

**CLOUD4COM – TECHNICAL
SPECIFICATION OF SERVICES**

<https://www.cloud4com.com/>



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1. VIRTUAL PRIVATE DATA CENTER

Corporate IT infrastructure of today usually runs on servers with certain operating systems, which run applications providing business services to their users. Most companies use servers located in their own data centers (dedicated building or room) to operate modern IT infrastructure. Data is stored either directly on local server disks or in a shared disk repository (disk array), which enables higher availability, security and flexibility. All these components are connected by local area networks (LAN) and dedicated storage networks (SAN). If the infrastructure exceeds certain limits, the local data center becomes quite costly to operate and administer. Most IT managers keep an eye on the TCO and consider alternative solutions for running corporate services, such as the IT infrastructure as a service (IaaS). Cloud4com offers enterprise IT infrastructure as a service – in the form of a leased Virtual Private Data Centre (vPDC). vPDC is completely isolated from vPDCs of other customers.

Virtual private data center (vPDC)				
Uptime & Quality SLA, Location				
Compute	Storage	Networking	Other	DR
Standard vServer	vSSD	vLAN	vBackup	Remote vBackup
Premium vServer	vDisk	vRouter	Software	Disk Replication
MS SQL vServer	Disk	Internet	Veeam Cloud	NAS Replication
Server	NAS	vPDC InterConnect	Connect Backup	

To provide IaaS services, it is imperative to have precisely defined **SLA (Service Level Agreement)** parameters for products such as availability, capacity, response time, recovery time objective, recovery point objective, etc. Cloud4com classifies these **SLA parameters** as follows:

1.1. SYSTEM AVAILABILITY = VPDC INFRASTRUCTURE UPTIME

Time period in the span of one calendar year, expressed in %, during which the system did not experience any failure and was operational. Calendar year used for the calculation is 365 days long and starts at 1 January. **Standard system availability value for basic products is 99.999 % (vServer, vDisk, vSSD, Disk a vLAN). For other products please see chapter 4.** Customer always gets this availability regardless of the number of vServers in his vPDC. System availability is determined by the availability of the following components:

Hypervisor Availability
Hardware Availability (Compute, Storage, Network)
Power & Cooling Availability

Components for the system availability Table

System availability or a functional system respectively, does not guarantee that qualitative parameters such as CPU NOT RDY % and DISK RESPONSE TIME will be available, whenever a

customer application needs them for proper function. Qualitative parameters are therefore critical for proper operation of applications.

1.2. AVAILABILITY OF QUALITATIVE PARAMETERS = QUALITY OF SERVICE VPDC

Time period in the span of one calendar month, expressed in %, during which an individual product from service catalogue did not meet the set quality parameter. Values are shown for the whole vPDC = all components in each vPDC have guaranteed availability of qualitative parameters. Values range from **99.6 % to 99.99 %**. An example of a qualitative parameter is the waiting time for the processor (CPU NOT RDY %), the waiting time for confirmation of a disk IO operation (Disk Response Time in ms), or Recovery Time Objective (RTO) for vDisks and vSSDs backups.

Availability of qualitative parameters (Quality of Service) for product types: vServer, vDisk/vSSD and vBackup are given in the table below.

Product	vServer (CPU)	vDisk / vSSD	vBackup / Remote vBackup
Quantitative parameter of capacity	Number of vCPU	Capacity in GB	total backup size
Quantitative parameter of performance	vCPU GHz	Throughput in IOPS	RET – retention
Qualitative parameter	CPU NOT READY % (max. 5 %)	Infrastructure Response Time (max. 25 ms / 15 ms)	RTO – recovery time objective (max. 8 h / 24 h)

Availability of qualitative parameters Table

1.3. GUARANTEE OF DATA OWNERSHIP

Cloud4com s.r.o. company guarantee, that data remains the customer’s property throughout the duration of contract and also provide an option to export all customer’s data after contract expires, in form of exported complete virtual servers (paid service) in the Open Virtualization Format (OVF) or in form of backup Veeam Backup & Replication (VBK). Handover of these data is in the form of an external storage media (new USB disk delivered by Cloud4com s.r.o. only), which remains the customer’s property, or export of data to the SFTP server of **Cloud4com** service.

2. SLA MONITORING AND EVALUATION

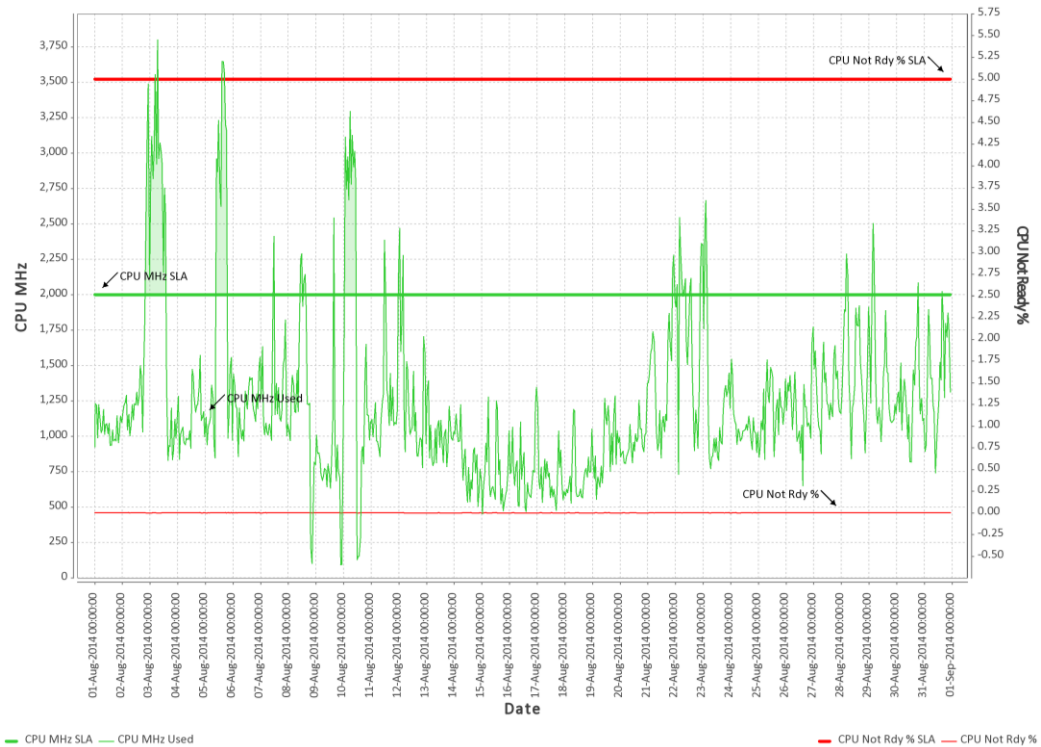
Cloud4com s.r.o. company offers its customers the unique SLA monthly evaluation reports.

Each customer gets a monthly report with the SLA evaluation for each one of their servers. These reports contain the virtual infrastructure monitoring data. Virtual CPU (vCPU) and virtual disk (vDisk, vSSD) workload values are being recorded for each virtual server. These values are presented on a monthly chart and summarized in a table.

2.1. SLA EVALUATION OF VCPU

- An average CPU workload value in MHz is obtained every 20 seconds. This is the sum of average working frequencies the virtual CPU(s) had been using since the time of the last measurement. 'CPU not ready' is another monitored value. It represents the time that the virtual CPU was ready but could not get scheduled to run on a physical CPU, which could have been used by another VM running on the same physical hardware.
- CPU utilization (given in MHz) is calculated for a reference processor using an algorithm specified in the 'Technical service documentation'.
- These 20-second readings are averaged into 5-minute and 1-hour intervals.
- SLA evaluation is based on the hourly interval averages.
- A thick green line on the graph represents the total purchased virtual CPU capacity, given in MHz, and is marked 'CPU MHz SLA'
- A thin green line on the graph shows real virtual CPU utilization based on the hourly intervals and is marked 'CPU MHz'. When real utilization exceeds purchased capacity, this is indicated on the graph by hatching. This is a case of using more capacity than the customer pays for.
- A thick red line represents the maximum guaranteed time the virtual CPU waits for physical CPU availability/scheduling. It is marked 'CPU Not Rdy % SLA'. This value is defined in the 'Technical service documentation' as 5 %.
- A thin red line represents the real period the virtual CPU had to wait for physical CPU scheduling and is marked 'CPU Not Rdy %'. If the real value exceeds the guaranteed maximum, it will be indicated on the graph by hatching.
- If the value of 'CPU Not Rdy %' exceeds the guaranteed 'CPU Not Rdy % SLA' while the 'CPU MHz' value does not exceed the 'CPU MHz SLA' for a given interval, then this is an example of an SLA breach. In such cases, the 5-minute intervals are examined to determine the exact number of occurrences when the SLA was breached. The SLA is evaluated based on the number of occurrences

of an SLA breach and the total number of measurements taken in a given month.



