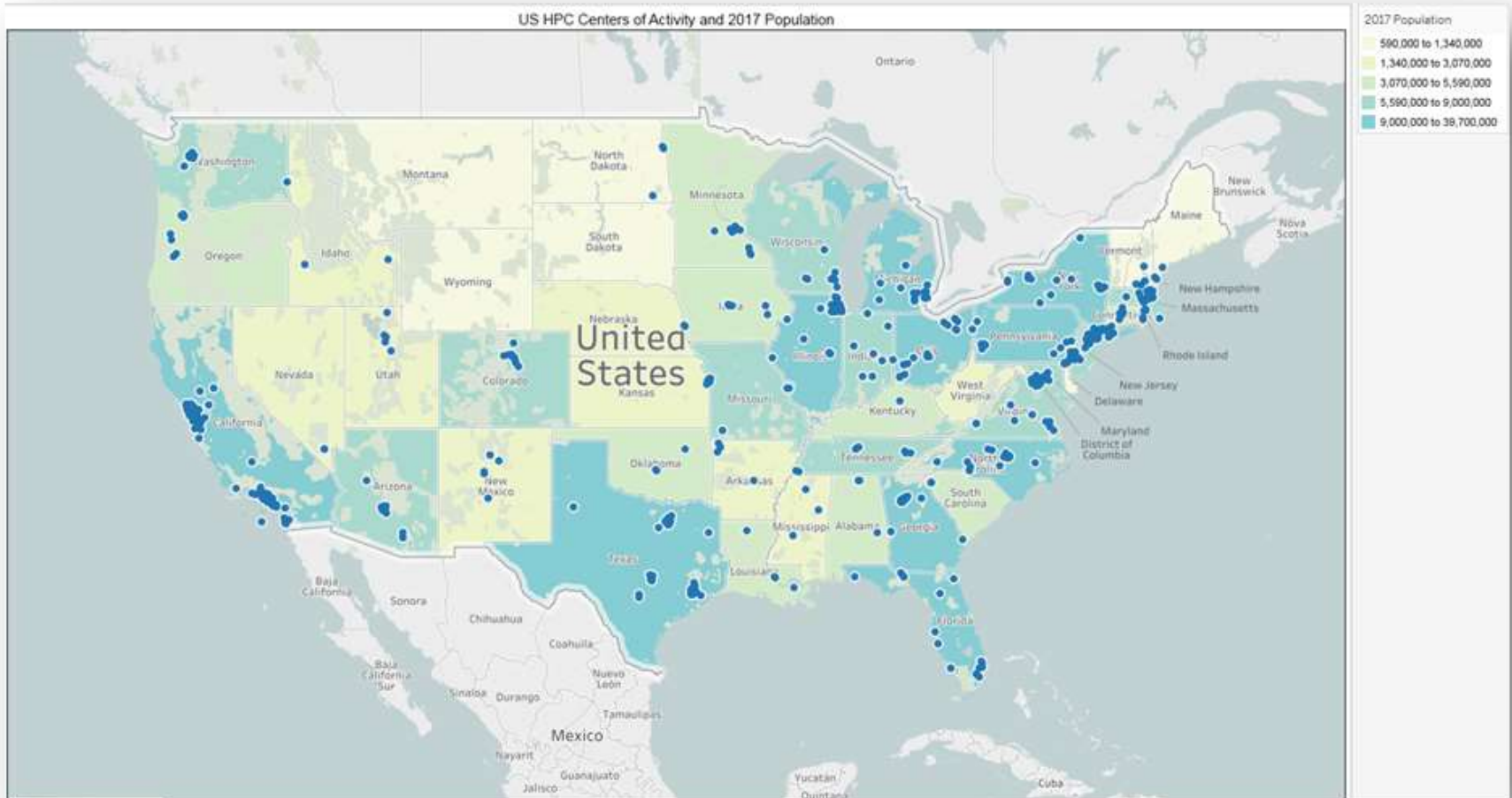
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# Optional Data Displays: Search By Name

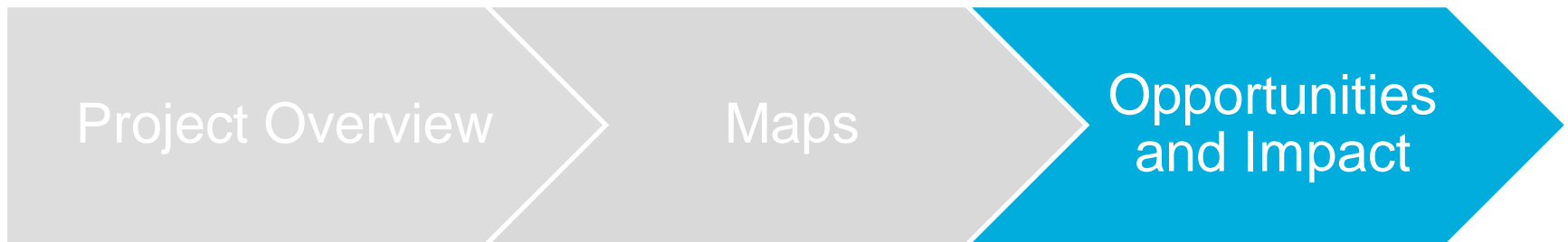


# US HPC CoA Database Demographics

## US HPC Centers of Activity and 2017 Population



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# Industrial Willingness For HPC Partnerships

