2017

Open Telekom Cloud

Business Applications & Cloud Services

Adriano Perri
Deutsche Telekom AG
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BUSINESS PARTNER

About The Author

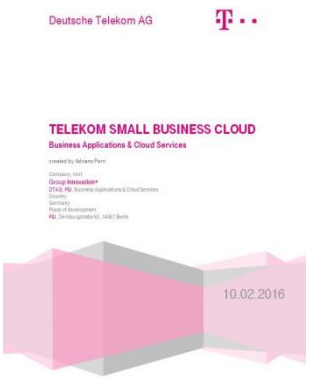
Adriano Perri

Mr. Perri is an apprentice as management assistant in IT systems at the Deutsche Telekom AG, the largest European telecommunication company. Currently he is working and learning in the department Business Applications & Cloud Services (BACS) until 2018.

Supported by his Team Cloud Development & Operations, he started to discover the world of Clou d Computing. Mostly specialized on the cloud operating system OpenStack.

Frank Klöker,Technology Manager of Cloud Applications, his guiding business expert, had the idea to integrate Cloud-Operation into the apprenticeship as a standard in the to-learn-framework.

To reach this goal he founded the project group “Cloud Kindergarten”. This group consists of the student Janika Schäfer, apprentice Oliver Klippel and apprentice Adriano Perri. It is foreseen that in the future the Cloud Kindergarten will expand.



This document is the second one he prepared for his unit. The first one (on the left), which contains the basics about OpenStack and more details about the DevOps Team can be downloaded on the following link:

https://github.com/adperri/Telekom-SMB-Cloud/blob/master/Telekom%20Small%20Business%20Cloud_Refcard.pdf

After he obtained the highest graduation at high school he gathered some experiences as Mac Expert and Call Agent for the Apple Online Store. Then he studied 1 year geoecology at the University Potsdam.

Contact

DEUTSCHE TELEKOM AG
International Delivery Unit
Products & **Innovation**
Adriano Perri
Business Applications & Cloud Services
Management Assistant In IT-Systems
Dernburgstr. 50, 14057 Berlin, Germany
E-Mail: **adriano.perri@telekom.de**

Content

Open Telekom Cloud

Deutsche Telekom AG [Business Applications & Cloud Services]

Document about Open Telekom Cloud prepared by Adriano Perri.

About This Document

This document describes Deutsche Telekom‘s Open Telekom Cloud (OTC) and is intended for business customer.

It features OpenStack as its base technology and focuses on advanced virtualization techniques to ensure basic aspects of modern cloud platforms.

1 Introduction

Open Telekom Cloud (OTC) is a public cloud platform developed by Huawei and T-Systems International (TSI), a subsidiary of Deutsche Telekom (DT). OTC is based on the OpenStack architecture and provides scalable, secure, and cost-effective infrastructure services for enterprises in Germany.

The first version of OTC was released on March 14, 2016, offering 11 IaaS services including: Elastic Cloud Server (ECS), Auto Scaling (AS), Object Storage Service (OBS), Elastic Volume Service (EVS), Volume Backup Service (VBS), Image Management Service (IMS), Cloud Eye (CES), Anti-DDoS, Identity and Access Management (IAM), Elastic Load Balance (ELB), and Virtual Private Cloud (VPC).

Last year at the 26th October 2016 DT becomes Gold Member of the OpenStack Foundation.

1.1 Certificates And Awards

1.2 Benefits For Enterprise Users

- **Security:** The data are hosted in highly secure Telekom computing centres in Germany
- **Scalability:** Computing power and memory can be ordered and set up online and adapted flexibly at any time
- **No vendor lock-in:** OTC is based on OpenStack, a freely available open-source standard. You can change the provider at any time
- **Instant provisioning of servers and storage:** Order, configure and deploy your infrastructure in minutes with our simple and intuitive online console
- **IaaS for all:** OTC is extremely flexible and therefore suitable for companies of every size

2 API First

OTC is developed based on the OpenStack architecture, and is compatible with OpenStack native APIs, with the purpose of building a real open public cloud platform. OTC takes customer requirements into account, and lets customers obtain the benefits of public cloud rather than bind customers. When customers want to migrate part or all of their data and services to a different environment for service adjustment or strategy concerns, OTC allows customers to easily migrate their data and applications to other cloud platforms that are compatible with OpenStack.

The OTC API provides APIs for each OTC service. With the APIs, users can interconnect cloud management tools with OTC services to enable automatic management and use of public cloud resources, which greatly improves the efficiency in managing IT infrastructure. The OTC API can invoke all open functions of OTC services. The service invoking complies with the RESTful API specifications and is implemented using HTTP. OTC provides open IaaS APIs, including standard OpenStack APIs (Nova computing, Cinder storage, and basic Neutron APIs) and combined APIs (such as VPC APIs).

OTC API architecture provides two types of APIs:

- Only publish non-admin APIs and native API through API gateway for Nova/Cinder/Glance/KeyStone
- Only publish combination APIs based on OpenStack Native API to carry out the combination API package, to reduce the complexity, such as VPC service API and extended ECS / EVS API

Further information on the Open Telekom Cloud API is available in the Open Telekom Cloud self-service portal under "Help Center". The APIs are standardized and can always be retrieved in the latest version online at: https://docs.otc.t-systems.com/.