An example of a virtual server CPU SLA chart

A summary table for virtual CPU utilization contains the following information:

- Purchased vCPU capacity – the total number of vCPUs @ 1,000 MHz, total amount of vRAM (in MB)
- Average vCPU utilization – the average utilization for a given period in MHz
- Median of vCPU utilization – the median of vCPU utilization for a given period in MHz. This is determined by ordering all readings for a given period from the lowest to the highest and the value found in the middle is the median.
- Maximum vCPU utilization – the maximum vCPU utilization based on 1-hour intervals, given in MHz.
- Number of intervals when utilization exceeded purchased capacity – how often vCPU utilization exceeds the purchased capacity.
- SLA evaluation – $(\text{total intervals count}) - (\text{SLA breach intervals count}) / (\text{total intervals count}) = \%$

- Recommendation – product change recommendation based on real vCPU utilization measurements for a given month.

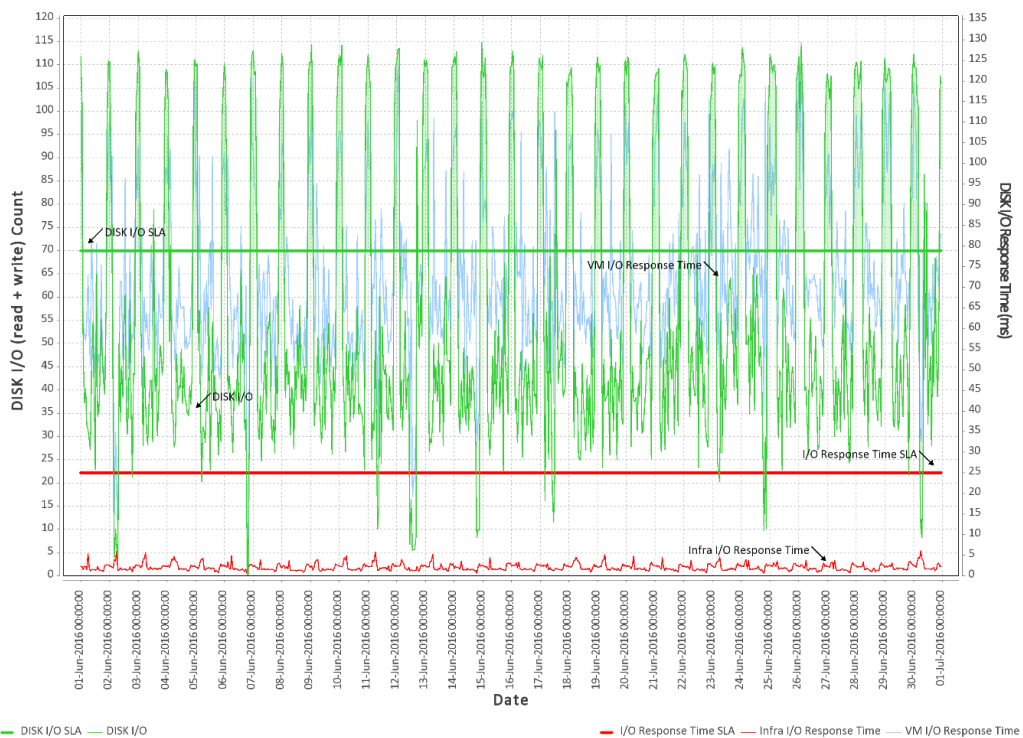
Virtual CPU utilization evaluation	
Purchased vCPU capacity	2 vCPU @ 1000 MHz, 8192 MB RAM
Average vCPU utilization	1232.48 MHz
Median vCPU utilization	1105.98 MHz
Maximum vCPU utilization	3798.92 MHz
No. of intervals when utilization exceeded purchased capacity	71 out of 744
SLA evaluation	100.00 %
Recommendation	Utilization occasionally exceeds purchased capacity, consider an upgrade

An example of a virtual server summary table for vCPU SLA – table example

2.2. SLA EVALUATION OF VIRTUAL STORAGE (VDISK AND VSSD)

- All readings are taken per summary of all vDisks attached to a single virtual server
- Performance readings are taken every 20 seconds
- Average numbers of IOPS of all vDisks combined per virtual server are recorded
- Average response times (in milliseconds) of all vDisks for an IO operation are taken at the virtual infrastructure level
- The 20-second interval readings are averaged into 5-minute and 1-hour intervals. IOPS readings are averaged in time. Response time readings are averaged against the total number of IO operations. IO operations bigger in size than 8 kB are first divided by 8 kB and the result is the total number of IO operations.
- SLA evaluation is based on the hourly interval averages.
- A thick green line on the graph represents the total purchased virtual disks throughput measured in IOPS and is marked 'DISK I/O SLA'
- A thin green line on the graph shows real virtual disk utilization measured in IOPS. It is based on the hourly averages and is marked 'DISK I/O'. When real utilization exceeds purchased capacity, it is indicated on the graph by hatching. This is a case of using more capacity than the customer pays for.
- A thick red line represents the guaranteed response time in which the IO operation takes place. It is marked 'I/O Response Time SLA'. This value is defined in the 'Technical service documentation' as 25 ms.
- A thin red line represents the real response time per I/O and is marked 'Infra I/O Response Time'. This value is obtained at hypervisor level from the physical datastore holding all vDisks of a given virtual server. Should the real value exceed the guaranteed maximum, it will be indicated on the graph by hatching.

- If the value of 'Infra I/O Response Time' exceeds the guaranteed 'I/O Response Time SLA' while the 'DISK I/O' value does not exceed 'DISK I/O SLA' for a given interval, then this is an example of an SLA breach. In such cases, 5-minute intervals are examined to determine the exact number of occurrences when the SLA was breached. The SLA is evaluated based on the number of occurrences of an SLA breach and the total number of measurements taken in each month.
- A thin blue line on the graph represents the real response time as perceived at the operating system level. This is marked 'VM I/O Response Time'. This value is usually higher than the infrastructure response time and is influenced by a few factors, such as the size of I/O operations and their spread in time (bursts). Since these factors are determined by applications, there are no guarantees given for this value. Even so, this value is one of the primary inputs for further infrastructure optimization.



An example of a virtual server virtual disk SLA chart

A summary table for virtual disk utilization contains the following information:

- Purchased throughput – total throughput in IOPS at total purchased capacity.
- Average throughput – average virtual disk throughput in IOPS for a given period.

- Median of throughput – median of virtual disk throughput for a given period in IOPS. This is determined by ordering all readings for a given time period from the lowest to the highest and the value found in the middle is the median.
- Maximum throughput – the maximum virtual disk throughput based on 1-hour intervals, given in IOPS.
- Number of intervals when utilization exceeded purchased capacity – how often vDisk utilization exceeds the purchased capacity.
- SLA evaluation – (total intervals count) – (SLA breach intervals count) / (total intervals count) = %
- Recommendation – product change recommendation based on real vDisk utilization measurements for a given month.

Virtual disk utilization evaluation	
Purchased vDisk throughput	70 IOPS on a total capacity of 250 GB
Average vDisk throughput	55.32 IOPS
Median vDisk throughput	44.01 IOPS
Maximum vDisk throughput	114.84 IOPS
No. of intervals when utilization exceeded purchased capacity	172 out of 720
SLA evaluation	100.00 %
Recommendation	Utilization occasionally exceeds purchased capacity, consider an upgrade

SLA Evaluation for virtual disks of a virtual server – table example

2.3. SLA EVALUATION OF UPTIME SLA

The customer may request their money back if the yearly SLA limit is not met. The customer may ask for a refund of 50 % of the total monthly price of affected vPDC components for the calendar month in which the yearly limit of **Uptime SLA** was breached.