**A recent Hyperion Research Study on industrial partnerships generated 127 suggestion areas of improvement from 45 industrial sites.**

- The sites included a broad range of industries and organization sizes. The sites had an average employee populations of 37,551 and average R&D staffs of 1,847 persons

## **Key Findings:**

- A large majority of the industrial respondents have resolution and/or scalability requirements that can only be met by HPC systems that are substantially more powerful than the ones available to them today.
- When asked about the potential impact to their revenues and profits that HPC-based technology improvements they desire would have, three-quarters (75.5%) of the industrial sites said the impact would be "very large" or "somewhat large."
- When asked about the impact of desired technology improvement on new jobs, more than half of the sites (55.5%) described the impact as either "very large" or "somewhat large."
- When asked about the potential impact of desired technology on their ability to compete effectively, more than five out of six (86.6%) of the industrial sites stated that the impact would be "very large" or "somewhat large."



# The Situation Within US Industry

- **There are clearly a large number of areas that the Government can help the US improve economic security and increase growth by assisting US industry in becoming more competitive globally.**
  - In many cases it will require some investments and changes in directions and policy, but the results could be substantial and cut across a wide swatch of US industries particularly in the manufacturing and service sectors.
- **Most industrial firms typically cannot justify the costs associated with acquiring the most powerful class of supercomputers, yet Hyperion Research analysis consistently shows that industrial firms of all sizes, including SMBs, can benefit significantly from access to high-end supercomputers for advanced, mission-critical research.**
  - US government programs such as INCITE and SciDac have done a first-rate job of supporting the high-end supercomputing needs of US firms, but these programs are consistently oversubscribed and are not designed to meet the systemic HPC-related needs of individual industries.
- **The study identified a relatively coherent set of industrial requirements -- 127 ideas from industry were sorted into 9 different potential areas that are worth exploring.**

# Examples of US Industry Preferences in Select Areas

<b>What US Industry Would Like (Note that this is a small subset of the full list)</b>		
<b>US Industry Need</b>	<b>Example #1</b>	<b>Example #2</b>
Power	Reduction in power space and network port requirements for HPC which means creating smaller form factor power optimized highly dense core count infrastructure.	Power consumption on devices like storage, servers and data centers could and should be lower.
Security	Embedded artificial Intelligence that is self-learning and self-correcting that will feed the knowledge database for clinical decisions.	Shared commercial use of large government based compute farms with easy access for data.
Co-Design, Collaborations and Application Design	Fault-tolerant MPI or equivalent so that resources can be added or subtracted from the job on the fly.	Create an open exchange with all universities not just the few that we have relationships with.
Scalability	Scalability for larger data needs and a way for business to understand and handle this scaling. Right now, we don't have the expertise to handle the scaling we will need in the future.	Security. One of the downside to HPC is with high scalability comes a frequently overlooks security aspect.
Big Data & Storage	Our biggest bottleneck is getting to/from storage, so if we could massively increase the "SSD" layer of storage by lowering the cost, we could substantially speed up our computing.	Faster, cheaper and more routinized diagnostic and predictive analytics to provide timely BI communications and adaptive reporting

Source: Hyperion Research, 2017

# Issues That Are Holding Them Back

# US Industry Barriers To Expanding HPC Usage

	Average Rating (1 to 10)
Financial barriers — budgets, system costs, other costs	7.3
3rd party applications costs	6.4
Programming hurdles with hybrid environments	6.3
Ease-of-use issues: e.g. lack of system management software	6.2
Difficulties related to scaling	6.0
Lack of knowledge, or skilled HPC/Technical computing staff	5.9
Lack of application availability	5.9
Power & cooling cost	5.8
Support of upper management/leadership	5.8
Organization acceptance that HPC is critical to the broader organization success	5.7
Space limitations	4.8
Total	

# The Potential ROI Value Of HPC Investments

## Latest Findings: The ROI from HPC is High

Based on Hyperion Research in-depth surveys of 673 sites HPC sites (so far) around the world, for every dollar invested in HPC, the average return in new generated revenue was \$551.

- The same dollar investment generated an average increase in profits (or cost savings) of \$52.
- Finally, the same survey set indicated that almost 2400 jobs were created as a result of these HPC activities.

Perhaps more important was that these impressive results were found across a wide of range of counties, sectors, and industries surveyed.

## Putting It Into A Global Context

# The Importance of Leadership-class HPCs

***Hyperion Research believes that countries that fail to fund development of future leadership-class supercomputers run a high risk of falling behind other highly developed countries in scientific innovation, with later harmful consequences for their national economies.***

- Any leading-edge supercomputer development community must be continually involved in the exploration of new system technology, or risk falling behind those consistently committed to the exploration and realization of leadership-class systems.
- The cost of missing even one generation of HPC development could cause substantial difficulties for any facility looking to maintain a world-class HPC-based research capability.



# Specific Recommendations

- **Spread the word that HPC is critical to the future global competitiveness of the any nation.**

Keys point to include:

- There are many more companies around the world could benefit from increased use of HPCs
- Public private partnerships would be a highly effective way to bring these firms up to speed on HPC usages
- National governments will be increasingly responsive to foreign HPC efforts targeted for the commercial sector in order to support and grow domestic companies and employment.

# QUESTIONS?



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