2.1 API-First Design

At the start of an organization's API journey there are a number of questions that need to be answered as a part of the initial planning and analysis phase of the API lifecycle. Among others: why your organization wants to develop and provide an API, who are the stakeholders within the organization, who is the audience for your API? Once a vision is in place for the API, an organization can move into the design phase where the architectural framework for the API is created.

ProgrammableWeb considers API-first design to be the preferred design methodology for designing APIs. With the API-first approach, stakeholders are consulted in an attempt to collaboratively design, mockup, implement and document an API before the application or other channels that will use it even exist. The API-first approach is also something of a clean-room approach whereby the API is designed with little consideration for the existing IT estate. The idea is to design a great API design as though there are no constraints. Then, twist the IT estate into submission, rather than compromise the API's design. One major benefit to this approach is that by quickly mocking an API and putting it in front of various stakeholders, an organization can get valuable feedback while continuing to iterate on the design with the goal of providing a service that actually delivers value in the eyes of those stakeholders; the API's eventual consumers.

Another benefit of designing in this way is that consistency is enforced across interfaces. In today's multi-screen world, this strategy allows organizations to serve applications across a range of devices be they on the desktop, mobile, tablet or elsewhere.

Traditionally, API design has come after an organization has already released a data-rich application. Akamai Technologies API Evangelist Kirsten Hunter has described the situation where too often, "APIs are created as an afterthought once the product has already been created as a tightly coupled system, with the frontend website and backend system entwined together in a highly codependent way and the REST API having to be 'shoe-horned' into this system as a separate entity."

A number of companies have shown that API-first can work including Lob, Instagram and Etsy. However, this design methodology won't work every time. For example, there are times when the market requires a company move fast to gain a competitive advantage and the time investment to implement API–first design principles may be more than the organization can afford.

3 OpenStack

This Chapter will give you an overview of OpenStack's core services and the services of the Open Telekom Cloud.

Explanation And Capabilities

OpenStack believes in open source, open design, and open development, all in an open community that encourages participation by anyone. The longterm vision for OpenStack is to produce a ubiquitous open source cloud computing platform that meets the needs of public and private cloud providers regardless of size. By focusing on ease of implementation, massive scalability, a variety of rich features, and tremendous extensibility, the project aims to deliver a practical and reliable cloud solution for all types of organizations. OpenStack is designed to run on commodity hardware. For customers who want to use specific enterprise grade hardware, special drivers are available.

The OpenStack platform is a collection of several interrelated projects to provide capabilities to manage compute, storage, and networking resources in your data centers. It also provides an open API so that all of these resources can be managed through a dashboard that gives administrators control while empowering users to provision resources through a web interface, a command-line client, or software development kits that support the API.

Many OpenStack APIs are extensible, meaning you can keep compatibility with a core set of calls while providing access to more resources and innovating through API extensions. The OpenStack project is a global collaboration of developers and cloud computing technologists.

3.1 OpenStack Core Services

3.1.1 Compute

OpenStack Compute service (Nova) provides on-demand provisioning and management of virtual machines. It supports multiple hypervisors including KVM, XenServer, VMware ESXi, and Microsoft Hyper-V. It also supports Linux containers such as LXC and Docker.
The OpenStack cloud operating system enables enterprises and service providers to offer on-demand computing resources, by provisioning and managing large networks of virtual machines. Compute resources are accessible via APIs for developers building cloud applications and via web interfaces for administrators and users. The Compute architecture is designed to scale horizontally on standard hardware, enabling the cloud economics companies have come to expect.

3.1.2 Networking

OpenStack Networking service (Neutron) provides a pluggable, API-driven platform for managing networks and IP addresses. It supports multiple network models (Flat, VLAN, VXLAN), static IPs, and DHCP. It can also leverage advanced networking capabilities by taking advantage of SDN platforms such as OpenFlow.
Like other aspects of the cloud operating system, it can be used by administrators and users to increase the value of existing datacenter assets. OpenStack Networking ensures the network will not be the bottleneck or limiting factor in a cloud deployment and gives users real self service, even over their network configurations.

Networking Capabilities

- OpenStack provides flexible networking models to suit the needs of different applications or user groups. Standard models include flat networks or VLANs for separation of servers and traffic.
- OpenStack Networking manages IP addresses, allowing for dedicated static IPs or DHCP. Floating IPs allow traffic to be dynamically rerouted to any of your compute resources, which allows you to redirect traffic during maintenance or in the case of failure.
- Users can create their own networks, control traffic and connect servers and devices to one or more networks.
- The pluggable backend architecture lets users take advantage of commodity gear or advanced networking services from supported vendors.
- Administrators can take advantage of software-defined networking (SDN) technology like OpenFlow to allow for high levels of multi-tenancy and massive scale.
- OpenStack Networking has an extension framework allowing additional network services, such as intrusion detection systems (IDS), load balancing, firewalls and virtual private networks (VPN) to be deployed and managed.

