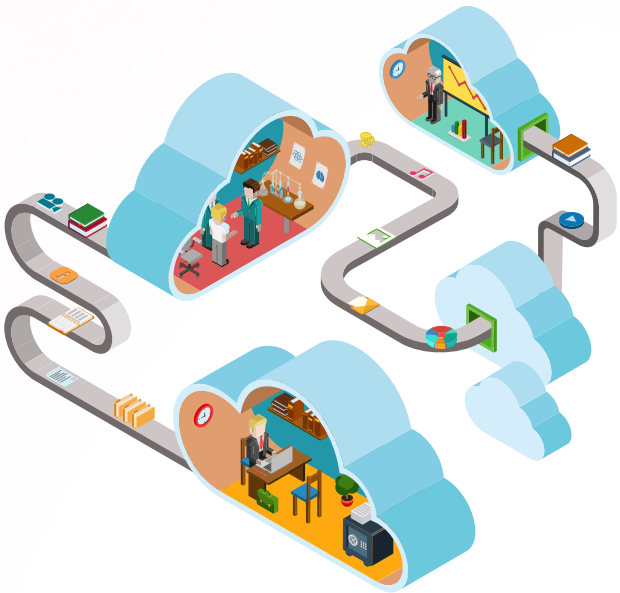
DEUTSCHE TELEKOM OPEN TELEKOM CLOUD POWERED BY HUAWEI FUSIONSPHERE

The First Large Scale, Multi-national OpenStack-based Public Cloud in Europe

HUAWEI

EXECUTIVE SUMMARY



According to Gartner, Inc., the worldwide public cloud services market is projected to grow 17.2 percent in 2016 to total $208.6 billion, up from $178 billion in 2015. The highest growth will come from cloud system infrastructure services (infrastructure as a service [IaaS]), which is projected to grow 42.8 percent in 2016. [1]

It is undeniable that public cloud IaaS offerings are rapidly gaining acceptance among enterprises as a replacement or compliment to existing on-premises hardware for IT infrastructures. While big US public cloud service providers are the ones which have initiated and grown public cloud services, they face challenges in expanding their market outside of US, especially in Europe due to data sovereignty and security issues. We are seeing a trend that telecommunication service providers such as Deutsche Telekom and other first tier or second tier telcos outside of US are starting to provide IaaS to compliment and to add value to their existing telecom services. Enterprise customers would prefer to use a telco operated public cloud service provider due to the reasons of security, cost, convenience, localization, and trust.

Open source has been a significant trend in ICT innovation. OpenStack, an open source cloud operating platform, has achieved tremendous success and adoption in the developer, user, and vendor communities. Both Huawei and Deutsche Telekom are strong supporters and contributors in OpenStack, and are using OpenStack as one of the core technologies for their ICT innovation.

Deutsche Telekom and Huawei have formed a partnership to build and to operate the first large scale, multi-national OpenStack-based public cloud in Europe - Open Telekom Cloud, launched in March 2016, initially focusing on the European market, with the plan of going global in the future. Based on OpenStack, Open Telekom Cloud enables user and developer organizations to use cloud services for their innovative R&D and business needs and avoid vendor lock-in. It also meets the European legal requirements for IT operations, e.g. data protection and other compliance issues.

T-Systems (the global IT services and consulting arm of Deutsche Telekom) operates Open Telekom Cloud in two availability zones (AZ) at data centers in Magdeburg and Biere. These are twin-core, tier 3+ facilities located 25 kilometers apart. They are connected via a low-latency, high-speed network, and therefore meet all criteria for fail-safe operations. T-Systems guarantees 99.95 percent availability for its IaaS.

At the data centers, T-Systems maintains pools of commodity servers with Intel x86 architectures. Compute capacity for users' virtual machines is provisioned automatically. Class SATA, SAS or SSD storage is deployed in accordance with I/O rate requirements. The underlying network uses vSwitches, eliminating the risk of bottlenecks arising in the IP fabric.

