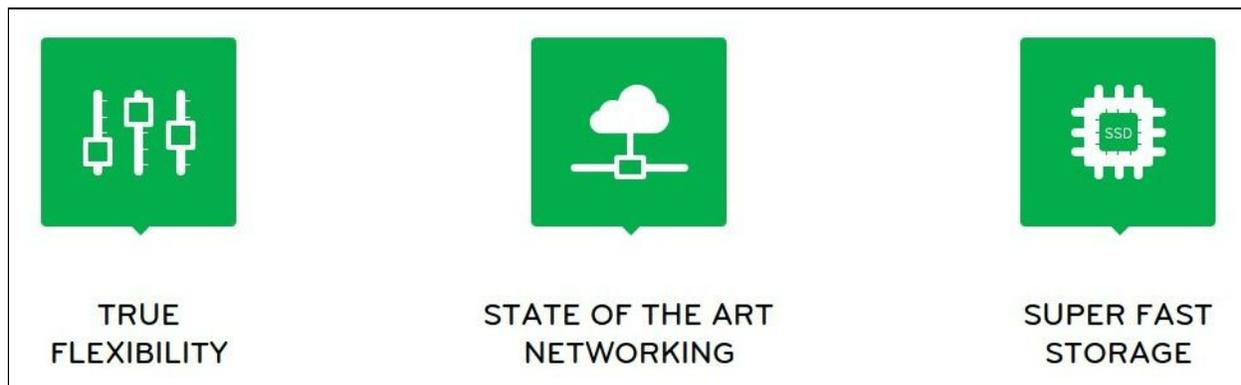


CloudSigma - Service Description

1. Company description

CloudSigma is a pure-cloud Infrastructure-as-a-Service (IaaS) provider that offers highly available, flexible, enterprise-class cloud servers and cloud hosting solutions. CloudSigma is operational in both Europe and the US, with plans to expand into Australia, Latin America and Asia. We have offices in San Francisco, Zurich and Sofia. With infrastructure in Equinix data centres in Zurich, Switzerland, an ATM data center in Warsaw, as well as Washington DC, San Jose & Miami, US, and a DRFortress data center in Honolulu, CloudSigma selects the highest-quality facilities to support its innovative infrastructure. We serve customers globally, with a focus on Europe, North & South America.



CloudSigma is one of the most customizable cloud providers on the market. Customers are able to provision processing, storage, networks and other fundamental computing resources at one's discretion, meaning CPU, RAM, Storage and bandwidth can be purchased independently to allow the best combination of cloud resources without the limitation of fixed sizes. Each resource is billed separately and transparently as either subscription or as pay-as-you-go 5-minute billing segments enabling customers to track exactly how much their cloud servers are costing over time. Any operating system and software can be installed with complete administrator/root control. Account administrators are able to assign specific access and control rights over certain account related operations. All our cloud servers and drives are persistent and controlled with the same methodology as physical dedicated server equivalents. VLANs and IP addresses are also controlled using standard behaviour.

2. Server provisioning and configuration

Virtual machines can be provisioned with a high degree of flexibility and control. CPU and RAM can be specified to the nearest MHz and MB. Furthermore, the CloudSigma platform is able to expose the full CPU instruction set to virtual machines providing an 'as hardware' environment for computing.

Block storage devices/SSD disk drives can be provisioned in sizes up to 8TB and up to 16 drives can be attached to one Virtual Machine. CloudSigma's block storage is a pure SSD solution priced as magnetic, which means that contention particularly for IOPS is eliminated and customers have no I/O wait in their workload as a result.

There is absolutely no restrictions on the type of operating system that the customer can deploy. As long as the OS can run on standard Intel/AMD architecture it will run on CloudSigma. Customers can use their own images, including importing AWS and VMWare images or use images from our Marketplace.

CloudSigma is providing latest generation high performance range Intel, combined with DDR4 RAM modules and enterprise SATA hard drives. Additionally, more SATADOM modules house the Ubuntu host OS, used to avoid reliance on a drive controller card through its direct motherboard connection and to offer the fastest possible boot-up and recovery times.

CloudSigma provides a modern RESTful API to provision and configure compute resources, which is covered by all major cloud API abstraction libraries including jclouds, fog, LibCloud, Ansible, Golang, as well as IaaS management platforms such as Enstratus, OpenStack HEAT and thanks to Canonical certified CloudInit support, Juju to name but a few. With the support of these tools, full automation of CloudSigma's cloud infrastructure is possible, including automatic scaling, load balancing and more. We offer a 'full control' API meaning that all account functions are available via the API and can thus be fully automated.

2.1 Unbundled resources and server configuration

The majority of public cloud architectures are based on a mix of basic elements, such as core processors (CPUs), storage, and memory. Most public-cloud providers bundle resources. This inevitably results in users having to pay for resources they don't actually need. To eliminate waste, at CloudSigma we never bundle resources together. Instead, we allow users to create server instances with exactly the combination of CPU, RAM, storage and bandwidth required, and charge them in short five-minute billing cycles. As a customer, you set the parameters of your virtual machines as if you were building a server to order for your own needs. Every component of your VM is billed separately, so you only pay for what you require and use. Furthermore, resources are completely scalable and thus users are able to adjust to their computing needs elastically over time. This is how we aim to make our IaaS cloud offering as close to true utility computing as possible.