3.1.3 Storage

OpenStack Storage service provides support for both object storage (Swift) and block storage (Cinder). Object Storage supports scale-out, distributed non-structured data and block storage provides virtual storage for virtual instances.
Object Storage is ideal for cost effective, scale-out storage. It provides a fully distributed, API-accessible storage platform that can be integrated directly into applications or used for backup, archiving and data retention. Block Storage allows block devices to be exposed and connected to compute instances for expanded storage, better performance and integration with enterprise storage platforms, such as NetApp, Nexenta and SolidFire.

Object Storage Capabilities

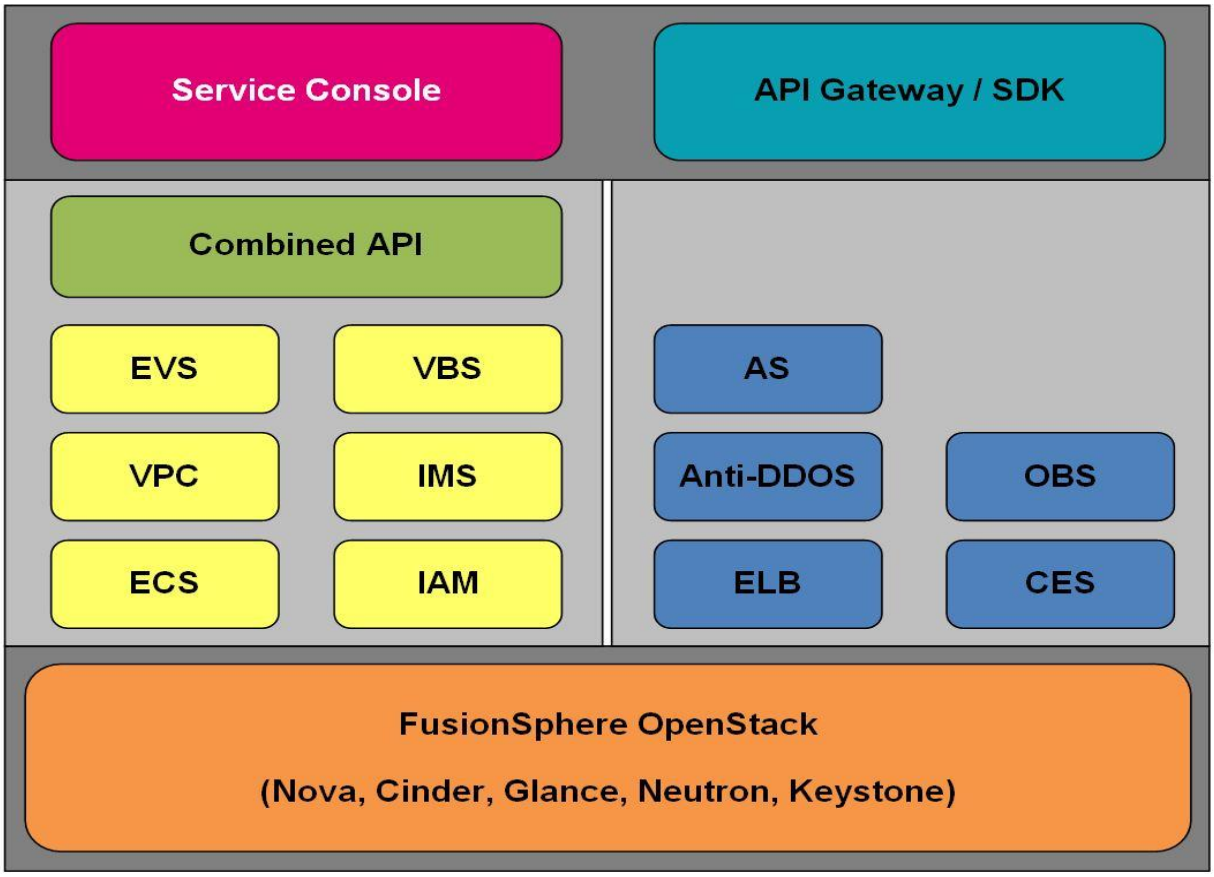
- OpenStack provides redundant, scalable object storage using clusters of standardized servers capable of storing petabytes of data
- Object Storage is not a traditional file system, but rather a distributed storage system for static data such as virtual machine images, photo storage, email storage, backups and archives. Having no central "brain" or master point of control provides greater scalability, redundancy and durability.
- Objects and files are written to multiple disk drives spread throughout servers in the data center, with the OpenStack software responsible for ensuring data replication and integrity across the cluster.
- Storage clusters scale horizontally simply by adding new servers. Should a server or hard drive fail, OpenStack replicates its content from other active nodes to new locations in the cluster. Because OpenStack uses software logic to ensure data replication and distribution across different devices, inexpensive commodity hard drives and servers can be used in lieu of more expensive equipment.

Block Storage Capabilities

- OpenStack provides persistent block level storage devices for use with OpenStack compute instances.
- The block storage system manages the creation, attaching and detaching of the block devices to servers. Block storage volumes are fully integrated into OpenStack Compute and the Dashboard allowing for cloud users to manage their own storage needs.
- In addition to using simple Linux server storage, it has unified storage support for numerous storage platforms including Ceph, NetApp, Nexenta, SolidFire, and Zadara.
- Block storage is appropriate for performance sensitive scenarios such as database storage, expandable file systems, or providing a server with access to raw block level storage.
- Snapshot management provides powerful functionality for backing up data stored on block storage volumes. Snapshots can be restored or used to create a new block storage volume.

