



## Insight

# Reexamining China's Recent Advances in the TOP500 List: Numbers Belie Widespread Technical Gains

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## IDC OPINION

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Much has been made about the rapid and recent increase in the presence of Chinese vendors on the TOP500 high-performance computing (HPC) list, and the most recent TOP500 list merely serves to reinforce that perspective. The major Chinese HPC makers have increased their presence on the list from fewer than 10 HPC systems 5 years ago to 173 HPC systems on the most recent list. Chinese HPC vendors are successfully shipping many systems that make it onto the list, following the rules of the TOP500 organization. In the past, the TOP500 list mostly represented technical computers (HPC servers), but now, over 25% of the computers on the list are non-HPC servers. It is important to note that systems identified on the TOP500 list within these application areas are not considered technical computers or HPC systems by IDC, which defines HPC systems as those used by scientists, engineers, analysts, and other groups using computationally and/or data-intensive modeling and simulation applications. In addition:

- Digging deeper reveals that a significant portion of the recent gains by China have come within a few specific non-HPC areas that include the internet, mobile, and service provider areas. In addition, these sites are almost exclusively in the Chinese market. Chinese suppliers saw their TOP500 share of installations at non-HPC sites increase from 0% to 80% over the past five years.
- There have been many technical and market gains by Chinese HPC vendors in the recent past, with growth rates that exceed all other vendors. In addition, this year saw the first world's number 1 supercomputer made from domestic Chinese processors, showing that producers in China are building custom systems from the ground up. China now has the top 2 computers in the world. But China still has a way to go in developing HPC capabilities across a broad set of HPC users and industries.
- The major Chinese HPC vendors are expanding into high-potential proximity markets for large computers, notably the internet and telecommunications sectors, whose leading firms require large scale-out systems, and indeed, these Chinese HPC vendors have made a strong foray into what may turn into a major new growth market for HPC vendors worldwide. This development can only help the efforts of Chinese HPC vendors to grow their businesses into other sectors and other regions of the world.

## IN THIS INSIGHT

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This IDC Insight reexamines China's recent advances in the TOP500 list. Much has been made about the rapid and recent increase in the presence of Chinese vendors on the TOP500 HPC list, and the most recent list reinforces that perspective. Digging deeper, however, reveals that a significant portion of the gains by China – making up more than 60% of all Chinese computers on the recent TOP500 list – are within non-HPC areas that include the internet, mobile, and service provider areas, and these sites are almost exclusively in China.

## SITUATION OVERVIEW

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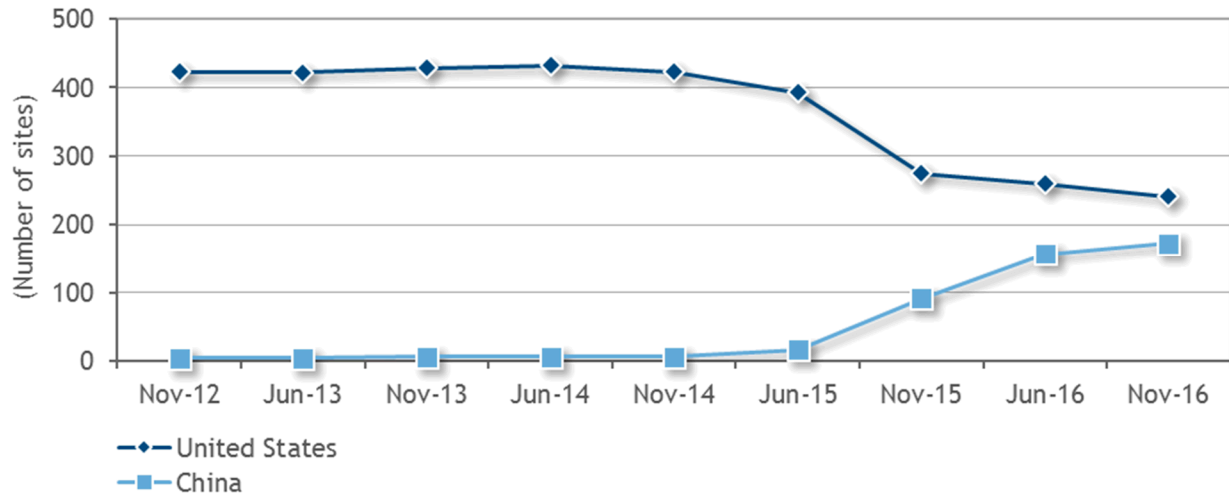
The release of the recent TOP500 HPC list in November at SC16, Salt Lake City, Utah, had only two new systems on the top 10: the Cori supercomputer, a Cray XC40 system, installed at Berkeley Lab's National Energy Research Scientific Computing Center at number 5, and the Oakforest-PACS supercomputer, a Fujitsu PRIMERGY CX1640 M1 cluster, installed at the Joint Center for Advanced High Performance Computing in Japan at number 6. The top 4 systems remained the same as on the prior list. This continues to show a weakness in the very high end of the HPC market.