There are many types of computing that require different combinations of resources. For example, applications for physics simulations, seismic analysis, genome analysis, aircraft design or Monte Carlo simulations may require a lot of CPU resources compared to the RAM resources needed. Other processes, such as big data analytics, will usually require high RAM usage in combination with low CPU usage.



Now imagine that you as a customer were stuck with pre-defined resources packages. You are in the e-commerce business and you are selling watches. You are prepared and you have calculated that around Christmas the traffic to the webpage and the purchase orders, logically, will grow. What does this mean for your cloud deployment which had been fixed at certain volume of resource? Well, you will have to increase the Virtual machine's compute and network resources size in order to cover for the peak periods, otherwise your Virtual machine would simply not be able to accept all requests and the web page will eventually stop working properly. The resources included in the package are not enough and you want to purchase additional CPU and RAM capacity. However, since all resources are bundled, you will have to purchase a whole package of resources, including storage capacity, IPs, networking capacity and most probably OS licenses. Of course, this means extra expenses for resources you will never actually make use of.

In contrast with this imaginary provider which made you pay for a package, CloudSigma will provide you with the specific resource and necessary capacity volume. Why is this flexibility important? Because you are not forced to pay for idle resources and you retain a level of transparency and flexibility which is saving you cash for other purposes and enabling you to predict capacity growth and respective charges over time.

2.2 Drives Library and Operating System Support

CloudSigma's stack offers an open API and a very high degree of compatibility with end users who have legacy requirements. There are absolutely no restrictions on the type of operating system that the customer can deploy, as long as it is x86 compatible. This includes the BSDs,

Linux variants and all versions of Windows. Customers can find the latest releases and version of all legacy OSs in our or Drives library or in other words Marketplace.

As stated above, the cloud platform provides an extensive library of ready-to-use public drive images that include pre-installed systems that can be deployed instantly, alongside install CDs for users preferring to install their own systems from scratch. To illustrate, look at the following table which provides a sample of the available drive images in the marketplace:

Linux distributions	CentOS 5.X, 6.X, 7.X Debian 5.X, 6.X, 7.X, 8.X Fedora 19, 20, 21, 22 Linux Suse 11, 12 RedHat Enterprise 5.x, 6.X, 7.x Ubuntu 12.X, 13.X, 14.X CoreOS, CloudLeap, Elastix, Finnix, Knoppix, OpenVPN, pfSense, Vyatta
Windows distributions	MS SQL Server Standard MS SQL Server Enterprise MS SQL Server Web VirtIO Drivers for Windows Windows Server Datacenter Windows Server Standard 2008, 2012
Solaris distributions	Oracle Solaris 11.X
Other drive images	FreeBSD 8.X, 9.X, 10.X GParted NetBSD 6.X OpenBSD 5.X

In addition to the listed images, we have provided customers with a simple and easy way to import and export data and ready OS images into and out of the system.

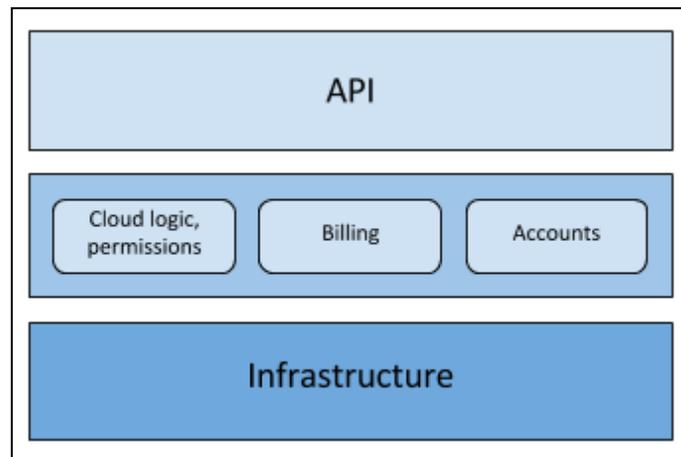
Last but not least, there is a number of ready appliances allowing customers to immediately deploy VPN and SFTP servers to secure external access and move data into and out of the cloud.

2.3 Elastically expand storage capacity

A developer may require a database server as part of their development stack. What initially appears to be a good specification of storage resource requirements may in time turn out to be insufficient. CloudSigma's infrastructure offers the flexibility to elastically expand storage capacity to match growing data sizes, without the need to migrate the data to a new drive image. The service is giving you the option of drive re-size. Should a VM's datastore become saturated, simply request more storage capacity and CloudSigma's cloud storage allocation will see to it that it is made available to your VM.