Downtime limit for SLA: $Uptime\ in\ minutes = 525600 * (1 - defined\ Uptime\ SLA\ of\ service)$

Uptime SLA	Downtime limit
99.999 %	5.256 min/year
99.95 %	262.8 min/year
99.6 %	2,102.4 min/year

Uptime SLA Downtime limits Table

Outages example for Uptime SLA:

- vServer – Virtualization platform or server platform outage
- vDisk, vSSD, Disk – Storage infrastructure outage
- vLAN – LAN infrastructure outage

2.4. SLA EVALUATION OF QUALITY OF SERVICE

For **Quality of Service SLA** compensations, please see the table below:

Ordered availability of Quality parameters	Maximum number of unfulfilled sampling intervals	Additional charge for higher SLA	Service price	Real availability provided and the amount of discount							
				99.99 %	99.95 %	99.90 %	99.60 %	99.00 %	98.00 %	90.00 %	0.00 %
99.60 %	35	0 %	100 %					35 %	50 %	75 %	100 %
99.90 %	9	20 %	120 %				27 %	46 %	58 %	79 %	100 %
99.95 %	5	30 %	130 %			18 %	33 %	50 %	62 %	81 %	100 %
99.99 %	1	40 %	140 %		17 %	24 %	39 %	54 %	64 %	82 %	100 %

SLA parameters measurement and evaluation table

The customer may ask for a refund 100 % of the total price of every affected product **vBackup** if the Quality of Service SLA parameter RTO of data restore request is not maintained (and for only month when Quality of Service SLA parameter was not maintained).

3. TECHNICAL SUPPORT

Cloud4com Technical Support is available 24 hours a day, 7 days a week. Customers can contact Technical Support by opening a ticket in the Virtix application, by calling **+420 734 649 889**, or by sending an email to support@cloud4com.com. Only persons who have existing user account in the VIRTIX application and have permissions for given customer are entitled to technical support.

Incident initial response time is 15 minutes. Technical Support responds to the customer by sending an email confirming that the incident was logged and ticket created.

If the incident resolution requires an involvement of a specialist, the specialist reaction time is:

- In business hours (working days between 9:00 and 17:00): 1 hour
- Outside of business hours (between 17:00 and 09:00, on weekends, and on public holidays): 8 hours

There are 3 priority levels of incidents:

- P1 – high priority
- P2 – normal priority
- P3 – low priority

When assigning priority, these rules are followed:

- P1 - Interruption making a critical functionality inaccessible (e.g. outage of virtual server/virtual disk/virtual router, request for backup restore)
- P2 – Function of service components is impacted (e.g. limited performance of virtual servers or disks, VPN tunnel outage, requests for VPN tunnel configuration, changes in firewall and NAT rules)
- P3 – incidents and requests that do not have an impact on the quality of provided services (e.g. graphs and reports are not available)

Outside of normal business hours or if the customer wants to create a high priority P1 incident, they must contact technical support by phone.

4. CLOUD4COM SERVICE CATALOG

4.1. VIRTUAL PRIVATE DATA CENTER (VPDC)

Product	Variants	Quality SLA Parameters
vPDC Virtual Private Data Center	vPDC-9999	99.99 %
	vPDC-9995	99.95 %
	vPDC-999	99.9 %
	vPDC-996	99.6 % (standard)

4.1.1. PRODUCT DESCRIPTION

With the professional Virtual Private Data Centre (vPDC) product, you can easily rent required services for your corporate IT infrastructure to optimize investments in the development of your own production, testing, or backup environment.

Cloud4com s.r.o. company runs enterprise IT infrastructure in professional data centers in the Czech Republic and uses state-of-the-art virtualization technology to be able to isolate, secure, administer and lease the infrastructure to individual customers, who use it to run their own operating systems with their own specific applications. Each vPDC environment of an individual customer is isolated from the environments of other customers. It also guarantees up to **99.999 %** System Availability (Uptime). In their data center, the customer designs their own virtual infrastructure based on the Compute, Storage and Network products type with their defined SLAs. Using these virtual objects and complementary software (for example Microsoft and VMware SW), it is possible to flexibly define and run the infrastructure of a whole data center.

Prague data centers are located at TTC Teleport (Prague Malesice) and DC Tower (Prague Zizkov) premises, where they are connected to the internet backbone with backed-up connectivity to NIX and abroad. The vPDC service enables locating a virtual private data center in the fully secured and air-conditioned collocation center of Cloud4com s.r.o. company and connecting it to the backbone 40/10 Gbps network. This ensures excellent data center availability for the Internet as well as for the company data network without any strain on customer's own internet connection.

Operation of Cloud4com s.r.o. data centers is designed to achieve maximum stability of the environment and availability of their own infrastructure. The data centers run reliable power supply systems, which include robust UPSs and motor-generators, power distribution systems, cooling and fire protection systems with central monitoring systems. High-available connections of the datacenters to backbone networks is a standard.

- **Security**

Physical security – non-stop 24x7 entrance is allowed only if accompanied by the responsible helpdesk worker, after the identity of the visitor is verified. There are alarm systems, lockable racks, fire detectors as well as automatic fire suppression system.

Network security – identification and prevention of a potential DoS attack implemented on the backbone routers, possibility to expand the service with firewall protection, integrity check, data encryption and data backup.

Data encryption – for data encryption customers can leverage encrypted vServers with external key management implemented at customer premises.

- **Full redundancy of resources**

Full redundancy of all resources is ensured for all important services:

WAN network is connected to NIX in two locations by two independent lines with a capacity of 10 Gbps each. Connectivity abroad is secured by two independent suppliers of transit IP connectivity with an overall capacity of 40 Gbps.

LAN network infrastructure is implemented with redundant enterprise Cisco routers and switches (Nexus, Catalyst and ASR).

Physical servers are run on a fully redundant enterprise server system, Cisco UCS (Unified Computing System), with blade servers.

Disk repositories use fully redundant Enterprise disk arrays from NetApp.

Virtualization platform VMware vSphere provides full redundancy for virtual server infrastructure.

4.2. VIRTUAL SERVER STANDARD (STANDARD VSERVER)

Product	Product parameters	
Standard vServer Virtual Server	Number of vCPU quantitative parameter	1 – 28
	vCPU GHz quantitative parameter	1 GHz – 3.35 GHz (normalized value) (hourly average, 1GHz guaranteed)
	CPU %NOT RDY qualitative parameter	Max. 50 ms/s = 5 % (average value for one vCPU)
	Size of RAM v GB quantitative parameter	0.25 - 384

4.2.1. PRODUCT DESCRIPTION

The virtual server standard product (**Standard vServer**) is a service running on enterprise blade servers CISCO Unified Computing System (UCS), which run a server virtual layer (VMware Hypervisor ESXi) that enables abstraction, flexibility and partitioning of server performance. The virtual server has accurately defined performance parameters and SLA (Service Level Agreement) describing guaranteed service availability. Standard vServer products are defined by the number of virtual processors (vCPU) and the size of available RAM. The vCPU parameter is a virtual processor operated on one core of a physical processor with a guaranteed frequency of 1 GHz (normalized value). The second parameter is the capacity of RAM, which is given in GB. Standard vServer is a diskless virtual server to which virtual disks (vDisk, vSSD) can be connected, ordered by the customer as additional products. Such virtual servers are connected to customer-defined virtual networks. Virtual server supports up to 10 virtual network interface cards and 14 virtual storage devices (vDisk, vSSD).

Server virtualization secures a virtual server service with guaranteed processor performance and memory capacity. The VMware High Availability (HA), VMware vMotion and VMware Distributed Resource Scheduler (DRS) technologies ensure an appropriate level of availability. A virtual server is the equivalent of a physical server without disks and operating system.

Standard vServer product is offered with an optional client SW CTE from the Thales company. This SW provides virtual server data encryption capability. The encryption/decryption rights management is fully under control of the customer. The customer can choose to use a dedicated Key Management Server located on his premises in the form of a Virtual Appliance as a service.

For optimal operating system performance, we strongly recommend deploying of the current version VMware Tools.