Much has been made about the rapid and current increase in Chinese vendors on the TOP500 HPC list, and the most recent data reinforces that perspective. Indeed, in the past five years, the major Chinese HPC makers – Huawei, Inspur, Lenovo, and Sugon – have increased their presence from fewer than 10 HPC systems – most of which were one-off systems installed at Chinese government facilities – to 173 HPC systems installed in a wide range of primarily Chinese commercial sites. Further:

- Chinese HPC vendors are mounting a serious challenge to the superiority of U.S. HPC vendors (Cray, Dell, HPE-SGI, and IBM) on the TOP500 list.
- The current trends suggest that within the next year or so, Chinese vendors could equal, if not surpass, U.S. counterparts in the number of installed HPC systems on the TOP500 list (see Figure 1).

**FIGURE 1**

**TOP500 Count of Major Chinese and U.S. Vendors, November 2012 to November 2016**



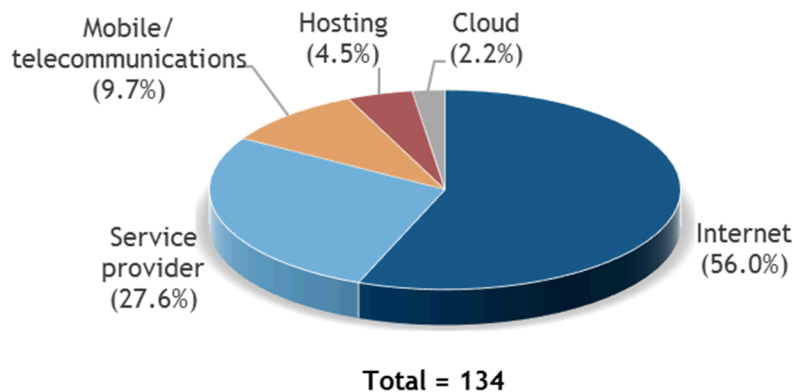
Source: IDC, 2016

The bulk of Chinese systems are, however, concentrated within the non-HPC segments of the TOP500 list, which could be defined as "service related" applications in the internet, mobile, and service provider areas:

- On the most recent TOP500 HPC list, of those 245 sites classified as industry, about half (134) sites are at a mix of non-HPC sites (see Figure 2).
- The remaining industry sites consisted of the more traditional industrial HPC application areas, such as automotive, aerospace, and oil and gas.

**FIGURE 2**

**Non-HPC Service-Related Sites on the TOP500 List, November 2016**



Source: IDC, 2016

## Approaches Used to Classify Supercomputers

Putting the previously mentioned numbers in context, computers can be measured by using any number of metrics:

- Hardware-based metrics that include theoretical peak performance; industry- or sector-related performance benchmarks that include computational, graphic, or other applications-specific tests; and even a combination of power and performance efficiency such as GFLOPS/watt:
  - The TOP500 list relies on a single performance metric (the LINPACK Benchmark) for determination of inclusion and ranking, and there is no stated application, use case, or price range for any system on the TOP500 list.
- Use based (e.g., technical versus commercial computing)
- Form factors (e.g., mobile, tablet, desktop, or server)
- Price range