T-Systems holds comprehensive certifications validating the correct operation of the infrastructure platform, including ISO 27001 and ESARIS (Enterprise Security for Reliable ICT Services). Moreover, the provider has obtained cloud-specific certifications such as CSA STAR level 2 Gold, and TÜV Trusted Cloud Service. Other certification processes are scheduled for completion in 2016, including ISO 27017 and 27018, and the Trusted Cloud Label. T-System has completed the OpenStack Defcore test, and obtained the right to use the "OpenStack Powered" trademark.

Moving forward, Deutsche Telekom and Huawei will continue to make investments and to hold significant roles in growing the OpenStack platform, ecosystem, and community; and to utilize the best in OpenStack in making Deutsche Telekom's Open Telekom Cloud the most competitive public cloud and better serving business customers' ICT needs.

1. SOURCE: HTTP://WWW.GARTNER.COM/NEWSROOM/ID/3443517

OPENSTACK, HUAWEI, DEUTSCHE TELEKOM, AND THEIR PARTNERSHIPS

The OpenStack project is a global collaboration of developers and cloud computing technologists producing the open standard cloud computing platform for both public and private clouds. Companies large and small are using OpenStack through a range of consumption models for a variety of workloads. OpenStack is used by 50 percent of the US Fortune 100, spanning industries including financial services, manufacturing, media, government/university research, retail, technology & telecom. Launched in 2010, the OpenStack project, one of the fastest growing open source communities in the world, is backed by a vibrant community of developers and some of the biggest names in the industry. To date, over 20 million lines of code have been contributed by 62,000+ people and 630+ supporting companies in 180 countries.

Huawei, one of the leading ICT technology and service providers, is a firm believer of innovation via open source. Huawei has been fully committed to OpenStack's success and its entire ecosystem starting from the OpenStack Grizzly release timeframe, June 2013. Huawei's Cloud OS, FusionSphere 5.0 and beyond, is built based on OpenStack. Within only three years, Huawei's code contribution for the later releases of OpenStack since Juno release has been consistently ranked as one of the top 6 to 8 companies in the OpenStack community.

Huawei, currently a Gold member of the OpenStack Foundation, has been a loyal and significant contributor of OpenStack in providing vision, software development, testing, bug fixes, and resources; sponsoring and participating in large and small OpenStack summits, meetups, OpenStack Days, hackathons; and the protection and promotion of the OpenStack brand. In the past two years, Huawei has lead four China Bug Smash (aka hackathon) events, which fixed over 300 bugs. Moving forward, Huawei will continue its leadership, commitment, and contribution to the OpenStack Foundation, and the developer and user communities.

DEUTSCHE TELEKOM, one of the world's leading integrated telecommunications companies with more than 156 million mobile customers, 29 million fixed-network lines and around 18 million broadband lines (as of December 31, 2015). The group provides fixed-network/broadband, mobile communications, Internet, and Internet-based TV products and services for consumers, and ICT solutions for business customers and corporate customers.

DEUTSCHE TELEKOM has been a public supporter of OpenStack since 2012, and has been actively promoting OpenStack via sponsoring and participating in OpenStack Summits and OpenStack Days events, meetups, code fest, etc. Moving forward, Deutsche Telekom hopes to continue to share operator expertise in running a large size, multi-national public cloud and help OpenStack developer community understand public cloud requirements and improve OpenStack; and make OpenStack the de facto cloud platform.

Deutsche Telekom and Huawei have been partners for years in the area of developing and operating ICT services. In July 2016, Deutsche Telekom and Huawei have jointly announced their partnership **in Deutsche Telekom OPEN TELEKOM CLOUD, the first large scale, multi-national OpenStack-based public cloud in Europe.** With Deutsche Telekom's expertise in ICT operations, Huawei's expertise in ICT technology and services, Deutsche Telekom Open Telekom Cloud will be a highly performing, scalable, reliable, secure, cost effective, agile cloud platform meeting enterprise customers' needs in today's fast growing digital economy.