2.4 Architecture

CloudSigma offers a Linux KVM based public cloud that can be thought of in three layers. The base layer is the software running on the physical servers, which provide the virtualized resources. Each physical 'host' server runs a Linux distribution with the KVM hypervisor. For management within the host we use Libvirt, which is used to communicate and respond to information requests from the next layer up, the management layer. The management layer consists of the resource allocation logic, customer records management, and billing. This layer has been entirely coded from scratch by CloudSigma. The management layer is responsible for our ability to expose a range of unique functionality and freedoms to users. Our utility pricing around simple charging per resource unit in short 5-minute cycles derives from this management layer, also. The third and final layer is the public layer, which provides two primary interfaces, which allow customers to control and manage their cloud infrastructure. These two public interfaces consist of the public web provisioning portal and the public API. Furthermore, we are rolling out additional 'wrappers' that allow compatibility with other mainstream IaaS APIs. We offer a 'full control' API meaning that all account functions are available via the API and can thus be fully automated. As a public multi-tenanted cloud, we provide an open computing environment for customers, whilst simultaneously protecting the cloud and existing customers from malicious behaviour.



3. Networking

3.1 Redundancy

CloudSigma works with multiple global carriers and constantly updates its routing based on live latency measurements to optimize latency from any given Internet eXchange point to our cloud locations. Our clouds sit on multiple 10GbE IP lines from major network carriers like Level3, Tinet and others. We complement this with layer 2 peering lines to major exchanges like AMS-IX, DE-CIX, Swiss-IX etc. As a result, all VMs regardless of their size benefit from an

excellent visibility over internet routes and redundancy across networks. From customer's perspective, this means less down time, lower latency and faster load times. Most importantly, CloudSigma does not limit connection speed of Virtual machines so all customers have full 10GigE networking speed exposed.

In addition, latency can be reduced by connecting to a private line from a customer location into the nearest Internet eXchange or directly into the VLAN/CloudSigma data centre locations to form a hybrid deployment. We are global partners with Equinix and can offer direct access to our cloud locations from various class A office buildings into our cloud if the building is on the Equinix IBX. This is offered at a typical cost of 200-300 USD per month. Intra-node networking is provided via Optical Ring technology, resulting in extremely low latency SLA guarantees between VMs.

3.2 Firewall Policies

CloudSigma offers a custom firewall policy creation feature to facilitate the improvement of security and traffic in and outside of the cloud. If you use the API, there is a template where you need to fill in the rules. Management is achieved via policies which are applied to single or groups of infrastructure allowing each management and application across both small and large scale infrastructure in a convenient way.

You can also choose the consequence in which you want the firewall rules to be applied. In order for the firewall policy to be active it needs to be applied on your public network interface.

Order #	Source IP	Destination IP	IP protocol	Source port	Destination port	Direction	Action
0		178.22.66.228/32	tcp		80	both	accept
1		178.22.66.228/32	tcp		443	both	accept
2	46.218.123.34/32	178.22.66.228/32	tcp		22	both	accept
3			tcp	53		in	accept
4			udp	53		in	accept
5			tcp		0:1024	in	drop

The policies range from a single rule that blocks all external public IP traffic, to complex schemes that only allow connections to certain ports from a set of IPs. Network policies are saved and then applied to one or more virtual servers as required. Furthermore, network policies can be reconfigured and re-applied to running servers without service disruption.

4. Security

As a company, CloudSigma endeavours to deliver a high degree of security for customers in accordance with the various aspects of their computing. We regard security as a top priority and are committed to openness and transparency with respect to our security procedures and policies.

4.1 Root Access

Customers retain full sole access to their data at the file system level; the CloudSigma system does not have access inside VMs or drives. All customer data is handled automatically by our system. This includes activities such as drive deletion and scheduled deletion (for deprecated accounts). CloudSigma takes no copies of client drive data and therefore the sole copy resides in our cloud unless the customer chooses to clone the drive to another storage system or location.

With this in mind, we recommend as a best practice that customers perform boot-level encryption of sensitive data and retain the keys outside our cloud. Customers can also connect to their VMs using encrypted protocols also to ensure the integrity of login and other data they transmit to and from their servers.

4.2 SSH Keys

The platform is giving access to the UI by SSH keys. This allows users to run commands on a machine's command prompt without them being physically present near the machine. It also allows users to establish a secure channel over an insecure network in a client-server architecture, connecting an SSH client application with an SSH server.

The SSH key creation covers the following three scenarios:

- CloudSigma support team can generate a public and a private SSH key for the customers.
- Customers can generate the SSH keys themselves and upload only the public key in their CloudSigma account. In this scenario customers take the responsibility for the protection and access of the private key. This option is provided for customers that are especially concerned about security in the cloud.
- Customers can generate the SSH keys themselves and upload both SSH keys in the CloudSigma account. Currently, this scenario doesn't provide additional benefits, but in the near future an SSH console (similar to the VNC console today) will be opened automatically in the Webapp. This option will be only available for customers that have uploaded both their public and private SSH keys to their CloudSigma accounts.

4.3 Two-step Verification

Furthermore, in order to log in their accounts, CloudSigma customers are able to use the Google Two-step authentication. The two-step verification increases the security for access to

the CloudSigma account by providing a six- to eight-digit unique password which users must provide in addition to their username and password to log into CloudSigma UI. The feature is currently available via an API call and will be soon exposed in the Webapp. The default status of the feature is disabled and can be activated by individual customers if they want to.