4 Relationship Between OTC And OpenStack

OTC uses Huawei's FusionSphere OpenStack solution, ensures security of the whole system, and provides services at the IaaS+ layer. OTC develops six cloud services based on the OpenStack services and develops five new cloud services. With OTC, users have both the native OpenStack capabilities as well as various IaaS+ functions.

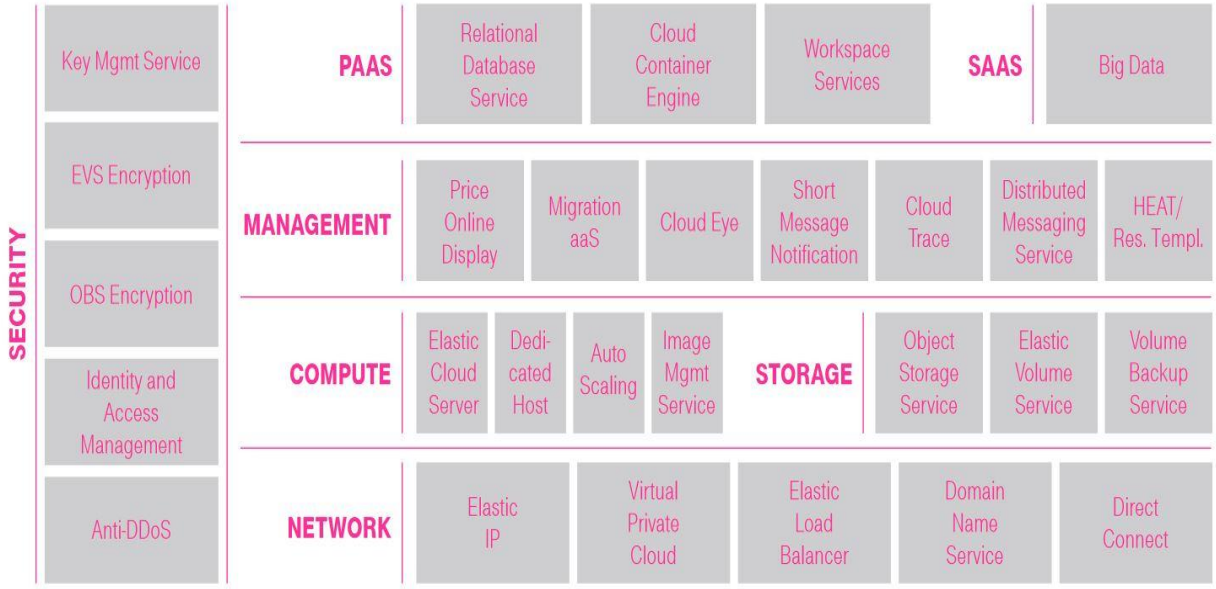


The relationship between each OTC service and OpenStack is as follows:

- Elastic Cloud Server: invokes OpenStack Nova capability to provide virtual computing service
- Elastic Volume Service: invokes OpenStack Cinder capability to provide virtual block storage service
- Volume Backup Service: invokes OpenStack Cinder capability to provide EVS creation and backup services
- Image Management Service: invokes OpenStack Glance capability to provide image management service
- Virtual Private Cloud: invokes OpenStack Neutron capability to provide virtual network environment service
- Identity and Access Management: invokes OpenStack Keystone capability to provide user management service