4.2.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

The CPU hourly average performance is guaranteed up to **1 GHz**, which means that the processor can momentarily use up to **6 GHz** of normalized performance while the hourly average can still be less than 1 GHz. If the CPU performance used is up to **1 GHz (quantitative parameter)**, then we guarantee CPU NOT RDY % (**qualitative parameter**) of less than 5 %. The CPU NOT RDY % parameter represents the time, the virtual machine waited for a processor(s), which could be used by a different virtual machine on the same physical server at that moment. Cloud4com s.r.o. uses data from the **SPECint_base2017** (SPEC CPU2017 Integer Speed Base – single-threaded performance) and **SPECfp_base2017** (SPEC CPU2017 Floating Point Speed Base – single-threaded performance) – **performance values for one CPU core**. The normalized performance evaluation of a processor is calculated from the average performance evaluation, which is available at <http://www.spec.org>.
Calculation of normalized values for used Intel Xeon processor family:

Intel Xeon Gold 6226R 2.9 GHz in Cisco UCS B200 M5 (2x CPU)		Intel Xeon Platinum 8462Y+ 2.8 GHz in Cisco UCS X210c M7 (2x CPU)	
SPECint_base2017	10.10	SPECint_base2017	15.80
SPECfp_base2017	135.00	SPECfp_base2017	343.00
SPECint_base2017 CPU 1 GHz	3.48	SPECint_base2017 CPU 1 GHz	5.64
SPECfp_base2017 CPU 1 GHz	46.55	SPECfp_base2017 CPU 1 GHz	122.50
SPECint_base2017 Norm	1.00	SPECint_base2017 Norm	1.62
SPECfp_base2017 Norm	1.00	SPECfp_base2017 Norm	2.63
Average Normalization int + fp	1.00	Average Normalization int + fp	2.13
Normalization coefficient = 1		Normalization coefficient = 2.13 (1 GHz 8462Y+ = 2.13 GHz 6226R)	
Intel Xeon Platinum 8358P 2.6 GHz in Dell PowerEdge R650 (2x CPU)			
SPECint_base2017	12.20		
SPECfp_base2017	249.00		
SPECint_base2017 CPU 1 GHz	4.69		
SPECfp_base2017 CPU 1 GHz	95.77		
SPECint_base2017 Norm	1.35		
SPECfp_base2017 Norm	2.06		
Average Normalization int + fp	1.70		
Normalization coefficient = 1.70 (1 GHz 8358P = 1.70 GHz 6226R)			

Virtual machine metrics definition (Ready, %RDY a Co-stop, %CSTP) used by Cloud4com s.r.o. on VMware virtualization platform is available at: <https://kb.vmware.com/kb/1017926>

4.3. VIRTUAL SERVER PREMIUM (PREMIUM VSERVER)

Product	Product parameters	
Premium vServer Virtual Server	Number of vCPU quantitative parameter	8 – 72
	vCPU GHz quantitative parameter	3 GHz – 3.5 GHz (normalized value) (hourly average, dedicated CPU core guaranteed)
	CPU %NOT RDY qualitative parameter	Max. 50 ms/s = 5 % (average value for one vCPU)
	Size of RAM v GB quantitative parameter	128 – 1400

4.3.1. PRODUCT DESCRIPTION

The virtual server premium (**Premium vServer**) product is a service running on enterprise blade servers CISCO Unified Computing System (UCS), which run a server virtual layer (VMware Hypervisor ESXi) that enables abstraction, flexibility and partitioning of server performance. The virtual server has accurately defined performance parameters and SLA (Service Level Agreement) describing guaranteed service availability. Premium vServer products are defined by the number of virtual processors (vCPU) and the size of available RAM. The vCPU parameter is a virtual processor operated on one core of a physical processor with a guaranteed frequency of 3 GHz (normalized value). The second parameter is the capacity of RAM, which is given in GB. Premium vServer is a diskless virtual server to which virtual disks (vDisk, vSSD) can be connected, ordered by the customer as additional products. Virtual servers are connected to customer-defined virtual networks. Virtual server supports up to 10 virtual network interface cards and 14 virtual storage devices (vDisk, vSSD).

Server virtualization secures a virtual server service with guaranteed processor performance and memory capacity. The VMware High Availability (HA), VMware vMotion and VMware Distributed Resource Scheduler (DRS) technologies ensure an appropriate level of availability. A virtual server is the equivalent of a physical server without disks and operating system.

Premium vServer product is offered with an optional client SW CTE from the Thales company. This SW provides vServer data encryption capability. The encryption/decryption rights management is fully under control of the customer. The customer can choose to use a dedicated Key Management Server located on his premises in the form of a Virtual Appliance as a service.

For optimal operating system performance, we strongly recommend deploying of the current version VMware Tools.

4.3.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

The CPU hourly average performance is guaranteed **3 GHz**, which means that the processor can momentarily use up to **3.6 GHz** of normalized performance while the hourly average can still be less than 3 GHz. If the CPU performance used is up to **3 GHz (quantitative parameter)**, then we guarantee CPU NOT RDY % (**qualitative parameter**) of less than 5 %. The CPU NOT RDY % parameter represents the time, the virtual machine waited for a processor(s), which could be used by a different virtual machine on the same physical server at that moment. Cloud4com s.r.o. uses data from the **SPECint_base2017** (SPEC CPU2017 Integer Speed Base) and **SPECfp_base2017** (SPEC CPU2017 Floating Point Speed Base) – **performance values for one CPU core**. The normalized performance evaluation of a processor is calculated from the average performance evaluation, which is available at <http://www.spec.org>. **Calculation of normalized values for used Intel Xeon processor family:**

Intel Xeon Gold 6154 3.0 GHz in Cisco UCS B200 M5 (2x CPU)		Intel Xeon Gold 6254 3.1 GHz in Cisco UCS B200 M5 (2x CPU) and in Cisco UCS B480 M5 (4x CPU)	
SPECint_base2017	8.92	SPECint_base2017	10.40
SPECfp_base2017	121.00	SPECfp_base2017	140.00
SPECint_base2017 CPU 1 GHz	2.97	SPECint_base2017 CPU 1 GHz	3.47
SPECfp_base2017 CPU 1 GHz	40.33	SPECfp_base2017 CPU 1 GHz	46.67
SPECint_base2017 Norm	1.00	SPECint_base2017 Norm	1.17
SPECfp_base2017 Norm	1.00	SPECfp_base2017 Norm	1.16
Average Normalization int + fp	1.00	Average Normalization int + fp	1.16
Normalization coefficient = 1		Normalization coefficient = 1.16	

	(1 GHz 6254 = 1.16 GHz 6154)
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Virtual machine metrics definition (Ready, %RDY a Co-stop, %CSTP) used by Cloud4com s.r.o. on VMware virtualization platform is available at: <https://kb.vmware.com/kb/1017926>

4.3.3. SAP HANA VIRTUAL SERVERS

Production SAP HANA workloads need specific settings:

- CPU model and SAP HANA version support, CPU Architecture + placement.
- RAM reservation settings.
- Certified Enterprise Storage, FibreChannel SAN requirements.
- SAP HANA Network Requirements + SAP HANA internode network KPIs.
- VMware Virtualization support, VM CPU Configuration, VMware vSphere host monitoring interface.
- Workload-based sizing for virtualized environments. Supported Operating Systems.

Please choose Premium vServer for SAP HANA workload. For more information contact our support.

4.4. MS SQL VIRTUAL SERVER (MS SQL VSERVER)

Product	Product parameters	
Premium vServer Virtual Server	Number of vCPU quantitative parameter	1 – 10
	vCPU GHz quantitative parameter	1 GHz – 3.1 GHz (normalized value) (hourly average, shared CPU core)
	CPU %NOT RDY qualitative parameter	Max. 50 ms/s = 5 % (average value for one vCPU)
	Size of RAM v GB quantitative parameter	3 – 512

4.4.1. PRODUCT DESCRIPTION

The MS SQL server premium (**MS SQL vServer**) product is a service running on rack servers HPE ProLiant DL360 Gen10 Plus, which run a server virtual layer (VMware vSphere) that enables abstraction, flexibility and partitioning of server performance. The virtual server has accurately defined performance parameters and SLA (Service Level Agreement) describing guaranteed service availability. MS SQL vServer products are defined by the number of virtual processors (vCPU) and the size of available RAM. The vCPU parameter is a virtual processor operated on one core of a physical processor with a guaranteed frequency of 1 GHz (normalized value). The second parameter is the capacity of RAM, which is given in GB. MS SQL vServer is a diskless virtual server to which virtual disks (vDisk, vSSD) can be connected, ordered by the customer as additional products. Virtual servers are connected to customer-defined virtual networks. Virtual server supports up to 10 virtual network interface cards and 14 virtual storage devices (vDisk, vSSD).

Server virtualization secures a virtual server service with guaranteed processor performance and memory capacity. The VMware High Availability (HA), VMware vMotion and VMware Distributed Resource Scheduler (DRS) technologies ensure an appropriate level of availability. A virtual server is the equivalent of a physical server without disks and operating system.

