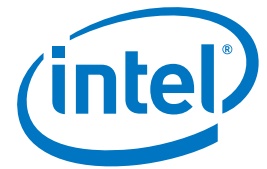


## SOLUTION BRIEF

### Intel® Xeon® Processor E5 Series

High-Performance Computing  
Cloud Computing



# Enhancing computing resource management

Research institutions improve computing resource utilization and achieve highly efficient management with BingoCloud\* based on Intel® Cloud Builders



"Bingo's BingoCloud cloud computing platform, based on Intel® Cloud Builders, is built with a HPC virtual machine template. With the assistance of Intel VT the users can deploy an HPC environment in a few minutes. This not only helps universities or research institutions solve the problem of computing resource management, it also improves the computing resource utilization to provide services for the faculty and students."

Qiu Yang

Product Manager

Guangzhou Bingo Software Development Co., Ltd.

Academic and research projects at a top university in Guangzhou, China, have high-performance computing (HPC) needs. As these projects continue to grow, the university's departments have decided to purchase HPC servers. However, since these resources were scattered across various departments, the information center was concerned that they would be difficult to manage, especially those that are idle.

## CHALLENGES

- **Improve utilization of computing resources.** Make full use of idle HPC resources such as computing capacity and storage through unified management of scattered HPC resources.
- **Simplify deployment of HPC environment.** Make it easier for those without professional knowledge of computers, like teachers and students, to deploy an HPC computing environment without excessive time and effort.
- **Reduce storage costs.** Cut down on storage costs, since data obtained through lengthy computing can only be stored for a short time.

## SOLUTIONS

- **Deploy BingoCloud cloud computing platform based on Intel Cloud Builders.** Integrate scattered HPC resources into a resources pool. Using Intel® Virtualization Technology (Intel® VT), recombine physical servers in the form of a virtual machine according to users' needs while improving computing resource utilization.
- **Deploy HPC environment template.** Using Intel VT, allow users of the cloud platform to submit requests through self-service Web interface. In a few minutes, a practical virtual machine with operating system and high-performance computing environment can be delivered.
- **Create distributed storage.** Use the university's previous-generation Intel® architecture-based servers to form a distributed storage cluster, creating a storage environment with equal capacity at one-tenth the original cost.

## IMPACT

- **Improved computing resource management capabilities.** With BingoCloud, based on Intel Cloud Builders, the university has accurate HPC resource management and can quickly find information such as hardware resources and users' status.
- **Improved work efficiency.** Since it operates automatically, teachers and students can work in an HPC environment quickly and efficiently, even without professional computer knowledge. They can put more time and effort into their research or projects.
- **Fully utilized computing resources.** The resource pool created through Intel VT allowed computing resources to be intelligently allocated, reducing waste and improving utilization.

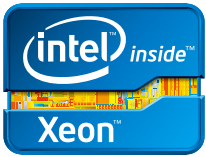
## Growing data in the academic field

In academic fields such as chemistry, physics, and geography, researchers need meticulous algorithms and vast quantities of data. They also need vast quantities of data computing and storage capacity, plus HPC software to provide support.

This need was evident for a top university in Guangzhou. Taking pride in its strong scientific research and teaching faculty, the university often had demanding scientific research projects. To meet this demand, the university purchased HPC servers. But with the increasing number of projects, the number of servers had also grown. For the university's information center, maintaining the growing number of servers had become a daunting task.

## Facing challenges in the management and utilization of HPC resources

The university needed a way to effectively manage its HPC resources. A staff member at the university information center shares, "The demands of HPC are normally based on the project or department. HPC servers are purchased by the teachers and installed in their own offices. It has become a problem for the information center to manage these scattered computing resources. For example, if we want to know information such as the number of servers in the university, the storage space, or the number of project teams these servers can serve, we have to rely on telephone or mails to do the job manually. This is, of



## BingoCloud cloud computing platform, based on Intel Cloud Builders, meets the HPC resource management needs of universities and research institutions

course, not efficient, and the counting job is often incomplete or inaccurate. The university wants a more convenient way to manage these computing resources."

Also, the university's computing resources were not being fully utilized. When a project ended, the servers used for some projects would become idle. It was a massive waste of resources, especially when some teachers or research teams didn't have enough funding to purchase new servers. Moreover, students needing a practical operating environment to learn HPC weren't able to use these idle computing resources.

Even when some departments had the chance to purchase new servers, they would need the help of the information center in building the operating environment. For example, commercial HPC software is quite expensive, so many teachers and students prefer using free, open-source software. This software is generally run in the Linux\* operating system, so associated database files had to be manually compiled and installed. This could be quite difficult for teachers and students without professional IT expertise.