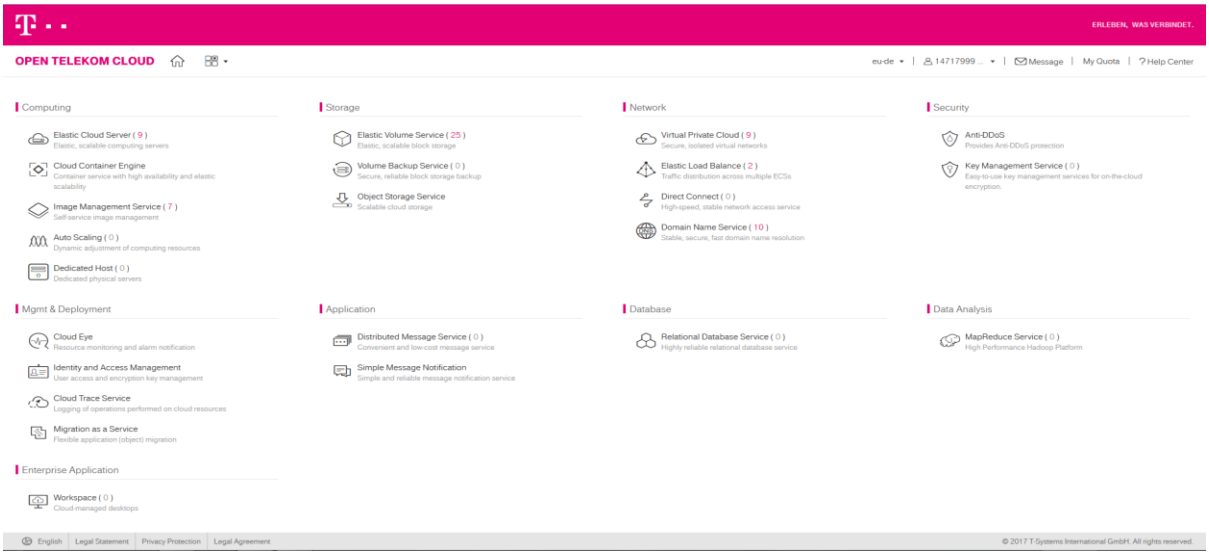
4.1 OTC Services

The Open Telekom Cloud is continuously supplemented by further services and features. With mySQL and PostgreSQL, two databases are now available, as well as a MapReduce/Hadoop Suite for big data analyses. The use of Open Telekom Cloud becomes more convenient and even more secure by means of Heat Resource Templates, communication services for resources and applications as well as Cloud Trace as a protocol service.



4.1.1 Console

The “Console” allows you as the user to select and configure individual components. You can choose from network services, computing services and storage services. These IaaS basic services are supplemented by additional services such as Container Engine, relational databases, a Big Data Suite and management functions.



4.1.2 Elastic Cloud Server

The Elastic Cloud Server (ECS), as a virtual computing server, consists of a processor (vCPU), memory (RAM), OS image (operating system, public or private image), and block storage resources (volume storage service).

The customer can choose between pre-assembled Elastic Cloud Server types called flavors. When the customer selects vCPU, RAM, storage, and image, Telekom automatically provides it with the selected Elastic Cloud Server flavor.

The Open Telekom Cloud self-service portal provides virtual network computing (VNC) consoles.

A distinction is made between the following Elastic Cloud Server types:

a) General purpose: vCPU/RAM ratio – 1:4

b) Compute I: vCPU/RAM ratio – 1:1

c) Compute II: vCPU/RAM ratio – 1:2

d) Memory optimized: vCPU/RAM ratio – 1:8

e) High performance: 1 vCPU is equal to one physical core

For further information visit:

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https://docs.otc.t-systems.com/en-us/doc/pdf/20170330/20170330093806_92756.pdf

4.1.3 Elastic Volume Service

The Elastic Volume Service (EVS) provides the customer with data storage in block level storage capacities. Customers can use the Elastic Volume Service separately or connect it to storage capacities for use on Elastic Cloud Servers. Up to 10 other block storage actions of different types may be assigned to each Elastic Cloud Server. With the Elastic Volume Service, identical copies are stored on multiple storage nodes, in order to store the data inventory at 99.99995 percent without loss.

The following block storage types are available to the customer for selection:

- Common I/O: SATA disk; IOPS: up to 1000; data throughput rate: up to 40 MB/s; Response time: 10 – 15 ms
- High I/O: SAS disk; IOPS: up to 3000; data throughput rate: up to 120 MB/s; Response time: 6 – 10 ms
- Ultra-high I/O: SSD disk; IOPS: up to 20000; data throughput rate: up to 320 MB/s; Response time: 1 – 3 ms
- Ultra-high I/O (optimized latency): SSD disk; IOPS: up to 20000; optimized data throughput through InfiniBand: up to 400 MB/s;
  Response time: 1 ms – for use with the "large memory" flavor.

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4.1.4 Relational Database Service

The Relational Database Service (RDS) is a cloud-based online relational database service. RDS is stable, reliable, scalable, and easy to manage. You can start using it right after purchasing it. RDS provides a comprehensive performance monitoring system, multi-level security protection measures, and a professional database management platform, allowing you to easily set, operate, and extend the relational database. On the RDS console, you can execute almost all mandatory tasks without programming, which simplifies the operation procedure and reduces routine O&M workload, helping you focus on application development and service development.

The following databases are available:

- mySQL version 5.6.x (Community version)
- PostgreSQL version 9.5.x (Community version)

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4.1.5 Image Management Service

The Image Management Service (IMS) provides images pre-configured by Telekom and fixed images in the form of operating systems for use on Elastic Cloud Servers. It also offers the opportunity to use the customer's own images.

Every Elastic Cloud Server must be assigned an image by the customer.
The following public images are provided in the version that is supported by Telekom, whereby Telekom strives to provide the respective latest version.

Public images:

- **Community Linux derivatives based on:**
  openSUSE 42.x
  CentOS 6.x & 7.x
  Debian 8.x
  Fedora 24

- **Ubuntu**
  Ubuntu 14.04.x
  & 16.04.x

- **SUSE Enterprise Linux (SLES)**
  SUSE Enterprise Linux 11 SP4 & 12 SP1

- **Oracle Linux**
  Oracle Linux 6.
  8 & 7.2

- **Red Hat Enterprise Linux**
  Red Hat Enterprise Linux 6.8 & 7.3

- **Microsoft Windows**
  Microsoft Windows 2008 Enterprise R2 SP1 English
  Microsoft Windows 2012 R2 Standard English
  Windows Server 2016 Standard English

The full list of available public images can be viewed at http://imagefactory.otc.t-systems.com/.