DEUTSCHE TELEKOM OPEN TELEKOM CLOUD OVERVIEW

OPEN TELEKOM CLOUD SERVICES

Deutsche Telekom launched Open Telekom Cloud in March 2016, initially focusing on the European market, and with the plan of going global in the future. **Open Telekom Cloud provides all the resources business customers** need in development and operation of their digital business models, and for projects that require additional resource capacity. Based on Huawei FusionSphere (OpenStack Powered cloud operation system),this IaaS from the public cloud makes customers' IT more flexible, reliable, scalable, secure, and cost effective than the proprietary public cloud services in the marketplace. Customers have complete control over CPU power, RAM, storage, and network connectivity. Via an user-friendly self-service portal or API, customers can configure all relevant parameters, and order optional security and management solutions as needed.

Deutsche Telekom Open Telekom Cloud means faster roll-out of customer digital business models, thanks to fully scalable resources ordered on demand. Business customers can leverage Open Telekom Cloud and Huawei's extensive experience in ICT and cloud computing to gain competitive edge and enjoy the following benefits:

THE BENEFITS OF OPEN TELEKOM CLOUD

- Security made in Germany: all applications are hosted at Deutsche Telekom's certified data centers in line with German data-protection legislation
- Scalable IT resources: simple access to CPU power, storage, network and additional services
- Ease-of-integration: the OpenStack architecture meshes easily with customer's in-house IT environment
- Total cost transparency: customers only order and pay for the IT resources they actually require
- Certified data security: access, infrastructure, and governance, risk and compliance systems are all designed to international standards (TÜV, CSA STAR) for rock-solid end-to-end protection

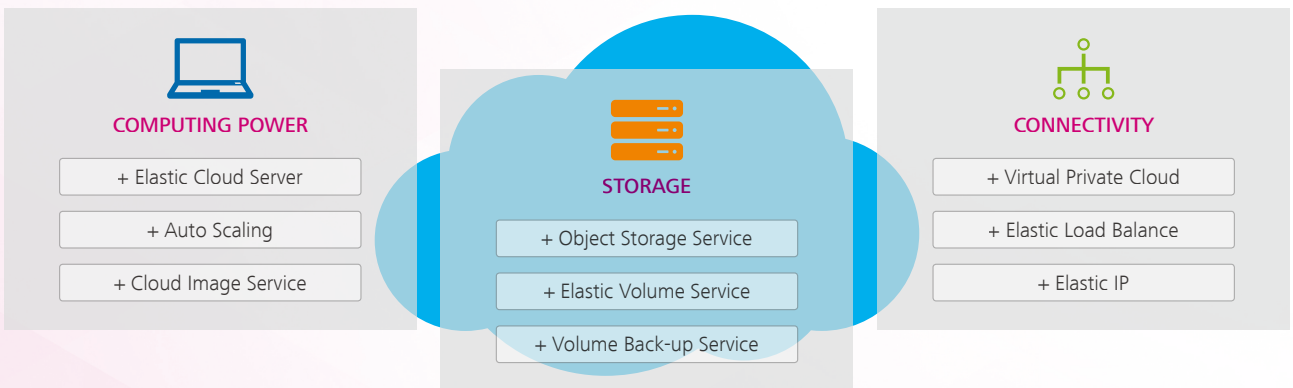
OPEN TELEKOM CLOUD SERVICE OFFERING OVERVIEW

- **Computing:** Elastic Cloud Server, Auto Scaling, Image Management Service
- **Storage:** Object Storage Service, Elastic Volume Service, Volume Backup Service
- **Network:** Virtual Private Cloud, Elastic IP, Elastic Load Balancer
- **Additional Services:** Cloud Eye, Cloud Container Engine, Relational Database Service, Security/Anti-DDos
- **Upcoming Services:** DNS, Direct Connect, OBS Encryption, new flavors of OS, and many more. DT OTC is committed to continuously developing the service landscape.

INFRASTRUCTURE, SUPPORT, AND CERTIFICATION

T-Systems, the IT arm of Deutsche Telekom, operates Open Telekom Cloud in two availability zones (AZ) at data centers

Create your individual IaaS solution



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T-Systems provides users with first-and second-level support. Huawei offers third-level support by phone.