Installing and configuring HPC software also takes professional knowledge. For teachers and students, this meant extra learning costs. Moreover a problem with one step of the software installation could result in failure of installation. In short, the university needed to simplify the deployment of the HPC operating environment to let project teams, teachers, and students put their time and effort into researching, not into deploying a complex operating environment.

The university also faced high storage costs. Since it generally uses a high-cost SAN storage system, all the projects need a storage space of several hundreds of terabytes (TB). A teacher explains, "Take the satellite position computing in astrophysics as an example. The generated data can go up to 20TB, and the data size of other research can be similar. Due to pressure on the project's progress or the approval process for purchasing these servers, we can only use the existing servers and storage space. Because of limited storage capacity, the computing results that have taken us several weeks to obtain can be deleted since there is no backup to storage. If we need the data again in the future, we have to compute all over again." The need for storage capacity that could handle a huge number of terabytes requires an investment of nearly one million Yuan. The university needs a storage environment that will not cost a fortune while providing support for HPC.

To solve its problems, the university decided to deploy a cloud computing platform to meet all the demands of HPC projects.

### Solving the problem of computing resource management and utilization

After testing and comparing peer cloud computing platform products, the university decided to go with Guangzhou Bingo Software Development Co., Ltd.'s (Bingo) BingoCloud. BingoCloud has many features optimized for HPC.

Bingo used the university's two servers with Intel® Xeon® processors E5 series as control servers for the BingoCloud cloud computing platform, and for backing each other up during testing. When one server failed, the other took over control. The cloud control server, on the other hand, served as the brain of the entire cloud platform, playing the roles of cloud controller and cluster controller for the cloud platform and being available at all times. Timely scheduling, management, and control of the BingoCloud resources were also essential. Once the server is down, it will affect the normal operation of the entire cloud platform. The Intel Xeon processor E5 series, with its industry-recognized stability, met the cloud platform's requirements.

Deploying the open Intel Cloud Builders reference architecture was easier and faster than expected. The information center's administrators were able to check the usage status of the physical server resources through the Web interface in real time. Utilization of the processors and storage was quite straightforward, so the administrators were able to generate a report whenever they needed one. Using Intel Cloud Builders significantly enhanced the management of the university's computing resources.

The cloud platform based on Intel architecture has improved the utilization of HPC resources. The 11 HPC servers based on the Intel Xeon processor E5 series, which were scattered all over the departments, were made available for use of the teachers and students through a virtual machine. The idle computing resources were automatically taken over by the system for other users. Compared with previous servers, the resources of each physical server through the virtual platform can now be fully utilized.

"The HPC production environment is highly demanding on computing and storage resources," explained Qui Yang, product manager at Bingo.

"BingoCloud takes some optimized measures to ensure the virtual machine's performance. For example, the system administrator can be allowed to take a strategy of specifying greedy mode for the production environment to avoid other applications scrambling the computing resources. In addition, in all nodes, the server uses high-performance Intel® Solid State Drives to improve the virtual machine's building speed. Through the network data throughput capacity of Intel® Ethernet 10 Gigabit Server Adapter, the user can improve the virtual machine experience. Utilizing Intel VT further optimizes the network for virtualization, boosting the HPC

### LESSONS LEARNED

- Bingo's BingoCloud cloud computing platform can help universities and research institutions simplify their IT environments and achieve a unified management of computing resources to improve work efficiency.
- With Intel VT, BingoCloud automatically delivers an HPC environment, lowering the technical threshold for building an operating environment.
- A cloud computing platform based on Intel Cloud Builders helps utilize old computing resources and improve resource utilization, so that more teachers and students can be offered learning opportunities in computer services or training.

cluster's performance for large amounts of network computing. With an Intel VT-based virtual machine, the university benefits from a highly reliable operating environment for HPC."

The university was satisfied with the test HPC environment that was deployed. Now, no matter what the level of computer knowledge its users have, they can have a complete operating system and corresponding computing software installed in an HPC environment. Users only need to submit requests for information on the processor, storage, and memory based on the computing size through a unified Web interface. In the past, this job took a few days or even longer; now it only takes a few minutes. The user can focus on more important tasks such as research. The HPC resources are being fully utilized.

"Because we're fully utilizing the server resources and deploying an automatic computing environment, we can now offer teachers and students more practical training and learning opportunities in an HPC environment," explained the director of the university's information center. "The teachers and students are much more encouraged to participate in study or innovations."

In addition, BingoCloud, the cloud computing platform combines one Intel architecture-based server for the university's existing storage resources and several previous-generation Intel architecture-based servers into this platform's management, forming a distributed storage cluster that fully uses each byte for storage. Moreover, when HPC requires more storage, the user can quickly apply for a larger storage space through the Web interface and use that space immediately. Also, the distributed storage architecture can use ordinary computers to hook ordinary disks for storage expansion. The university can now support the storage needs of its HPC projects at just one-tenth of the cost of the past system.

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