4.4 Access Control Lists

As a relatively new feature at CloudSigma, the access control lists (ACLs) are meant to segment account control rights and access to the different operational aspects. With this feature the account administrators can allow access to different resources or a group of resources across the account. The account administrator delegates permissions to each account and lets each user log in to the web console with their own user credentials. Examples of delegated abilities:

- Provide accounting with access to billing, but not to edit any server/networking resources.
- Give junior sysadmins access to start/stop servers, but not to create or delete anything.
- Provide senior sysadmins access to fully manage the architecture, but not being able to access billing.
- Provide the operations team with access to firewall policies and networking, but not to servers.
- Provide a team with full access to their servers (using server tagging), but not not any of the other resources.

The ACLs enable a very granular control over the account's permissions and budget, resulting in higher levels of transparency and security. For each module, it is possible to delegate either read-only or read-write permission. It is also possible to delegate permission on individual resources, for example a server or set of drives.

4.5 DDoS Protection Measures

The following measures are used to prevent Distributed Denial of Service (DDoS) attacks:

- Implement additional rules for fraud payment prevention (Number of tries per new account ex.5 it should only apply if the account age is less than a week)
- Apply an ISP approach for safety - Traffic shaping (put a policy in terms of number of packets and throughput), upon request that policy will be editable for particular client or set of clients
- blacklisting of IP addresses
- 500% increase in spare IP connectivity to absorb malicious traffic
- additional firewall measures both at our edge and internally
- obfuscation of and removal (in some cases) of public IP connectivity from infrastructure where possible
- externally hosted cloud status page allowing status updates even during a potential total outage (see <http://status.cloudsigma.com/>)
- using IP proxies on core services and other measures that can't be shared public
- automatic blocking of DDOS attacks against our clouds

4.6. VM Monitoring via New Relic

Our partnership with New Relic allows customers to get better insight into their compute usage. After installing the Server Monitoring agent, customers can monitor and get alerts for servers or applications running within them against performance or availability issues. The Application Monitoring tool provides greater insight into application behaviors, which tremendously simplifies the process of identifying bottlenecks and application health issues such as capacity issues, server health issues, server availability, CPU utilization, memory utilization, disk I/O utilization, and many others.

Uniquely, customers can choose to delegate read only access to New Relic data so that CloudSigma technical support and customer technical resources can share data in order to achieve fast root cause analysis.

Once registered, customers should automatically be upgraded to the 'standard' tier by signing up using the web app. The 'standard' tier falls somewhere in-between ['lite'](#) and ['pro'](#) and is fully free of charge. Customers also get a free 30-day trial of the 'pro', but if once it has expired, customers will automatically get downgraded to the 'standard' tier again.

5. Privacy

5.1. Data protection

Each CloudSigma location is controlled by a legally separate entity. In order to circumvent the Patriot Act and to be able to treat customer data in accordance with the country where it is physically residing, CloudSigma is operating clouds under different and legally separated entities for each location.

It is important to mention that customer data residing in the Swiss cloud is protected by the Swiss data privacy protection legislation. For example, if you were an American citizen/company having opened an account in Zurich, the US authorities will not have access to its data. This can only happen if information is officially requested by the appropriate agencies and approved by the Swiss state.

It is still possible to open an account in each location, connect the VMs via a VPN and be able to transfer data for recovery options for instance. We will soon implement a UI feature for customers with multiple location accounts registration to be able to manage their account instantly from a single access point.

5.2. Certificates

CloudSigma is ISO-27001 certified and PCI-DSS compliant. All our data centers are covered by a number of certifications such as ISO 27001, ISO 9001, and PCI/DSS compliance. We can provide a list of certifications upon request. CloudSigma is subject to Swiss data laws, which are very strict regarding the handling of data. Unlike data protection laws in the EU, Switzerland treats company data and data from individuals under the same provisions.

A copy of any certificate can be obtained upon request.

6. Integrated backup and Recovery

6.1. Live Drive Snapshots

This feature enables users to create point-in-time snapshots of their drives, which can later be cloned and upgraded to create stand-alone drives. Priced simply by size of each snapshot, it means users only pay for the delta (i.e. the difference between the snapshot and the source drive) over time. Unlike cloning of drives, snapshots can be created while the server is running. By using snapshots customers can protect themselves from data corruption or use them for auditing purposes.

Furthermore, there is an advanced snapshot management feature, allowing customers to create snapshot management policies and apply them to one or more drives. In this manner, customers are able to automate the snapshot process.

6.2. 'Avoid' functionality

When customers move from private to public infrastructure, they think they are going to lose visibility over the physical infrastructure on which their computing is residing. By using the 'avoid' functionality customers can create a high availability architecture to avoid single points of failure on the infrastructure level. This feature guarantees that any drive provisioned with the "avoid" functionality, does not reside on the same physical storage box as any other drive provisioned to avoid it. This allows true high availability cluster setups to be provisioned.

CloudSigma supports all types of network traffic including multicast and broadcast, which is critical in many cases to run high availability protocols over the network.

7. Bulk Operations

7.1. Bulk clone and start

Sometimes users need to create many VMs at once. In this case, they have the opportunity to make use of the bulk server clone and start. The feature combines cloning and starting of (e.g. template) servers without a limit on the number of clones. Once the cloning is complete, the system automatically start the VMs one by one.

In addition, all new cloned servers are tagged with a tag, which can be either automatically generated or customer-specific. Last but not least, this whole process requires just a single API call to be initiated. As a result, customer experience is improved and the time required originally for bulk server creation is decreased tremendously.