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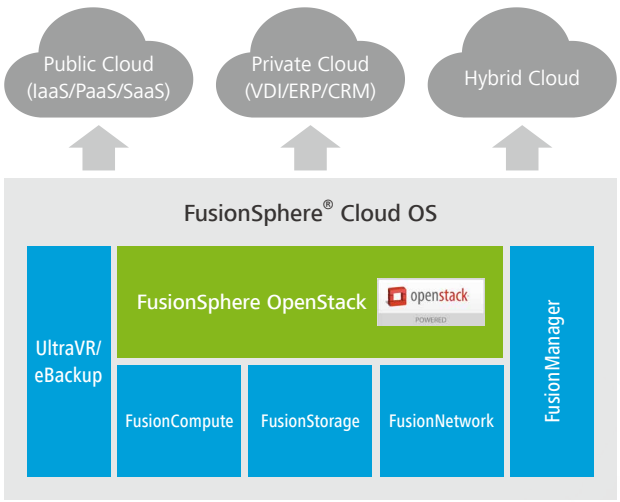
ADVANTAGES OF HUAWEI FUSIONSPHERE

FUSIONSPHERE

The engine that powers the Open Telekom Cloud - Huawei FusionSphere, an OpenStack Powered Cloud Operation System (OS) Optimized for ICT Convergence.



Huawei built its commercially used Cloud OS, FusionSphere, based on native OpenStack, thus it is compatible with the OpenStack ecosystem. This enables Huawei FusionSphere to support all hypervisors and software and hardware products that are certified on OpenStack. In addition, **Huawei added OpenStack expansions to improve the performance, reliability, availability, security, ease-of-use, compatibility, automation, and management of OpenStack for its customers' commercial use.** All the expansions and enhancements are implemented based on the native OpenStack plug-ins/drivers. There are no changes made in the OpenStack trunk code. Drivers of other vendors' hardware can be easily integrated into Huawei's FusionSphere. This ensures the integrity of OpenStack core platform within Huawei FusionSphere while providing Huawei's customers a production ready, enterprise grade, cloud platform. In addition, FusionSphere offers a rich set of north bound APIs that includes a set of standard OpenStack APIs which are fully compatible with the OpenStack tenant service interfaces, as well as FusionSphere added APIs improving the management of a large, multi-resource pool and the ease-of-use for application developers.

THE FUSIONSPHERE ADVANTAGES:

Mobility, Cloud, Social, and Internet of Things are rapidly blurring the boundaries between telecommunication and IT. We are experiencing the height of ICT convergence in data centers. **Huawei FusionSphere differentiates itself from other OpenStack based cloud operating systems in the area of ICT support:**

1. "Enterprise Ready" Server Virtualization
   - **Reduced Latency** - FusionSphere hypervisor is built with the technology to improve communication performance of virtual machines (VMs) by 1.5 to 3 times, significantly reducing latency.
   - **Higher Performance** - FusionSphere's cloud resource scheduling allocates virtualized resources according the affinity between network elements to improve VM performance. In addition, a "performance priority" policy is available to ensure

that all the VMs for a logical network element (multiple VMs working together to provide a complete service function) stay close physically in the network topology to guarantee optimized latency and throughput between VMs. Our test results have demonstrated performance improvement of key applications such as Oracle database by 20%. With the same memory resources, the VM density of the FusionSphere platform increases by 130%, which helps to reduce procurement costs on memory components by 30%.

- **Higher Reliability** - High Availability (HA) and Fault Tolerance (FT) features are built in FusionSphere to include resource redundancy, fault detection, fault recovery to minimize or eliminate system and application downtime. In addition, a web UI based installation and automatic deployment of the cloud platform, one-click smooth cloud platform upgrade, one-click health check and system information collection are included to minimize user error and improve overall system reliability.

2. Distribute Storage Virtualization

FusionSphere adopts SDS (software defined storage), a state-of-the-art distributed storage system that provides low latency, high performance, scale-out storage capability. FusionSphere virtualizes various storage systems and enables storage resources to form resource pools, building application-oriented storage systems with an unified management.

