



## 99Cloud Is Transforming the World's Largest Utility with Hyper-converged Infrastructure

An OpenStack\* software-defined infrastructure (SDI) solution is bringing orchestration and higher resource utilization to complex, mission-critical infrastructure across multiple data centers.



### Executive Summary

The world's largest utility company, State Grid, is continuously seeking new ways to increase the efficiency of managing its mission-critical data centers located across China. As part of its efforts, the company recently worked with 99Cloud, a leading OpenStack\* solution provider, to deploy an orchestrated software-defined infrastructure (SDI) solution in nine data centers. The scalable solution, based on the OpenStack platform and servers built on Intel® processors, has successfully simplified orchestration and increased resource utilization at the data centers while adding centralized monitoring and management of resources. As a result of the successful deployment, 99Cloud is expanding the OpenStack solution to more than 30 additional State Grid data centers.

### Addressing the Challenges of Complex, Distributed Infrastructure

Like many enterprise organizations around the world, State Grid faces multiple challenges around managing complex, distributed, heterogeneous, mission-critical data centers. The company wanted to optimize its infrastructure use and meet performance objectives without over-provisioning. State Grid also sought a way to scale and redeploy infrastructure more quickly in response to rapidly changing demands. Most importantly, the company wanted a more efficient way to centrally manage its distributed network and heterogeneous environment while staying within budget.

One way the company could improve efficiency would be to expand its use of virtual machines and containers.



Figure 1. State Grid is the world's largest utility, with data centers across China providing services for over one billion people<sup>1</sup>

But those solutions would be difficult to orchestrate across the complex, distributed nature of State Grid's data centers and networks. In addition, those software-based solutions would not be able to optimize utilization of the underlying hardware infrastructure—particularly for the company's legacy servers and storage assets.

Another approach to simplified management would be to use converged infrastructure solutions, but this option would also have limitations. Converged infrastructure often leads to “vendor lock-in” because it relies on costly proprietary hardware and technologies. State Grid wanted to ensure maximum flexibility to meet its needs and the objectives of China's Internet Plus initiative (see the China's Internet Plus Initiative sidebar), so the converged infrastructure approach would have conflicted with the company's desire to pursue a true open infrastructure.

To address these complex requirements, State Grid turned to 99Cloud—a leading OpenStack solution provider—to help the company implement a more effective, comprehensive solution based on the scalable OpenStack platform and open source software.

### China's Internet Plus Initiative

In 2015, China announced an initiative to integrate mobile Internet, cloud computing, big data, and the Internet of Things with modern manufacturing, in order to fuel development of e-commerce and industrial networks. Today, the goals of the initiative have expanded to help drive technological innovations in general by encouraging enterprises to develop and implement open source solutions that tackle technological bottlenecks and strengthen risk controls.

The SDI project between 99Cloud and State Grid is a reflection of the Internet Plus initiative, meeting the government's goals by creating a more agile, robust solution built on the OpenStack\* platform and other open source tools and APIs.

### Deploying OpenStack to Optimize and Manage Data Centers

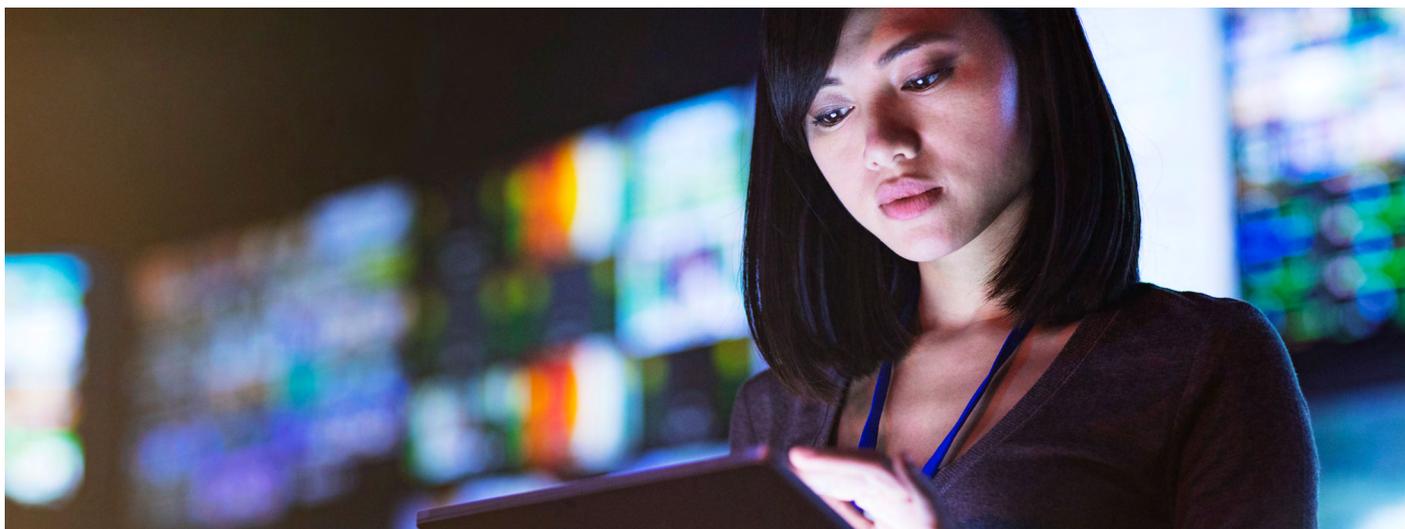
99Cloud initially deployed an SDI solution based on the OpenStack platform in a limited scale. The solution was deployed to data centers in nine provinces, with plans to ultimately expand the deployment to a total of 30+ data centers across China. The solution was designed to optimize and manage a heterogeneous environment of servers, centralized storage, distributed storage, and virtualization solutions connected using a virtual network. Throughout the deployment, 99Cloud was able to use a mix of new and existing hardware and storage for the SDI solution, which helped speed implementation and mitigate costs.