7.2. Golden images a.k.a. cliches

The Golden images a.k.a. cliches feature increases the speed of cloning drives that have already been cloned previously. On one side, clients are allowed to clone their drives faster and on the other, they can save on storage space by reusing copies.

A ZFS Copy-on-write mechanism is applied when cloning a drive from another drive. Before making any changes of the new drive, the space it occupies is 0. As soon as the customer starts writing, it takes into account only the deltas.

When a client uploads his own drive image, taking into consideration whether they have a dedicated storage pool (storage space reserved for this particular customer only), we can clone and plant the cliches.

8. Hybrid cloud

Various government agencies and local municipalities collect, store and manage large amounts of data from closed circuit cameras, traffic cameras and traffic lights as well as from sensors for alerting first responders to emergencies such as fires and road accidents. There are various levels of authentication needed to be able to access and process this data which is being collected by diverse sources such as Internet of Things (IoT) devices. While some data may be public (eg. traffic delays or roadworks information), a large amount of data will contain sensitive information and therefore will require secure storage and multi-level access policies. For example, privacy invasive tools such as face-recognition and detection tools will require much more stringent policies on access and use. Such tools, used for law enforcement, will no doubt require a much higher level of security and encryption as well as greater processing power and high availability. Data may also need to be shared between government agencies and/or local municipalities, each requiring their own level of authentication. Data portability will also play a big part while public services begin to move private datasets into the cloud, and make them accessible to legitimate users in a secure way.

Hybrid cloud solutions combine features of public and private clouds, while addressing many of the security and privacy concerns associated with public cloud. The use of private

patching-enabled hybrid clouds allows users to connect their own private infrastructure directly to the vLANS of a public cloud. This eliminated many of the security issues associated with public cloud while maintaining the level of flexibility, scalability and accessibility customers have become used to. Private patching technology affords users with full authority and control over the security of their data. This is particularly important to enterprises that deal with highly sensitive information.

By housing private infrastructure in the same data centers, or immediate area, as the chosen public cloud provider, users will significantly reduce their connectivity cost to the public environment (sometimes to zero) and virtually eliminate latency. Network-as-a-service offerings and cross subsidization of public cloud spend against private hosting costs are also becoming increasingly widespread.

Hybrid cloud - customers can cross-connect their private infrastructure into our public cloud and bridge both environments using private IP only. In other words, the cross connect from the customer private infrastructure can be connected to one or more VLANs in our public cloud and exposed on the same network subnet with full traffic isolation. This allows customers to add a public cloud environment to their private infrastructure without needing the expose their environment to public IP.

Additionally the hybrid cloud offering allows customers to run a second separate connection into our public cloud front-end IP connectivity. This allows customers to take advantage of our multiple 10GigE redundant connectivity and routing and protection systems. Our protection systems include anti-DDOS systems and IDS. We charge a simple per GB rate for traffic in the same way as we do for traffic coming out of our public cloud from customers. In short this allows customers to deploy a private infrastructure solution with the same capacity, redundancy and protections that a full public cloud employs at a simple per GB traffic volume based cost.

We have three options available for the hybrid cloud: private patch connection, colocation and public patch connection. If the client has his own physical servers, they can be connected directly to our cloud (via public or private patch).

9. Billing models

There are two purchase models: subscription and pay-as-you-go burst pricing. Subscriptions can be acquired for a minimum of 1 month, whereas the pay-as-you-go burst pricing is being charged in very short 5 minute billing cycles. The combination helps customers optimize their resource purchasing.

9.1. Subscription pricing

The subscription purchase model is preferred by our users that have relatively predictable computing resource requirements. CloudSigma allows such users to save money by subscribing for the resources they need for a certain period. Subscription are available for 1 month, as well

as for 1 year (discounted by 10%) and 3 years (discounted by 25%).

1 month	1 year (10%)	3 years (25%)
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Discounts up to 42.5% are also available for higher volume purchases. The two discount types interact so that customer can take a maximum advantage of the price cuts.

For convenience, users can take advantage of the account auto-billing and subscription auto-renew features available in the webapp.

9.2. Burst pricing

The dynamic burst pricing is offered for the following computing resources - CPU, RAM, storage and outgoing bandwidth (all incoming bandwidth is free). This billing model is applied when there is no previously reserved capacity. Actual burst prices vary depending on the level of utilization of our cloud. CloudSigma uses an advanced pricing algorithm that allows our pay-as-you-go burst pricing to change over time depending on how busy our cloud is. We still have a maximum price which is never more than 2.5 times our regular one month subscription pricing but most of the time our burst pricing is a lot cheaper than this maximum.

Many of our customers use a combination between the two purchase models. On the one hand, they buy subscriptions for the predictable resources to take advantage of the discounts, and on the other they use the flexible 5-minutes billing in burst for shorter periods of time in case they need unplanned resources.