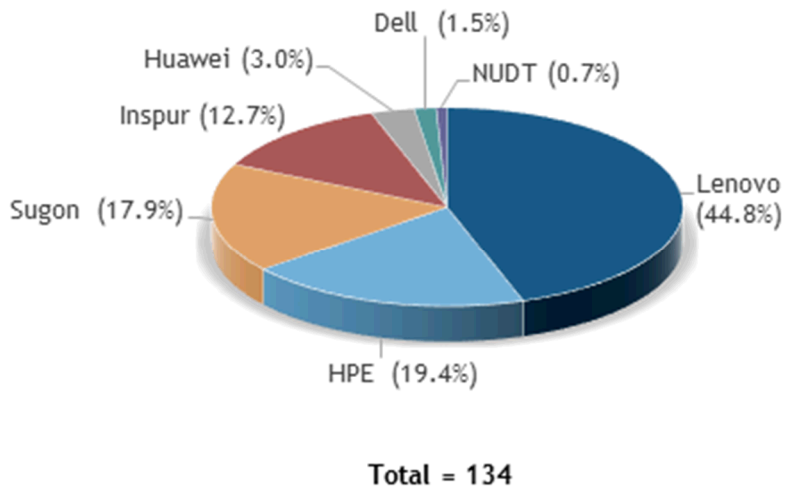
IDC uses the terms *technical computing* and *high-performance computing* to encompass the entire market for computer servers used by scientists, engineers, analysts, and other groups using computationally and/or data-intensive modeling and simulation applications. As such, technical servers range from small servers costing less than \$5,000 to large supercomputers valued in hundreds of millions of dollars. Based on IDC definitions, a number of systems in the TOP500 list would not be considered as technical computers or HPC systems.

Chinese vendors have taken a dominant hold on the non-HPC sites in the TOP500 list, supplying 106 (79%) of the 134 non-HPC computers shipped to service-related sites on the most recent TOP500 list (see Figure 3):

- Five years ago, U.S. vendors – essentially HPE and IBM – supplied 100% of the 154 non-HPC systems on the TOP500 list.
- In the current TOP500 list, U.S. vendors – primarily HPE and, to a lesser extent, Dell – shipped only 28 non-HPC systems, representing a net loss of 126 sites from five years ago, worth about one-quarter of the list.

**FIGURE 3**

**Non-HPC Service-Related Computer Suppliers on the TOP500 List, November 2016**



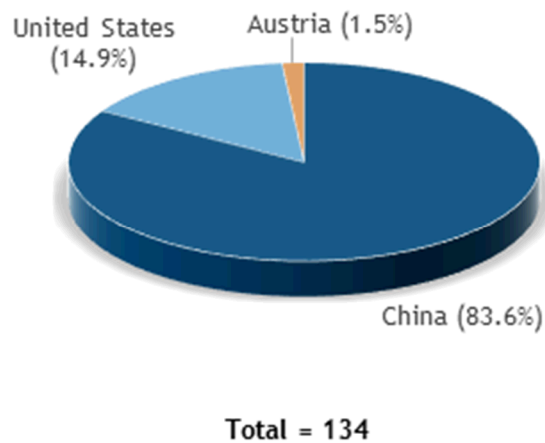
Source: IDC, 2016

Perhaps as important, the geographic center of gravity for this sector has shifted significantly. Today, over 83% of all non-HPC computers in the TOP500 list are installed in China, and all but 6 of those systems were installed by a Chinese HPC supplier (see Figure 4). As a result, of the total 173 Chinese HPC systems on the current TOP500 list, 106 (61%) of those are non-HPC systems:

- Five years ago, the U.S. market was the dominant consumer of non-HPC systems (hosting 48% of these sites), with China (33%) and a host of other countries in the mix as well.

**FIGURE 4**

**Location of Non-HPC Service-Related Computers on the TOP500 List, November 2016**



Source: IDC, 2016

## FUTURE OUTLOOK

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If China is to continue to gain share in the TOP500 list, suppliers need to expand their success beyond the sectors they address today in their home market (refer back to Figure 1 for the current trends). And it's no surprise that this is what all of the Chinese vendors are planning to do in the near future.

In addition, Chinese vendors are clearly expanding into high-potential non-HPC markets for large computers, notably the internet and telecommunications sectors, whose leading firms require large scale-out systems, and the Chinese HPC vendors have made a strong initial foray into a major new growth markets. This development can only help their efforts to grow their businesses. Further:

- China may also be concentrating on driving HPC capabilities to the internet and telecommunications spaces as a way to help support Beijing's ambitious internet of things agenda that will require large amounts of computational capabilities to support the collection and analysis of vast amounts of real-time and standing data for applications, including food safety, healthcare, transportation, and pollution control.

Finally, it is clear that something is up with the mix of computers in the TOP500 list and the decision process that vendors and sites use to submit results for consideration. It will be interesting to see whether the trend of adding more non-HPC computers to the list continues in 2017.

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