The product includes MS SQL Server license (Standard or Enterprise edition) and Windows Server license (Standard, or Datacenter edition). The lower edition is recommended for installation.

For optimal operating system performance, we strongly recommend deploying of the current version VMware Tools.

4.4.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

The CPU hourly average performance is guaranteed **1 GHz**, which means that the processor can momentarily use up to **3.1 GHz** of normalized performance while the hourly average can still be less than 1 GHz. If the CPU performance used is up to **1 GHz (quantitative parameter)**, then we guarantee CPU NOT RDY % (**qualitative parameter**) of less than 5 %. The CPU NOT RDY % parameter represents the time, the virtual machine waited for a processor(s), which could be used by a different virtual machine on the same physical server at that moment. Cloud4com s.r.o. uses data from the **SPECint_base2017** (SPEC CPU2017 Integer Speed Base) and **SPECfp_base2017** (SPEC CPU2017 Floating Point Speed Base) – **performance values for one CPU core**. The normalized performance evaluation of a processor is calculated from the average performance evaluation, which is available at <http://www.spec.org>. **Calculation of normalized values for used Intel Xeon processor family:**

Intel Xeon Gold 6346 3.1 GHz in HPE DL360 Gen10+ (1x CPU)	
SPECint_base2017	12.10
SPECfp_base2017	178.00
SPECint_base2017 CPU 1 GHz	3.90
SPECfp_base2017 CPU 1 GHz	57.42
SPECint_base2017 Norm	1.00
SPECfp_base2017 Norm	1.00
Average Normalization int + fp	1.00
Normalization coefficient = 1	

Virtual machine metrics definition (Ready, %RDY a Co-stop, %CSTP) used by Cloud4com s.r.o. on VMware virtualization platform is available at: <https://kb.vmware.com/kb/1017926>

4.5. DEDICATED PHYSICAL SERVER

Product	Product parameters	
Server Dedicated Server	Number of CPU quantitative parameter	1 – 4
	Size of RAM v GB quantitative parameter	from 32 (for 1 CPU)
	Storage capacity	Product Dedicated Storage

4.5.1. PRODUCT DESCRIPTION

Dedicated physical server is a service running on enterprise CISCO UCS blade or rack servers. This product has precisely defined performance parameters corresponding to the rented physical server configuration. Server products are defined by the number of CPU sockets and CPU cores, clock rate (GHz) and the amount of RAM (GB) available. Price of Server product includes up to 56 virtual network interface cards (vNIC) and HBA (vHBA), that are available for use. Server is diskless or with

optional Disk products connected over FC protocol, ordered by the customer just like any other product. Server product should be connected to customer-defined virtual vLAN networks.

4.5.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

4.6. VIRTUAL STORAGE VDISK

Product	Product parameters	
vDisk Virtual Disk	Capacity in GB quantitative parameter	10 – 1024 (1 TB) Capacity > 1 TB without RTO guarantee for vBackup
	Performance in IOPS quantitative parameter	20 – 5120 (hourly average)
	Disk response time qualitative parameter	Max. 25 ms (shared infrastructure response time)

4.6.1. PRODUCT DESCRIPTION

The virtual disk is a service running on enterprise-class storage systems from NetApp AFF + EF. Data is protected with the help of the RAID technology and separated into logical units accessible by virtual hypervisors that provide storage system virtualization for individual vDisk products. vDisk products differ in thin provisioned capacity and performance parameters. Disk capacity is given in GB and performance in IOPS (number of input/output operations per second), where performance is monitored as an hourly average. vDisks are connected to vServers, so that they fulfil the operational requirements of customer’s specific applications. Max 14 virtual storage (vDisk, vSSD) to 1 vServer.

Thanks to server virtualization that uses enterprise disk arrays, the virtual disk service is provided with guaranteed availability, capacity and performance. VMware Storage vMotion technologies also allow for flexible virtual disk relocation within a disk array or between different physical disk arrays. A virtual disk is the equivalent of a physical disk and can be connected to one virtual server only. If a shared disk is required, it is possible to use NAS product. vDisk product is not backed up or replicated by default! We do recommend purchasing a vBackup product for vDisks, that ensures data backups according the chosen RPO value.

4.6.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

A storage capacity in **GB** is guaranteed. The guaranteed hourly average is up to bought **IOPS**, which means that the disk could momentarily use more resources while the hourly average can be less than bought **IOPS**. If used performance of a disk is less than bought **IOPS (quantitative parameter)**, then we guarantee the time disk response (**qualitative parameter**) up to 25 ms. Performance in **IOPS** is guaranteed while up to 8 kB block size is used and the ratio of read and write operations 50:50.

For storage capacity higher than 1 TB with vBackup product SLA parameter RTO is not guaranteed.

4.7. VIRTUAL STORAGE VSSD

Product	Product parameters	
vSSD Virtual SSD	Capacity in GB quantitative parameter	10 – 1024 (1 TB) Capacity > 1 TB without RTO guarantee for vBackup
	Performance in IOPS quantitative parameter	100 – 51200 (hourly average)
	Disk response time qualitative parameter	Max. 15 ms (response time of shared infrastructure)

4.7.1. PRODUCT DESCRIPTION

The virtual SSD is a service running on enterprise-class Flash storage systems from NetApp AFF + EF. Data is protected with the help of the RAID technology and separated into logical units accessible by virtual hypervisors that provide storage system virtualization for individual vSSD products. vSSD products differ in their provisioned capacity and performance parameters. Disk capacity is given in GB and performance in IOPS (number of input/output operations per second), where performance is monitored as an hourly average. vSSDs are connected to vServers, so that they fulfil the operational requirements of customer's specific applications. Max 14 virtual storage (vDisk, vSSD) to 1 vServer.

Thanks to server virtualization that uses enterprise disk arrays, the virtual disk service is provided with guaranteed availability, capacity and performance. VMware Storage vMotion technologies also allow for flexible virtual disk relocation within a disk array or between different physical disk arrays. A virtual disk is the equivalent of a physical disk and can be connected to one virtual server only. If a shared disk is required, it is possible to use NAS product. vSSD product is not backed up or replicated by default! We do recommend purchasing a vBackup product for vDisks, that ensures data backups according to the chosen RPO value!

4.7.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

A storage capacity in **GB** is guaranteed. The guaranteed hourly average is up to bought **IOPS**, which means that the disk could momentarily use more resources while the hourly average can be less than bought **IOPS**. If used performance of a disk is less than bought **IOPS (quantitative parameter)**, then we guarantee the time disk response (**qualitative parameter**) up to 15 ms. Performance in **IOPS** is guaranteed while up to 8 kB block size is used and the ratio of read and write operations 50:50.

For storage capacity higher than 1 TB with vBackup product SLA parameter RTO is not guaranteed.

4.8. VIRTUAL BACKUP VBACKUP

Product	Product parameters	
vBackup vDisk a vSSD backup	Capacity of Backed Product quantitative parameter	1 GB – 1 TB > 1 TB without RTO guarantee
	RPO recovery point objective	Daily (max. 28 hours), Monthly (max. 31 days)

	RET retention	Number of backup versions , with RPO value determines how long backups are kept (days/years)
	LOCATION	Local – Backup data to the same DC as source data (ReFS Backup Repository). Remote – Backup data to the geographically remote DC (NAS Repository – CIFS).
	RTO recovery time objective	Max. 8 hours (local backups) Max. 24 hours (remote backups) qualitative parameter per each vBackup product

4.8.1. PRODUCT DESCRIPTION

vBackup products provide backup capabilities for vDisks and vSSDs as well as complete virtual servers using Veeam Backup & Replication software. Veeam Backup & Replication software is used to create one full backup and then create incremental backups of changed data regularly according to the chosen RPO (Recovery Point Objective) to considerably reduce the backup window size. Real value of RPO may differ from the service catalogue value, as it is influenced by other concurrent backup jobs. Monthly jobs are scheduled from the following day in month in interval <1; 28>. Backup windows for Local vBackup is from 20:00 to 1:59, and for Remote vBackup is from 2:00 to 6:59. Local vBackup products can be combined with Remote vBackup products.

Storage technology guarantee for Local and Remote vBackup products:

- **Local vBackup:** data is stored on ReFS backup repository in MS Failover Cluster for high availability.
- **Remote vBackup:** data is stored on remote NetApp FAS storage systems as CIFS backup repository.