The 99Cloud OpenStack solution used servers built on the Intel® Xeon® processor E5 family and the Intel Xeon processor E7 family. Intel Xeon processors are ideal for SDI deployments because they provide increased scalability, automation, and orchestration capabilities across compute, storage, and networking workloads. Intel Xeon processor-based infrastructure also delivers performance based on workload demands, which helps improve resource utilization in the OpenStack deployment. In addition, Intel collaborates with a broad ecosystem of partners who build and optimize their software to run on Intel platforms. As a result, many of the world's most popular apps and services can reach peak performance on Intel processors.

99Cloud also deployed Intel® Solid-State Drive (SSD) DC S3600, S3700, and S3800 Series drives. These SSDs provide exceptional performance, data integrity, and reliability.<sup>2</sup>

### Measuring the Success of the OpenStack Deployment

The initial implementation has successfully simplified infrastructure orchestration for State Grid by providing the organization with centralized monitoring, scheduling, and management of mission-critical resources across all nine data centers. The SDI solution has also improved the company's resource-utilization rate by enabling dynamic allocation of resources and automatic recovery from faults. The increased efficiency of CPU and memory use has also helped reduce operational costs for State Grid.



Overall, the deployment demonstrates the feasibility of using an OpenStack platform-based SDI solution for large-scale, mission-critical deployments. State Grid has approved extending the OpenStack solution to more than 30 additional data centers across China. Once completed, the SDI configuration will help State Grid maximize usage of its hardware infrastructure, centralize and standardize the management of its disparate resources, and provide it with the ability to scale its infrastructure quickly and dynamically.

Table 1. The OpenStack\* SDI deployment led to several performance and efficiency gains for State Grid<sup>3</sup>

State Grid SDI Deployment Benefits <sup>3</sup>
Reduced annual hardware and software capital costs
Improved CPU utilization
Improved memory utilization
Reduced physical footprint for individual data centers
Lower operating expenditures from reduced power, cooling, and servicing needs for infrastructure

### OpenStack Platform Solution Details

To achieve State Grid's objectives, 99Cloud built the solution on an OpenStack platform using a combination of new and legacy hardware in existing data centers. Different server configurations were used depending on each data center's specific requirements; optimal deployments consisted of the following components:

- Three controller-node servers, based on the Intel Xeon processor E7-4830 v3 (2.10 GHz) with 512 GB RAM, six 2-TB Serial ATA (SATA) hard-disk drives (HDDs), and a mix of four 800-GB Intel SSD DC S3600 Series and Intel SSD DC S3700 Series drives

### Intel Support for the OpenStack\* Platform

Intel is a platinum member of the OpenStack Foundation\* and is a major code contributor to the OpenStack community.<sup>4</sup>

Intel developers work with the community to expose Intel® hardware technologies to OpenStack software modules and to extend OpenStack technology to improve security and compliance, high availability, manageability, performance, and the end-user experience. These efforts help to ensure that users experience the best possible results when using OpenStack software with Intel architecture.

- Several general-use servers, based on the Intel Xeon processor E5-2650 v2 and v3, with 256 GB RAM, six 1-TB SATA HDDs, and a mix of four 800-GB Intel SSD DC S3700 Series and Intel SSD DC S3800 Series drives
- Several legacy VMware vSphere\* and Linux\* OS-based servers
- KVM hosts used for compute resource pooling
- Ceph\* distributed storage to enable a hyper-converged cloud model with scale-out and resource pooling capabilities; used for storage pooling
- OpenStack APIs with a customized front-end management portal; used for all management and orchestration