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4.1.6 Elastic Load Balance

Elastic Load Balance (ELB) is a service that automatically distributes access traffic to multiple Elastic Cloud Servers (ECSs) to balance their service load. ELB enables you to achieve higher levels of fault tolerance in your applications and expand application service capabilities.

You can create an ELB service on a web-based console, configure monitoring ports required by the ELB service, and configure ECSs associated with the ELB service. The ELB service helps to eliminate single points of failure, improving availability of the whole system.

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4.1.7 Domain Name Service

Domain Name Service (DNS) provides highly available and scalable domain name services. It is used to translate domain name or application resources into IP addresses so that the end user's access requests are directed to the required websites or application resources. In addition, the DNS service also manages domain names.

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4.1.8 Cloud Eye

Cloud Eye (CES) is an open monitoring platform that provides monitoring, alarm reporting, and alarm notification for your resources. CES monitors metrics of Elastic Cloud Server (ECS), Elastic Volume Service (EVS), Virtual Private Cloud (VPC), Elastic Load Balance (ELB), Auto Scaling (AS), and Relational Database Service (RDS). You can add alarm rules and configure alarm notification policies to learn the running status and performance of the monitored objects in a timely manner.

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4.1.9 Cloud Trace Service

Cloud Trace Service (CTS) provides records of operations on cloud service resources. With CTS, you can query, audit, and backtrack operations.

CTS records three types of operations:

- Operations performed on the management console
- Operations performed by invoking supported APIs
- Operations triggered by cloud services

On the Cloud Trace Service console, you can query operation records for the last 7 days. To obtain more operation records, you can enable the Object Storage Service (OBS) and deliver operation records to the OBS bucket for storage in real time.

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4.1.10 Anti-DDOS

The Anti-DDoS traffic cleaning service (Anti-DDoS) is a network security service that defends IP addresses against distributed denial of service (DDoS) attacks. Anti-DDoS monitors traffic, in real time, directed to specified IP addresses and detects access traffic at network egresses to discover DDoS attacks as soon as possible. It then cleans abnormal traffic according to user-configured defense policies so that services run as normal. In addition, monitoring reports are generated, presenting users with clear network security evaluations.

Anti-DDoS provides the following functions:

- Providing defense against the following attacks: SYN flood, challenge collapsar, slow HTTP, UDP flood, ACK flood, and TCP attacks
- Providing monitoring records for each IP address, including the current defense status, current defense configurations, and the last 24 hours' traffic and abnormalities
- Generating interception reports for all defended IP addresses of a user. Statistics over the last four weeks can be queried, including the number of cleaning events, cleaned traffic, the weekly top 10 most frequently attacked Elastic Cloud Servers (ECSs), and total number of intercepted attacks.

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5 Deployment

This chapter gives an insight into the OTC environment and their developer tools.

5.1 Developer Tools

Native Tools :

https://github.com/OpenTelekomCloud/

SDKs are a vital part of the OpenStack ecosystem, they help developers write applications for OpenStack and other clouds.

OpenStack Software Development Kits (SDK) :