Here is how it works:

- Every five minutes our system calculates our overall cloud utilisation rate
- The system then schedules a price level change for burst pricing to occur in five minutes in the future (T+5)
- The system posts the new pricing level and time change to a public RSS feed that our users can subscribe to
- At the pre-allotted time the price level is adjusted for the next 5 minute billing segment
- The price level for T+5 is again calculated and the process repeats

In this way, all our users have easy access to both current burst pricing and the next pricing level in five minutes. By posting this information transparently via RSS, you can use CloudSigma to automate the timing of your usage which isn't time critical and take advantage of quieter, cheaper periods during the day or night. In other words, our burst pricing isn't more expensive than other providers compared with subscription but at less busy times it becomes significantly cheaper.

SSD storage is charged at a fixed burst rate of x1.68 of the equivalent one month subscription price for the relevant time period.

HDD storage is charged at a fixed burst rate of x2.0 of the equivalent one month subscription price for the relevant time period.

9.3. Free Tier

We decided to reward every single CloudSigma customer with a free tier of lifetime resources:

- 1GB RAM
- 50 GB of SSD storage
- 5 TB of outgoing data transfer (incoming is free-of-charge)

This 'package' of resources remains at customer's disposal as long as they have a cloud usage of at least 10 credits (in any acceptable currency) per month, irrelevant of what the credits are spent on. When the monthly value of customer's 1-2-or 3-year subscriptions equals at least 10 credits/month, then they get the free tier.

10. Storage

10.1 Architecture

These servers house the CPU, RAM and block storage that is virtualised and offered for sale to end-users. The cloud platform uses a clustered storage system, offering high IOPS performance and low latency. This highly available system is designed to survive multiple storage node failures and to provide an always-on environment that can continue service uninterrupted through software and hardware upgrades. The storage solution is the foundation on top of which customers are able to use features, such as the "Avoid" functionality (section 6.2.) and hybrid cloud (section 8), provided to build high availability environment in a redundant manner.

It is integrated fully onto the compute nodes housing customer virtual machines. This approach offers a highly efficient power/space footprint and high utilisation through a simple modular hardware design. Under this quite efficient infrastructure utilisation design, both the storage client and server processes run locally on the computing nodes exposing full access to the wider clustered storage system. These compute/storage nodes are connected via dual 10GigE networking to redundant top of rack switches. The dual 10GigE Mellanox networking card used supports RDMA to boost storage performance through significantly reduced memory-access latencies. Compute and storage nodes run on dual power from two independent power supplies.

10.2 Hardware

Each compute node consists of two latest generation high performance range Intel E5-2697v3 2.6GHz eight core processors, 16x32GB RAM DDR4 LRDIMM 2133MHz modules (giving 512GB total RAM per node), six 960GB Samsung SM863 enterprise SSD drives and six 2TB HGST 7.2k enterprise SATA hard drives. Additionally a 64GB SATADOM module houses the

Ubuntu host OS. A SATADOM module is used to avoid reliance on a drive controller card through its direct motherboard connection and to offer the fastest possible boot-up and recovery times.

10.3 Redundancy

If a compute node with converged block storage failed (such as a full motherboard failure), this would impact active compute workloads for VMs housed on that machine at the time. No impact would be felt by the storage system due to its clustered nature. The incident would be detected by our monitoring system within 1min and our service engineers would begin recovering affected VMs within 15min. Storage on the affected node would be re-replicated from the other two copies housed elsewhere on the clustered block storage system in order to repair the system to a full three copy system for that portion of data from that failed node.

11. Service Classes

The following tables outline specifications relating to VM provisioning, VM image transformation, compute capacity, storage, networking, and RAM.

Service class: VM provisioning
Resources at CloudSigma are unbundled and purchased independently, allowing users to build virtual server instances with the exact combination of CPU, RAM, Storage and bandwidth required.
Users are given the option of full API access with all account actions available, allowing complete automation and remote monitoring.
Users are also given the option of a feature-rich, yet intuitive web browser based GUI. It has been designed to allow easy resource management via any web browser.
Resource usage is calculated using rolling 5 minute billing periods so you only pay for what you use. Subscription discounts are available: 1 month, 1 year (10%), 3 years (25%) Visit https://www.cloudsigma.com/pricing/ for up-to-date pricing.
Service level offered: Guaranteed CPU, RAM and Storage Allocation backed by a 100% Service Level Agreement x50 credit

Service class: VM image transformation
Any x86/x64 operating system will run on the CloudSigma platform, as long as it is compatible with standard Intel/AMD architecture.
Users can upload drive images via API, web console or via an FTP client. All three methods allow pausing and resuming of uploads. Every account has direct access via secure encrypted FTPS allowing users not only to upload new drive images with ease, but also to download all their account

data storage at any time.

CloudSigma provides an extensive library of ready to use public drive images that can be deployed instantly.

An interface for exporting drives in RAW format via a GUI is provided. Third party conversion tools can also be used.

Our API is implemented using a RESTful interface, using the URL to specify an object and an action, HTTP GET to read state and HTTP POST to change state.

Service class: Compute capacity (processing)

The minimum and maximum range of CPU allocation is as follows: 1 Core 250Mhz minimum and 32 Core 80 Ghz maximum.

CloudSigma offers a minimum CPU availability proportional to reserved size. The total CPU available on a machine is shared pro-rata between virtual server instances subject to minimum allocation. At times where the CPU is not fully allocated, virtual server instances on our cloud will actually have more CPU allocated to them than paid for as we see no reason to limit CPU capacity if it is available.