In addition, FusionSphere uses an intelligent storage resource scheduling algorithm to deliver optimal performance and resource utilization. Compared to traditional disk arrays, FusionSphere SDS increases the IOPS of applications by 2 to 3 times, improves the throughput by 6 times, reduces the latency between server and storage by 20 percent to 50 percent and expands the peak I/O bandwidth by 10 times.

3. Software Defined Network

FusionSphere uses an overlayed virtualization network component that is based on software-defined networking (SDN) and virtual extensible LAN (VxLAN) to construct a full mesh Layer 2 network in one, and across multiple data centers, simplifying application development and making resource scheduling flexible. Being aware of topologies and Quality of Service, the SDN controller dynamically selects the correct routing path and adjusts the WAN routing policy and bandwidth among multiple data centers, reducing cross-data-center link bandwidth cost by 60 percent to 70 percent on average.

Huawei's SDN is directly programmable, agile, centrally managed, programmatically configured, based on open standards and is vendor neutral. Its differentiated offerings are DC-SDN, DCI-SDN, WAN-SDN, and Policy-SDN.

4. Security

FusionSphere is a cloud platform that is hardened for security in responding to the security risks and threats of cloud, such as security threats from external networks (IP attacks, OS and software vulnerabilities, virus, SQL injection, phising, zero-day attacks, etc) and security threats from intranet (worms and viruses are spread through patches and database vulnerabilities, confidential information leaked via unauthorized Internet access act, unsecured mobile device access, viruses spread via network applications, data leakage and virus spreading occur due to the lack of peripheral management, etc).

FUTURE ROADMAP

Over time, Huawei and Deutsche Telekom will continue to evolve Open Telekom Cloud in meeting more business customer requirements and helping customers meet the needs of today's fast growing digital economy.

Huawei will continue to be a significant contributor to OpenStack in providing thought leadership and resources in helping OpenStack grow into a more "Enterprise ready" and "ICT innovative platform" for developers and users. In addition to OpenStack, Huawei will further develop OpenStack enhancements, as part of the FusionSphere offering, in the areas of massive scalability, reliability, performance, disaster recovery, security, bare metal, and container technologies to provide Open Telekom Cloud more competitive advantages of being a large scale, multi-national public cloud.

From the Open Telekom Cloud services side, the relational database, the cloud container engine, and a high-performance flavor have been available since release 1.01 (July 2016). Further features will be added to the cloud container engine and the database services in late 2016. The platform will then support SAP HANA. Subsequently, Open Telekom Cloud will begin to offer additional platform services—PaaS and SaaS.

ROADMAP FOR FURTHER SERVICES

Q3 2016

- Cloud Container Engine (Docker)
- Relational Database ServiceBasic
- High Performance Flavor

Q4 2016

- Cloud Container Engine (Enhanced)
- Relational Database ServiceEnhanced
- Additional Flavors for SAP HANA, graphical processing, workspace and big data
- OBS Encryption
- DNS
- Direct Connect
- Migration as a Service

CONCLUSION

OpenStack, one of the most successful open source projects in the market today, offers faster speed in technology innovation with more quality assurance supported by a massive number of global member companies and developers. Both Deutsche Telekom and Huawei are committed to the longevity and the growth of OpenStack and its entire ecosystem. With Huawei and Deutsche Telekom's commitments in OpenStack and years of accumulated ICT and cloud computing expertise, Open Telekom Cloud will be the most flexible, reliable, scalable, innovative, secure, and cost effective public cloud for customers' ICT needs. And, the best of all, Open Telekom Cloud is made and operated in Germany.

Learn More

Check out these resources for more information:
Deutsche Telekom Open Telekom Cloud: https://cloud.telekom.de/en/cloud-infrastructure/open-telekom-cloud/
Huawei FusionSphere: http://e.huawei.com/us/products/cloud-computing-dc/cloud-computing/fusionsphere/fusionsphere

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