Choose a product with an appropriate retention (RET) to determine, for how long past backups will be retained. The RTO parameter defines the maximum guaranteed backup recovery time after a request for restore is received from an authorized person by our Service Desk. For storage products backups with capacity over 1 TB retention is limited to daily (30 versions) and monthly (12 versions) backups.

It is possible to restore complete vServer, or each vDisk and vSSD. All requests for a restore of data (vServer, vDisk, vSSD) must be sent to our Service Desk. Restored data is available for a period of 24 hours.

If the vBackup product is canceled (removed in Virtix) or the vServer to which the vBackup is attached is deleted, all previous backups are deleted! If the customer wants to retain the backups, he must contact the Support before cancelling the vBackup.

4.8.2. DESCRIPTION OF SLA PARAMETERS

Backup capacity is guaranteed for backing up products vDisk a vSSD.

RPO (daily = max. 28 hours, monthly = max. 31 days), **RET** (from 1 day up to 5 years) is guaranteed.

RTO is guaranteed at maximum 8 hours per every restore of vDisk / vSSD (qualitative parameter) of Local vBackup.

RTO is guaranteed at maximum 24 hours per every restore of vDisk / vSSD (qualitative parameter) of Remote vBackup.

RTO parameter is not guaranteed for storage products backups with capacity over 1 TB.

4.9. DEDICATED STORAGE

Product	Product parameters	
Disk Dedicated capacity on storage system	Capacity in GB quantitative parameter	step 1 Max. 15,97 TB
	Performance in IOPS quantitative parameter	step 1 (hourly average)

4.9.1. PRODUCT DESCRIPTION

Disk product is a service running on enterprise-class NetApp AFF storage, that provides dedicated block storage on a disk array. Data is protected through use of RAID technology. Disk capacity is given in GB and performance in IOPS (number of input/output operations per second), where the performance value is guaranteed by the physical configuration while using 8kB block size. Disk products are connected to the Dedicated physical Server product, so that they fulfil the operational requirements of customer's specific applications. Their formatted and usable capacity may differ from operating system point of view, when compared to the specified capacity in service catalogue. Disk product is not backed up or replicated by default! Data backup can be done with the Backup products or carried out by using your own tools in conjunction with the NAS product, that will provide storage capacity for backups. Product has support for Synchronous and Asynchronous replication with NetApp SnapMirror feature.

4.9.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**. (The guarantee is in effect on while required MPIO drivers are installed in connected Server in compliance with the requirements stated in storage vendor documentation.)

Disk capacity in **GB** is guaranteed. Performance in **IOPS** is guaranteed while 8kB block size is used and the ratio of read and write operations 50:50.

4.10. NETWORK STORAGE NAS

Product	Product parameters	
NAS Network attached storage	Capacity in TB quantitative parameter	1 – 100

4.10.1. PRODUCT DESCRIPTION

The NAS (Network attached storage) is a service running on Enterprise-class NetApp FAS storage systems. Data is protected with help of RAID technology (dual a triple parity) and can be connected to over CIFS and NFS or iSCSI protocols from the customer network. NAS products can be used as shared network storages, primarily for file services and as a target for D2D (disk to disk)

backups, where the network drive can be in a geographically remote location, providing an elegant solution for off-site backups. NAS product is not replicated or backed up in default configuration! For asynchronous replication NetApp SnapMirror and NetApp SnapVault features are recommended. Integration with AD is available for CIFS server and feature for local SnapShots.

4.10.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

NAS capacity in **TB** is guaranteed, QoS settings: max. 125 MB/s throughput and 2000 iops.

4.11. LOCAL NETWORK VLAN

Product	Product parameters	
vLAN Virtual Local Area Network	Capacity in Gbps quantitative parameter	1, 2.5, 5, 10

4.11.1. PRODUCT DESCRIPTION

Network products provide network services for the virtual data center. Basic product is **vLAN**, which defines a virtual local area network (802.1q) defined on a physical CISCO Nexus or Catalyst switch and propagated to the virtual infrastructure using VMware vNetwork Distributed Switch. Virtual local area networks operate at the L2 of the ISO/OSI network model and serve for basic interconnection of vServers and other objects which work at the higher network layers. At L3 vRouters provide the required filtration of every vPDC from the external environment and a connection point for VPN encrypted tunnels from remote branches and mobile workers. IEEE 802.1Q Tunneling (QinQ) is not supported!

4.11.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.999 %**.

Throughput up to in Gbps and the possibility to reach this value during Virtual Network Distributed Switch operation can be defined for a vLAN product. Total current data traffic can be measured at every network interface of each individual device connected to the vLAN. If vLAN connection outside the vPDC is requested, the maximum throughput is limited by the connection used.

4.12. PUBLIC IP ADDRESS

Product	Product parameters	
Public IP Block Block	Number of addresses in block quantitative parameter	Od 1

4.12.1. PRODUCT DESCRIPTION

Block of IPv4 addresses for vRouter product or custom network device (router). There are 2 types of product IP Block:

A. Local ISP

- local ISP provides IPv4 addresses only
- these addresses are available for use in a single DC location only
- these addresses are not transferable

B. C4C ISP

- provides IPv4 as well as IPv6 addresses
- these addresses are not location bound and can be used in all available DC locations - IP routes can be set in Virtix
- public addresses routed using BGP protocol – use of own network device, physical or virtual, is possible in this scenario

4.12.2. DESCRIPTION OF SLA PARAMETERS

Allocation guarantee of specific IP address(es) IPv4/IPv6 for customer environment.

4.13. VIRTUAL ROUTER (VROUTER)

Product	Product parameters	
vRouter Virtual Router	Number of network interfaces quantitative parameter	2 – 10
	Throughput in Mbps quantitative parameter	2 Gbps

4.13.1. PRODUCT DESCRIPTION

Virtual router (vRouter) enables IP traffic routing between the customer’s networks. It supports dynamic and static routing. vRouter also enables Firewall functions – state and state-less filtration with L3-L4 ACL, network translation SNAT and DNAT. It also supports specific QoS settings.

vRouter is access point for the encrypted VPN connections from remote office and mobile employees:

- Site-to-Site VPN – IPsec
- Remote Access – OpenVPN.

Supported Site-to-Site VPN – IPsec parameters:

vRouter IPsec 1 st phase supported parameters	
Key-exchange and authentication mode:	IKEv1/2
Negotiation mode:	main
Encryption algorithm:	AES-256
Integrity-check algorithm:	SHA-1, SHA-256
Diffie-Hellman group:	DH5,14-26
SA lifetime:	30-86400 seconds
vRouter IPsec 2 nd phase supported parameters	

Encapsulation/transport mode:	Tunnel-mode
Protection protocol:	ESP
Integrity-check algorithm:	SHA-1, SHA-256
PFS:	group5,14-26
SA lifetime:	30-86400 seconds
Encryption algorithm:	AES-256
Compression Method	no

4.13.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

There are at least 2 Ethernet interfaces guaranteed for vLAN connection with throughput up to 1 Gbps. Total real-time data traffic can be measured at every network interface of a switch connected to the vLAN. The minimum capacity is guaranteed according to port settings, the overall throughput according to configured services as requested by the customer. If connection outside the vPDC is requested, the maximum throughput is limited by the connection used (VPN connection, QoS etc.).

4.14. BASIC FIREWALL (FORTIGATE VDOM)

Product	Product parameters	
Managed Firewall	Connectivity in Mbps quantitative parameter	10 – 1000
	Management	Optional managed service

4.14.1. PRODUCT DESCRIPTION

Basic Firewall (FortiGate VDOM) product is an application firewall as a service in the Cloud4com environment on the FortiGate platform. The FortiGate platform is fully managed by CLOUD4COM’s administrators and includes FortiGate with Basic features (Firewall, VPN), one-time setup and operations of 1x IPSec VPN from the customer's site to the Cloud4com data center environment. Default service is managed by the customer (full access to the FortiGate management console). The optional managed service includes 1 hour of specialist work/month (configuration changes – e.g. managing firewall rules) and read-only access to the FortiGate management console for the customer. The price of the service does not include connectivity to the Internet.

4.14.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**. Guaranteed specialist response time to incidents is 2 hours (during working days 9AM – 5PM) for fully managed service.