With CloudSigma, you can manually override our system and specify the exact number of CPU cores you want any particular server instance to use. In this way, each virtual server instance can be optimised for the particular task it is undertaking by the user. The minimum granularity is 0.25Ghz per core.

CloudSigma platform is able to expose the full CPU instruction set to virtual machines providing an 'as hardware' environment for computing. The full CPU instruction set, including NUMA, SIMD, Streaming SIMD Extensions and all other instructions are made available to client VMs.

For Windows VMs, CloudSigma have enabled hv-tsc and hv-relaxed optimisations. These are optimisations specifically developed for Windows-based VMs. These optimisations considerably increase performance as such;

- hv_relaxed is a hypervisor setting, which enables relaxed timing for the CPU. Enabling hv_relaxed for Windows considerably increases performance.
- hv_tsc is a hypervisor setting, which enables the Time Stamp Counter to be passed through from the host to the server. By enabling hv_tsc for Windows, performance is considerably increased

Our current CPU pricing based on a non-discounted 1 month subscription period is 0.0127EUR Core-Ghz/hour.

Service Class: Storage

The minimum storage configuration is 1GB and the maximum is 25TB per volume. It is a fully redundant system. Up to 16 drives can be attached to one Virtual Machine.

All storage in CloudSigma cloud is persistent. Storage is available in the form of drives which are

created by the user. A drive's data is persistent whether associated or not with a server and whether or not a drive is mounted. Storage data is only removed from an account when the account owner deletes a drive.

The storage system is a clustered system so single points of failure are eliminated. It supports live migration meaning that client computing is not going to be disturbed whenever a reboot or planned maintenance is taking place. CloudSigma is planning to add implicit back-ups which a user can turn on as additional protection.

CloudSigma can offer a tiered storage system and provide automation software for managing the process of moving data between storage media. The number of storage tiers required and the type of media is determined by pre-defined service levels.

Our current SSD storage pricing based on undiscounted 1 month subscription period is 0.1400 EUR GB/per month.

Service class: Networking

Global connectivity is achieved by leasing physical infrastructure from service providers and operating layer 3 network on top of that. This allows for direct peering connection with other ISPs and guarantees performance and low latency.

CloudSigma offers bonded dual 10GigE networking as standard with free, unlimited incoming bandwidth for all accounts. All users can easily upload as much data as they require to our cloud using our API and FTP.

We don't apply rate limits to incoming or outgoing traffic, both on public and private networks.

All virtual server instances within the CloudSigma cloud have IP addresses assigned to them via DHCP. Users can also choose to assign a static or multiple static IP addresses to a server or turn off any external IP allocation altogether.

If a user already owns their own PI IP addresses, we are able to incorporate these into our BGP session with our upstream providers and make them available for allocation by that user to their virtual server instances within our cloud.

Users can create private networks within the CloudSigma cloud and configure as standard VLANs on the physical infrastructure. They operate without any restrictions and can be named by the user. Servers are easily added to them in an integrated way. An account can have an unlimited number of VLANs. All network traffic between virtual server instances in a VLAN is not billed.

Under the advanced settings for each virtual server instance the CloudSigma platform allows the user to specify both the public network card and private network card they prefer to use from a standard list. More specialised and advanced users can optimise the hardware simulation choice to best fit their networking usage and needs.

Our current pricing for network resources based on a non-discounted 1 month subscription period are 3.5 EUR per month for Static IP Admin and 7 EUR per month for VLAN.

Our current pricing for data transfer based on a non-discounted 1 month subscription period is **FREE** for Incoming Bandwidth and 0.0455EUR for Outgoing Bandwidth per/GB.

Service level offered: (1) 100% guarantee on network availability in any given month. (2) A network latency of 1ms or less for data packets between servers within CloudSigma service and network.

Service class: RAM

The maximum RAM on a virtual machine is 128.00 GB and on request we can provide up to 256 GB

Our current RAM pricing based on a non-discounted 1 month subscription period is 0.0146EUR GB/hour

12. Support Channels

Live support via Chat and Email ticketing system is provided 24/7. Customers can reach CloudSigma Technical Support team directly by emailing support@cloudsigma.com or better still via the Live Chat from the web app (UI) or website.

We use a number of other channels to communicate with customers and provide updated information. These include:

1. Service status page: <http://status.cloudsigma.com/>
2. Constant notifications from our Support team (support@cloudsigma.com) to your registered e-mail "xx@yy.zz". We send out an email in the case of various events, including maintenance, explaining the situation and delivering detailed root cause analysis.
3. Twitter account specially for automatic update: [@cloudsigma_zrh](#) and [@cloudsigma_lvs](#).

Service class: Support

Item	Silver	Gold	Platinum
Uptime guarantee	100%	100%	100%
Chat and Email Customer Service - 24x7x365	Yes	Yes	Yes
Web based ticket system	Yes	Yes	Yes
Online Support Forums	Yes	Yes	Yes
Documentation, White Papers, Best Practice Guides	Yes	Yes	Yes

Access to Technical Support	Yes	Yes	Yes
Named Contacts	2	5	Unlimited
Max. Response Time	12 hours	2 hours	30 minutes
Dedicated Resolution Engineer	No	No	Yes & continuous efforts
SLA credits for qualifying downtime after 15min	x50	x50	x100
Enterprise Architecture Solutions Support	No	No	Yes
Best Practice Guidance & Webinars	No	Yes	Yes
Direct Routing to Senior Engineers	No	No	Yes
Cell phone Customer Service - 24x7x365	No	No	Yes
Price	Free	CHF 95/month	CHF 1500/month

*Enterprise Solutions Architecture Support has a response time of 48 hours and is capped at 2 hours per month. Further use is paid as consulting by the hour of 250 CHF.