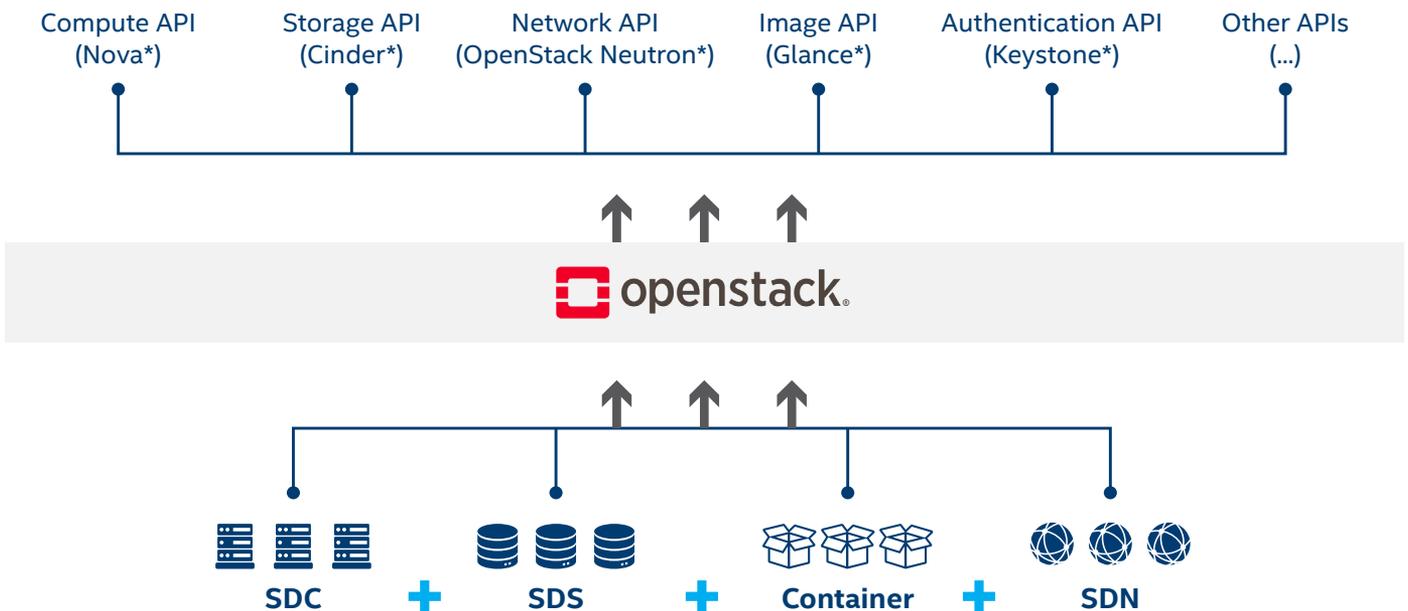


Figure 2. State Grid has a complex heterogeneous environment consisting of centralized storage, distributed storage, containers, and SDI, all of which are orchestrated through OpenStack\* APIs

## Future Considerations

99Cloud is now rapidly expanding the OpenStack SDI deployment to all 30+ State Grid data centers across China. When complete, the deployment will support more than 500 applications, including power scheduling, human capital management, enterprise resource planning, and internal control systems.

## OpenStack Platform: A Viable Solution for Mission-Critical SDI Deployments

The success of the State Grid implementation demonstrates the viability of the OpenStack SDI platform for extremely large-scale deployments that need the agility to change and scale on demand. The solution also shows the potential for other large enterprise organizations to confidently deploy an OpenStack SDI solution in mission-critical environments.

## About 99Cloud

99Cloud is a gold member of the OpenStack Foundation\* and a leading open source service provider in China. It is ranked within the top 10 OpenStack\* community contributors worldwide.

To see how 99Cloud is helping companies implement OpenStack solutions, visit <http://99cloud.net> or connect with 99Cloud on WeChat\* by searching CN99Cloud or by scanning the following QR code from the WeChat app.



## Learn More

See how Intel architecture is helping other businesses deploy open, hybrid clouds built on the OpenStack platform: <https://01.org/openstack>.

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You can also follow Intel Builders on Twitter\*, by using [#IntelBuilders](https://twitter.com/IntelBuilders).



<sup>1</sup> OpenStack. "The State Grid win Practical Application Award with its OpenStack based cloud platform." 2016. [openstack.org/news/view/289/the-state-grid-win-practical-application-award-with-its-openstack-based-cloud-platform](http://openstack.org/news/view/289/the-state-grid-win-practical-application-award-with-its-openstack-based-cloud-platform).

<sup>2</sup> Intel. "Break the Storage Bottleneck with No Critical Data Interruption." March 2016. <https://www-ssl.intel.com/content/www/us/en/solid-state-drives/ssd-dc-d3700-d3600-brief.html>.

<sup>3</sup> Based on the 99Cloud proof of concept conducted with State Grid in 2016 and 2017.

<sup>4</sup> Stackalytics. "Code Contribution." May 2017. <http://stackalytics.com/?release=all>.

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