https://wiki.openstack.org/wiki/SDKs

5.2 Environment

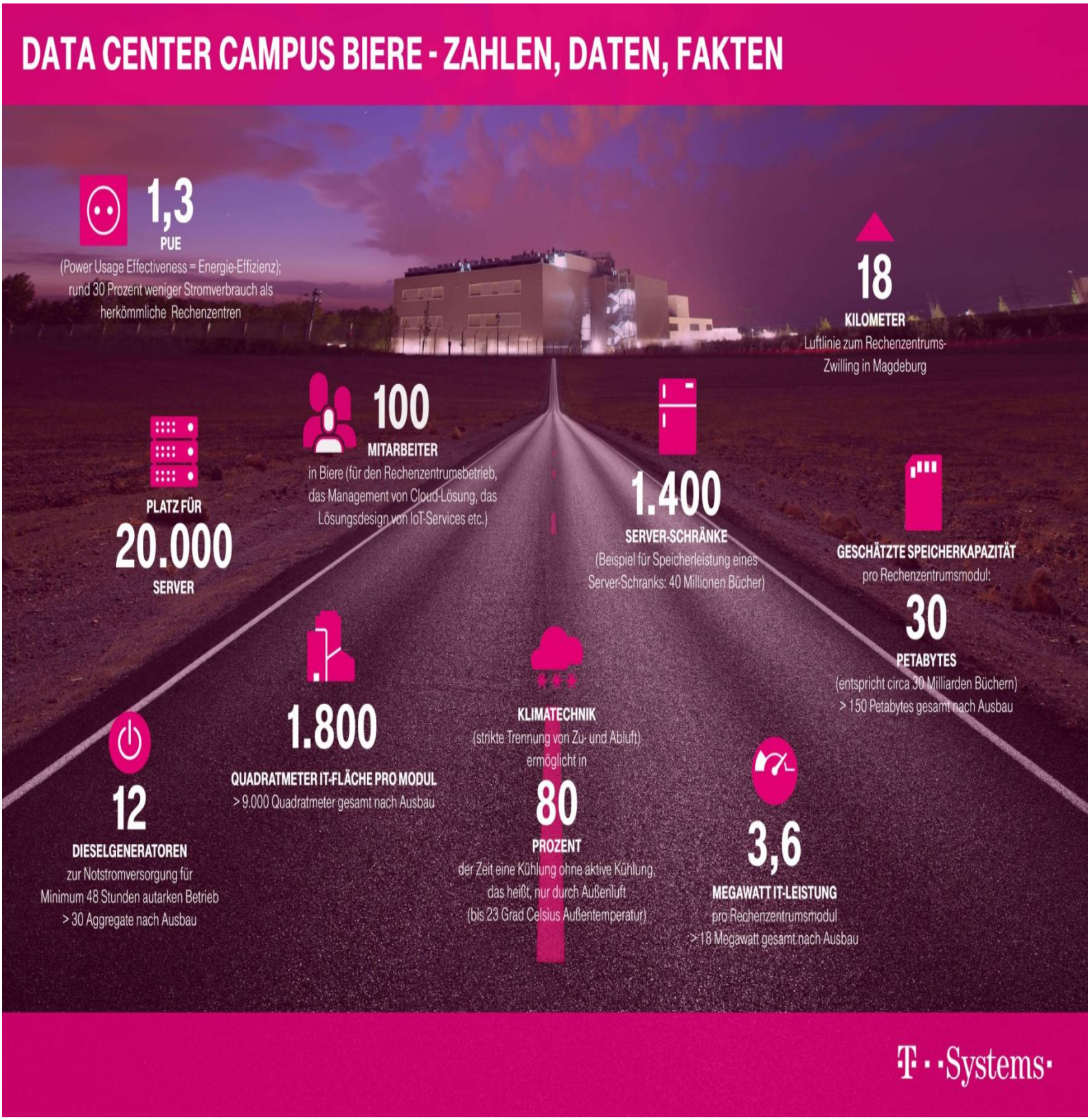
The services are produced at the data centers in Magdeburg and Biere, located around 25 km apart from one another. The two availability zones are connected by means of a low-latency, high-speed network. Since operation is carried out exclusively at German data centers, T-Systems as a German provider fulfills all relevant security requirements and regulations for operation of IT services.

The latest high-performance data center opened on July 3rd. With 39,600 square meters of space, the facility in Biere will be Germany's largest cloud data center and one of the largest in Europe after completion.

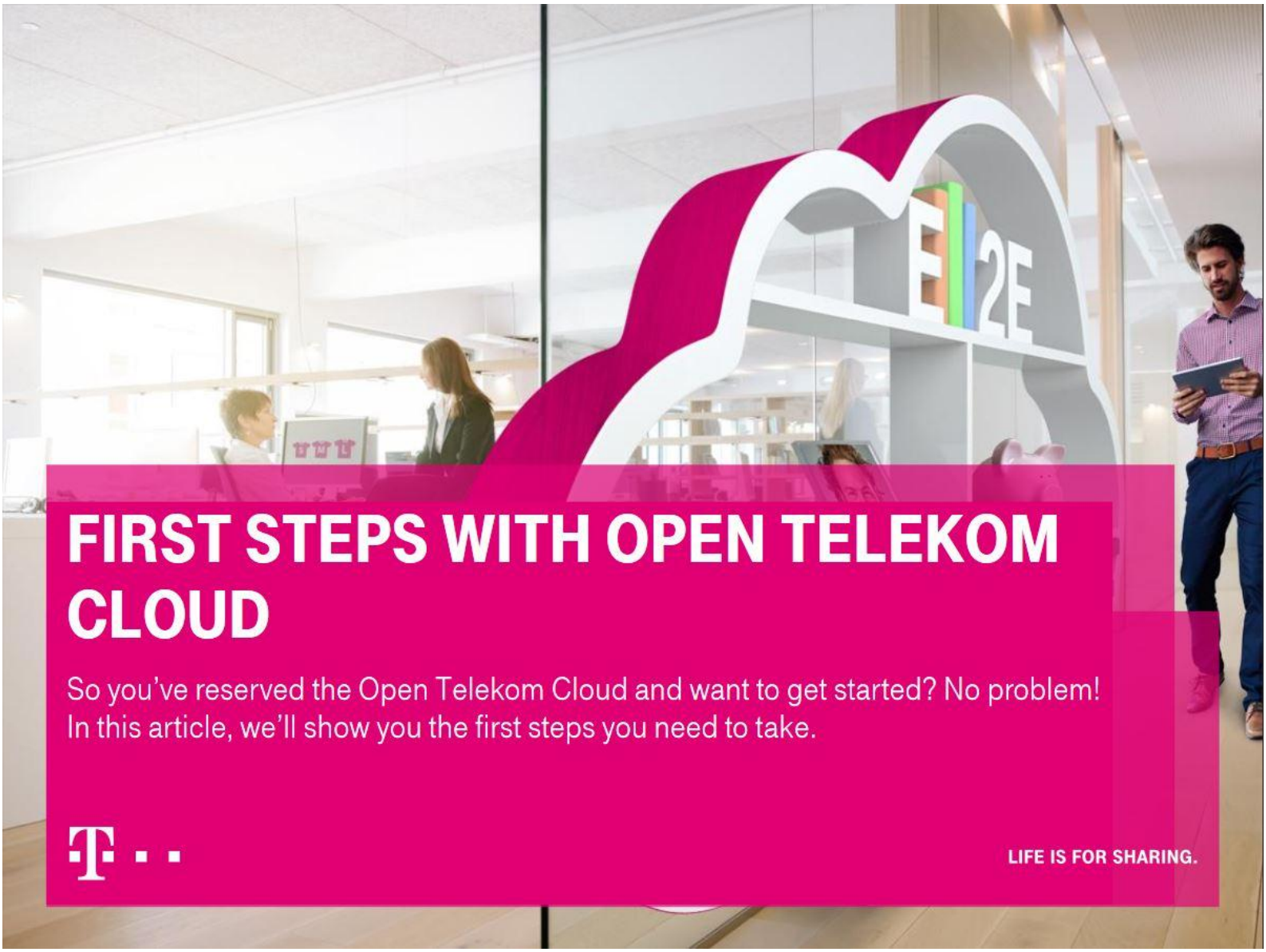
The new cloud data center guarantees the highest degree of data and operational security and is secure both in terms of technology and personnel. The twin-core concept dictates that the two mirrored cores be located at least 20 kilometers apart. That guarantees that the data at one of the two data centers is permanently available (99.999 percent availability) thanks to the other.