Escalation policy			
Item	Silver	Gold	Platinum
First level Customer Relation	Initial review, resolution during working hours. Escalation after 24 hours.	Initial review, 24x7 resolution effort. Escalation after 24 hours.	3 hours continuous effort then escalation
Second level - IT operations	48 hours then escalation	24 hours then escalation	6 hours continuous effort then escalation
Third level - developers	48 hours then escalation	24 hours then escalation	12 hours continuous effort then escalation
D- and C- level executives	Final escalation level	Final escalation level	Final escalation level

13. Service level agreement

As part of the Terms of Service governing all purchases of CLOUDSIGMA AG, trading as “CloudSigma” (“we”, “us”) services, we provide the following service level to you (“you”, “your”):

13.1. 100% Virtual server availability guarantee

CloudSigma guarantees 100% availability of virtual servers in any given calendar month as defined by their availability on our network and their responsiveness in a non-degraded way. This guarantee covers the hardware and virtualization hypervisor layers only and not the software (including but not limited to operating systems and applications) running within virtual servers.

13.2. 100% Network uptime guarantee

CloudSigma guarantees 100% network availability in any given calendar month. The network will be deemed 'available' if CloudSigma border routers and switches are available and responding to CloudSigma monitoring tools in a non-degraded manner.

13.3. 1MS or less network latency guarantee

CloudSigma guarantees a network latency of 1ms or less for data packets between servers within CloudSigma services and network. The network latency refers to network latency times between the boundary layer of one virtual server to the boundary layer of another virtual server and excludes internal latency times resulting from software running within a virtual server at either end of the data transit.

13.4. Credit

If we fail to meet the guarantees detailed above, you will be able to request a credit as detailed below up to a maximum of 100% of your fee for capacity used during the previous 30 calendar days:

- Credit of 50 times the fees for any period of lack of availability for a virtual server or network uptime lasting more than 15 minutes as measured from the time at which you validly inform us at support@cloudsigma.com or the time at which our monitoring systems detect the lack of availability, whichever is earlier;
- Credit of 50 times the fees for any period of network latency as defined above, with greater than 1ms lasting for more than 15 minutes as measured from the time at which you validly inform us at support@cloudsigma.com or the time at which our monitoring systems detect the lack of availability, whichever is earlier;
- Credit of your entire fee for the previous 30 calendar days in case of permanent loss of your stored data resulting from hardware or software failure of CloudSigma systems. This provision entirely excludes data loss or corruption resulting from software running within a virtual server.

In the event that we fail to meet the guarantee on more than one occasion within a period of 30 calendar days, then the credit that you may claim for any incident will be limited to the maximum

of 100% of your fee for capacity used since the previous incident or 100% of your fee for capacity used during the previous 30 calendar days, whichever fee is lower.

To receive a credit, you must contact us at support@cloudsigma.com within 30 calendar days of the incident, specifying the start time, date and duration of the qualifying period which forms the basis of your claim and the amount of credit claimed. We will be the sole arbiter regarding the award of credit and our decision will be final and binding.

13.5. Limitations and exemptions

The following items or situations are exempt from CloudSigma guarantees:

- Acts or omissions of you or your users;
- Software running within your virtual servers;
- Scheduled maintenance which we have announced at least 24 hours in advance;
- Factors outside our control, including but not limited to any force majeure events, failures, acts or omissions of our upstream providers or failures of the internet;
- Actions of third parties, including but not limited to security compromises, denial of service attacks and viruses provided CloudSigma makes reasonable efforts to keep its software and systems up to date;
- Violations of our Acceptable Use Policy;
- Any product currently in Beta as per our Terms of Service;
- Law enforcement activity.

A user must be up to date with all payments and have sufficient pre-pay balance where appropriate to cover current usage levels to be eligible for the credits outlined in this Service Level Agreement. No credits will be extended if a user is delinquent on any payments or has insufficient balance to continue using CloudSigma services at usage levels during the qualifying claimed credit period for at least 10 calendar days.

The award of credit by CloudSigma to you as described in this Service Level Agreement will be the sole and exclusive remedy for unavailability or performance degradation of CloudSigma services. Credits will only be provided against future service and for the avoidance of doubt may not be exchanged for cash or other forms of payment.

Notwithstanding anything in this Service Level Agreement to the contrary, the maximum total credit for the monthly billing period, including all guaranties, shall not exceed 100% of your fee for the previous 30 calendar days. Credits beyond your fee for the previous 30 calendar days will not be carried forward for use against future fees.

This Service Level Agreement forms part of your Agreement with CloudSigma, along with the Terms of Service and the Acceptable Use Policy, and is subject to all the terms and conditions stated in these documents.