4.15. UTP FIREWALL (FORTIGATE UTP VDOM)

Product	Product parameters	
Managed Firewall	Connectivity in Mbps quantitative parameter	10 – 1000
	Management	Optional managed service

4.15.1. PRODUCT DESCRIPTION

UTP Firewall (FortiGate UTP VDOM) product is an application firewall as a service in the Cloud4com environment on the FortiGate platform. The FortiGate platform is fully managed by CLOUD4COM’s administrators and includes FortiGate with FortiGuard - Unified Threat Protection (Firewall, VPN, IDS+IPS, Anti-Malware, Web Filtering, Antivirus), one-time setup and operations of 1x IPSec VPN from the customer's site to the Cloud4com data center environment. Default service is managed by the customer (full access to the FortiGate management console). The optional managed service includes 1 hour of specialist work/month (configuration changes – e.g. managing firewall rules) and read-only access to the FortiGate management console for the customer. The price of the service does not include connectivity to the Internet.

4.15.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**. Guaranteed specialist response time to incidents is 2 hours (during working days 9AM – 5PM) for fully managed service.

4.16. INTERNET

4.16.1. PRODUCT DESCRIPTION

Customers can choose from two products which provides internet connectivity in the vPDC. They are distinguished by redundancy, bandwidth and SLA parameters:

- **Internet – Local ISP**
- **Internet – C4C ISP**
- **Internet – DSC ISP**

Billing of the product Internet is based on calculation of 95th percentile (in Mbps). Bandwidth is measured during the month in 5-minute intervals – average bandwidth in Mbps is calculated for each 5-minute interval. At the end of the month, the samples are sorted from the highest to the lowest, and the top 5% (which equal to approximately 36 hours) of data is thrown away. The next highest measurement becomes the billable use for the entire month. The 95th percentile is calculated for both the in and out traffic, and higher value is the billable use for that month.

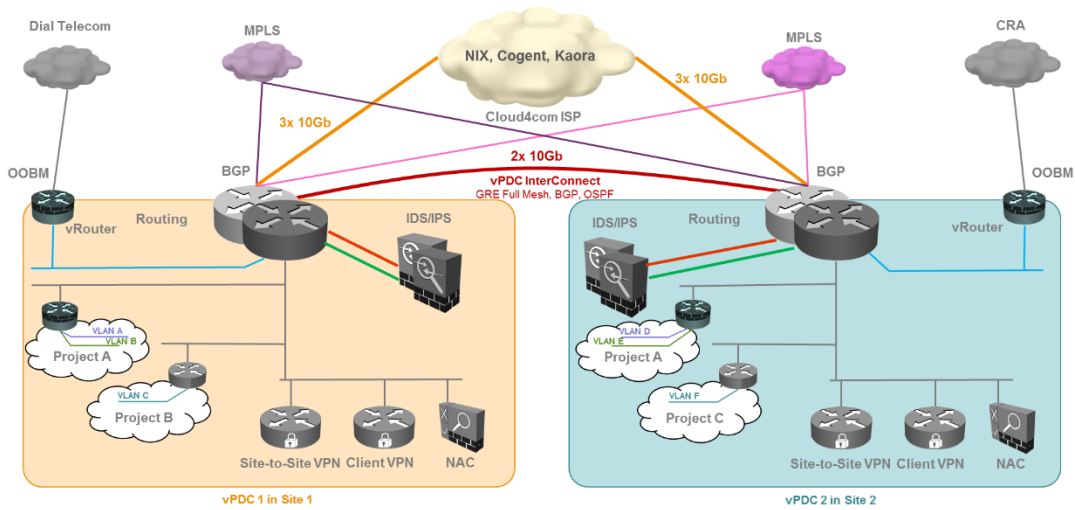
The price is calculated based on following prices and parameters:

- Price of 1 Mbps of guaranteed bandwidth in CZK – Mbps_CIR
- Price of 1 Mbps of over-usage in CZK – Mbps_Overusage
- Guaranteed bandwidth in Mbps – CIR
- Over-usage in Mbps – it is a difference between the calculated 95th percentile for that month and the CIR value (if the 95th percentile value is lower than CIR, than Over-usage equals to zero).

Billed price of product Internet in CZK = CIR * Mbps_CIR + Overusage * Mbps_Overusage

If the customer sets the Maximal bandwidth value equal to the Guaranteed bandwidth, Mbps_Overusage will always be equal to zero. When calculating the price of the product Internet for a specific month, the highest value of Guaranteed bandwidth set in that month will be used.

Internet infrastructure is depicted on the following picture.



4.16.2. INTERNET – LOCAL ISP

Product	Product parameters	
Internet Internet connectivity	Capacity in Mbps quantitative parameter	1-1000

Product Local ISP provides vPDC connectivity to the public Internet over one local Internet provider (Quantcom, formerly Dial Telecom in DC TTC, České Radiokomunikace in DC Tower). Following parameters specify this product:

- Guaranteed bandwidth (CIR – Committed Information Rate) – guaranteed bandwidth in Mbps
- Maximal bandwidth – maximal bandwidth in Mbps

Maximal bandwidth can be set in a range <CIR; 10x CIR>, i.e. maximal bandwidth can be set to a value equal to guaranteed bandwidth or it can set to a value up to 10-times higher.

- Available range for guaranteed bandwidth values: 1-200 Mbps
- Available range for maximal bandwidth values: 10-1000 Mbps

System Availability (Uptime) = **99.6 %**.

The value of capacity requested is guaranteed and can be measured at the vPDC's outbound interface of vRouter.

4.16.3. INTERNET – C4C ISP

Product	Product parameters	
Internet Internet connectivity	Capacity in Mbps quantitative parameter	10-10000

Product C4C ISP provides vPDC connectivity to the public Internet over Cloud4com s.r.o. ISP infrastructure (fully redundant infrastructure with several upstream Internet providers across datacenter locations). Following parameters specify this product:

- Guaranteed bandwidth (CIR – Committed Information Rate) – guaranteed bandwidth in Mbps
- Maximal bandwidth – maximal bandwidth in Mbps

Maximal bandwidth can be set in a range <CIR; 10x CIR>, i.e. maximal bandwidth can be set to a value equal to guaranteed bandwidth or it can set to a value up to 10-times higher.

- Available range for guaranteed bandwidth values: 10-1000 Mbps
- Available range for maximal bandwidth values: 10-10000 Mbps

Availability of the ISP border infrastructure from the customer vPDC is **99.95 %** (uptime).

Quality SLA: all transport links between the vPDC and the ISP border infrastructure (including the last external ISP border router interface) are utilized to max. 90 % bandwidth in the outgoing direction (measured in 5 minutes intervals). All transport links between the vPDC and the ISP border infrastructure are utilized to max. 90 % bandwidth in the incoming direction (measured in 5 minutes intervals).

4.16.4. INTERNET – DSC ISP

Product	Product parameters	
Internet Internet connectivity	Capacity in Mbps quantitative parameter	Up to 1000

Product DSC ISP provides vPDC connectivity to the public Internet over Cloud4com s.r.o. ISP infrastructure (fully redundant infrastructure with several upstream Internet providers across datacenter locations). It's legacy product for existing customers only.

The service includes Anti-DDoS protection of connectivity against attacks on their capacity (Volumetric Attacks):

- Protection at Layer 3 and Layer 4 of the OSI model (SYN, UDP, NTP, etc.).
- Protection at Layer 7 of the OSI model (HTTP GET/POST attacks, etc.).
- All incoming traffic from the international and Czech Internet is continuously evaluated and cleaned if it is evaluated as a DDoS attack.
- Traffic cleaning is provided by the so-called "scrubbing centre", which ensures that most unwanted traffic is blocked, while benign traffic should not be affected.
- Traffic is automatically redirected to a line without DDoS protection in the event of a Scrubbing Center failure.

System Availability (Uptime) = **99.6 %**.

4.17. VPDC INTERCONNECT

Product	Product parameters	
vPDC Interconnect vPDC connectivity	Throughput in Mbps quantitative parameter	1000 (Mbps)

4.17.1. PRODUCT DESCRIPTION

vPDC Interconnect product provides network connectivity of Customer's Virtual Private Data Centers through backbone of Cloud4com s.r.o. vPDC Interconnect must be bought for all connected vPDCs. This product specifies the maximum bandwidth on outbound interface of each vPDC and the bandwidth is shared with other customers (best effort).

4.17.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

Do not use IP addresses in your vPDC from range 100.64.0.0/10.

4.18. VBALANCER

Product	Product parameters	
vBalancer Virtual Load Balancer	Throughput in Mbps quantitative parameter	1000
	Number of http/https requests quantitative parameter	HTTP requests (100B) per second: 10 000 HTTPS requests (100B, AES256-SHA) per second: 800 HTTPS requests (100B, DHE-RSA-CAMELLIA256-SHA) per second: 400

4.18.1. PRODUCT DESCRIPTION

The virtual load balancer (vBalancer) is a device on F5 NGINX platform that allows load balancing among multiple servers hence ensuring and improving application availability and performance scaling. The device allows balancing of HTTP and HTTPS traffic. This device is under the Cloud4com s.r.o. management.