All of the data flows through secure IP VPN tunnels that are separated from public networks. That creates a closed system, completely protected from outside access. State-of-the-art encryption technology makes sure that data can only be viewed by authorized persons.

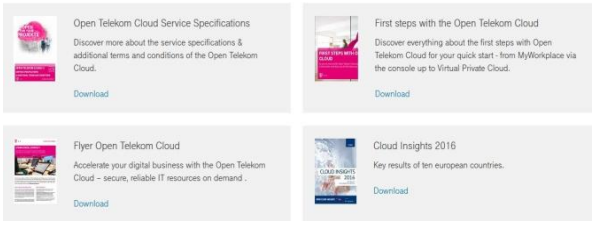
The firewall gets additional support from security mechanisms such as intrusion detection and intrusion prevention systems, which check data flows for suspicious elements like malware and track suspicious attack patterns. The security systems are constantly expanded in collaboration with the Telekom Cyber Defense Center in order to identify and prevent new forms of hacker attacks on a broad level. The cloud data center in Biere offers businesses the secure, digital production capacities that are so critical to their business.



6 OTC First Steps



To find the pdf-document to the article "**First Steps With Open Telekom Cloud**" please visit https://cloud.telekom.de/en/. Choose "Open Telekom Cloud" under the menu-point "Cloud Infrastructure". There you find all information about OTC. Click on "Downloads & Events" and scroll down till "Downloads". You can download four different pdf-documents.



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Keywords

Access Key/Secret Key

Used in combination to access and communicate with a compute instance. Secret key is used to digitally sign each request.

Availability Zone

An isolated set of hypervisors within a cloud used to provide fault tolerance to virtual machines.

Block Storage

Type of storage, intended to offer persistent storage mounts for virtual machines, that supports volumes, volume snapshots, and volume types.

Container (Object)

Organizes and stores objects in object storage.

Container (LXC)

Linux Container is a virtualization environment at the operating system level for running multiple isolated Linux systems on a single Linux host. OpenStack Container Service (Magnum) provides for management of application containers.

Fixed/Static IP

An IP address associated with a same VM instance each time it reboots. This is used for VM management, and is generally not accessible to users.

Flavor

A set of parameters of the virtual machine images; its parameters include CPU, memory size, storage size, etc.

Floating IP

An IP address associated with a VM instance so that the instance has the same public IP address every time it reboots.

Image

A collection of files for a specific operating system that one needs to create or rebuild a server. OpenStack supports multiple image formats (AMI, VMDK, VHD, QEMU).

Networks

A virtual network is a layer-2 network that provides connection between entities.

Object

An object is any kind of data that is stored in object storage, which could be of any format — file, music, video, or binary.

Object Storage

Type of storage that supports eventually consistent, redundant, non-structured data.

Public Image

Public image contains a standard OS image and preset public applications and is visible to all users. You can configure the application environment and required software to customize a public image.

Project/Tenant

A logical grouping of users; also commonly referred to as tenant.

Quotas

Resource limits on compute and storage resource, set on a per-project basis.

Role

A role includes a set of rights and privileges. A user assuming that role inherits those rights and privileges.

Security Group

A set of filtering rules applied to a compute instance.

Server

A virtual machine instance.

Service

An OpenStack service that provides endpoints through which users can access and control resources.

Snapshot

A point-in-time copy of a storage volume or an image.

User

A part of a project/tenant who consumes cloud resources.

Volume

Disk-based data storage that is generally represented as an iSCSI target with a file-system that supports extended attributes. This could be persistent or ephemeral (lost during reboots).

If you can't find an explanation you need visit:

https://docs.otc.t-systems.com/en-us/glossary/index.html

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