- Service status page with traffic statistics and remote monitoring
- Optional SSL Offload and HTTP to HTTPS redirect
- Optional **vBalanceru Plus** with **F5 NGINX Plus** license (with backend servers health check, connection limits per backend server and backend persistence with HTTP cookie)

Performance of virtual load balancer depends on bought Internet connectivity and vRouter configuration in vPDC. The vBalancer is provisioned on a virtual server which must be ordered alongside the vBalancer. The vServer specification is:

- vServer with 2x CPU and 2 GB RAM
- vSSD 40GB
- vBackup with 7 days retention period

4.18.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

4.19. VEEAM CLOUD CONNECT BACKUP

Product	Product parameters	
Veeam Cloud Connect	Repository Type	Standard Repository Repository with Object Lock
	Used Capacity quantitative parameter	per 1 GB + Optional Backup Protection feature, per 1 GB
	WAN Acceleration	Optional WAN Acceleration feature, per unit
	Number of licenses quantitative parameter	Number of unique virtual machines, agents (Server or Workstation) licenses consumed

4.19.1. PRODUCT DESCRIPTION

Veeam Cloud Connect product is fully integrated feature for simple and secure backup copy into cloud from your Veeam Backup & Replication and Veeam Agent and higher installation. Veeam Cloud Connect provides remote repository functionality. Configuration of the product is fully integrated into Virtix application frontend. The implementation of Veeam Cloud Connect accepts encrypted data only! Enable backup data encryption at your side in Veeam Backup (Copy) Job configuration. Backup data is stored by repository type:

- **Standard Repository:** 1 copy of the data in one site according to the vPDC configuration on a File Server cluster with NTFS/ReFS volume. The optional Backup Protection feature provides extra retention (8 days) for backup data in a dedicated folder. If you require a paid manual data recovery from the Backup Protection folder, please contact our technical support.
- **Repository with Object Lock:** 2 copies of data in two independent sites on NetApp StorageGRID S3 Storage with Object Lock (WORM) feature for 30 days (data cannot be overwritten/deleted).

An optional **WAN acceleration** feature is also available to optimize data transfer on slow lines. In case of paid restore request from Backup Protection folder please contact our support. Capacity is billed per used backup repository space on daily basis (with optional Backup Protection feature). Licenses are billed on monthly basis: per VM, Agent Server and Agent Workstation. Licenses are not charged if there is an SP license in the customer's installation.

Supported Veeam SW versions are [HERE](#).

4.19.2. DESCRIPTION OF SLA PARAMETERS

System Availability (Uptime) = **99.6 %**.

4.20. SOFTWARE

4.20.1. PRODUCT DESCRIPTION

Cloud4com s.r.o. company in **CLOUD4COM** service provides service-provider licenses and offers products from Microsoft (Windows Server, SQL Server, SharePoint, Exchange, Microsoft 365), VMware (Cloud Foundation), Fortinet, Thales (CipherTrust Manager, CTE, ProtectDB, ProtectApp), Veeam, SuSE, Red Hat which can be run on virtual and physical servers.

4.20.2. MICROSOFT SW

Windows Server operating systems can be operated only in Standard and Datacenter editions, both in the [currently supported versions](#) and in the versions prior to Windows 2000 Server. Activation is possible from Windows Server 2008 onwards using the provider's or customer's KMS infrastructure (KMS, Active Directory). Usage and generic license keys required for conversion from other activation methods are available on the [manufacturer's website](#). For activation of older versions, please contact our technical support.

Terminal Services (Remote Desktop Services) can be operated in a Per Device or Per User licensing model. Use of Per User licensing is subject to the terminal server's Active Directory domain membership and domain user accounts. To activate the appropriate number of purchased licenses from Virtix, please contact our technical support.

SQL Server, SharePoint Server and Exchange Server products can be operated in all editions and versions compatible with the running operating system. The license key is included in the installation media, product activation is not performed.

All licenses are charged on a monthly basis and usage is governed by Microsoft's SPLA program terms and conditions, which are available on the [manufacturer's website](#).

4.20.3. FORTINET SW

Fortinet SW can be operated in vPDC. SW licenses FortiGate-VM01 and FortiGate-VM02 for vServer installation:

- Basic features – Firewall, VPN, no VDOM
- UTP features – Firewall, VPN, IDS+IPS, Anti-Malware, Web Filtering, Antivirus, no VDOM

4.21. VMWARE ARIA OPERATIONS FOR LOGS

Product	Product parameters	
vLogServer VMware Aria Operations for Logs	EPS per node quantitative parameter	2000, 5000, 15000

4.21.1. PRODUCT DESCRIPTION

VMware Aria Operations for Logs is a platform that is used to collect and analyze logs from the customer's environment. Logs can be sent to the solution, for example, from virtual and dedicated servers, network devices operated in the Cloud4com environment and at customer sites. However, it is not possible to use the solution for logs from a VMware vSphere infrastructure with the customer's license.

- The solution is running on the dedicated vServer in the customer's vPDC, for which the customer pays.
- The throughput of the solution for logs ingest depends on the vServer configuration:

System size	EPS Events per Second	vServer	vSSD Default configuration OS + Data
Small	2000	4 vCPU, 8 GB RAM	20 GB + 510 GB
Medium	5000	8 vCPU, 16 GB RAM	20 GB + 510 GB
Large	15000	16 vCPU, 32 GB RAM	20 GB + 510 GB

- You can only add disk capacity for log storage as additional disks. There is no support for increasing the capacity of existing data disks.
- In addition, a VMware Aria Operations for Logs SW license must be purchased for the vServer in Virtix.
- Initial deployment is performed by a Cloud4com specialist as a paid service. The installation includes deployment of the virtual appliance to the customer's vPDC as a vServer, basic network configuration and handover of the platform to the customer.
- The price of the SW license includes an assisted upgrade of the VMware Aria Operations for Logs platform by the customer under the supervision of the Cloud4com specialist.
- All requirements are charged at an hourly rate as per the price list.

4.22. MONITORING SERVICE

4.22.1. PRODUCT DESCRIPTION

Monitoring service provides monitoring of servers, operating systems and applications hosted in customer's vPDC on **Hostmonitor** platform. Supported operating systems are Linux and Windows. Key characteristics of the service are:

- this service is primary intended for vPDC components only and is limited to 600 sensors (service extension is available per request),
- updates on current network status,
- scalable monitoring software,
- offers several options of reaction if thresholds of monitored parameters are breached (phone, e-mail a SMS),

- optional proactive investigation of incidents, active remote monitoring by team of specialists – on working days between 6am and 6pm,
- Hostmonitor Agent runs on Windows server in customer's environment and needs network visibility to monitored systems,
- dedicated account with local Administrator role is needed for Windows systems and Domain Administrator account for Domain Controllers,
- 2 TCP ports must be enabled for Agent – Server communication,
- SNMP (get) must be enabled for dedicated HW monitoring from Agent,
- SNMP (get) must be enabled for Linux servers monitoring from Agent.

Monitored parameters of servers with OS Windows:

General

- Network connectivity - ping
- CPU load
- Memory utilization
- Uptime
- Free disk space
- TCP connections
- NT system logs – application, system, AD, DNS, ...
- Processes – CPU utilization, RAM
- Services status monitoring
- Certificates validity
- URL availability/status
- Test of last Windows update date
- Disk utilization – read/write operations per second
- Network adapter throughput – send/receive/error packets
- Number of active and disconnected terminal server users

Active Directory

- DNS test
- DHCP test
- LDAP test
- NTP test
- Password change for accounts with administrative rights
- Last domain login of users

- PC in Disabled state
- Users in Disabled state
- DC replication checks
- Root certificate validity check

SQL server

- Availability and size of database
- Server load checks
- Number of connected users
- Deadlocks control

Other

- Test of data backups
- Blacklist checks – tests if mx records are blacklisted
- Checks of values of parameters via SOAP/XML
- Check of domain name expiration

Monitored parameters of servers with OS Linux:

- Network connectivity - ping
- CPU load
- Memory utilization
- Uptime
- Free disk space
- Processes – CPU utilization, RAM
- Services status monitoring