vRealize Operations Tenant App 2.6

for Metering and Chargeback

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vRealize Operations Tenant App Overview

VMware supports thousands of partners to host and sell clouds built on VMware technology using vCenter and Cloud Director (VCD). While vCenter provides the core of virtualization, Cloud Director provides needed constructs for segmenting the virtual infrastructure appropriately and offering it as a service to tenants of these partners.

As can be imagined, there are several variants of infrastructure that can be sold by these partners such as "Pay as you go", "Raw capacity" aka "Allocation based", "Raw capacity with minimum guarantee" aka "Reservation based", "Flex" i.e. "a combination of others". Potentially combination of these could be offered to same tenants. It becomes challenging to track usage over a period and charge appropriately due to this complexity. In addition, tenants demand for a transparency in this billing, and it is imperative that service providers offer it.

vRealize Operations Tenant App (TA) sets out to solve these problems by metering the infrastructure. Further, it provides options to configure different models for pricing this metered infrastructure. Finally, it closes the loop by providing tenant specific views that help tenants validate their charges by looking at usage.

Architecture of TA is based on

- Data collector that collects data from vCenter, VCD and NSX,

- Pricing engine, that applies the charging policies defined by provider on the collected data

The collector and the pricing engine reside inside vRealize Operations Manager (vROps). TA appliance acts as a simple interface for creating pricing policies and storing generated "Bill". TA appliance also provides a plugin to expose Tenant views inside VCD.

Because of these criterion, deployment of TA needs two Virtual Appliances namely the TA Virtual Appliance and the vROps Virtual Appliance. Partners who are already running vROps will be able to just connect Tenant App and begin, and those who do not can start with deploying the Chargeback Licensed edition of vROps.

Configuration of TA post deployment involves configuring vROps, Cloud Director, vCenter, and NSX. vROps connection is used for metering of collected data and bill generation. Cloud director connection is used for user management, providing Tenant view, and for collection of data from VCD using vROps VA. vCenter connection is used for collecting inventory changes and metering data about virtual machines using vROps. NSX connection is used for collecting usage information on network elements such as edges, load balancers, firewalls, etc. using vROps data collectors.

A functional flow of using TA involves

- Defining pricing policies

- Associating these pricing policies to Org- VDCs coming from VCD

- Generating bills and reports (showback) using this combination

- Exposing these bills and other usage data to Tenants

- Providing an isolated view of the infrastructure and services for each tenant

Functional Flow Diagram
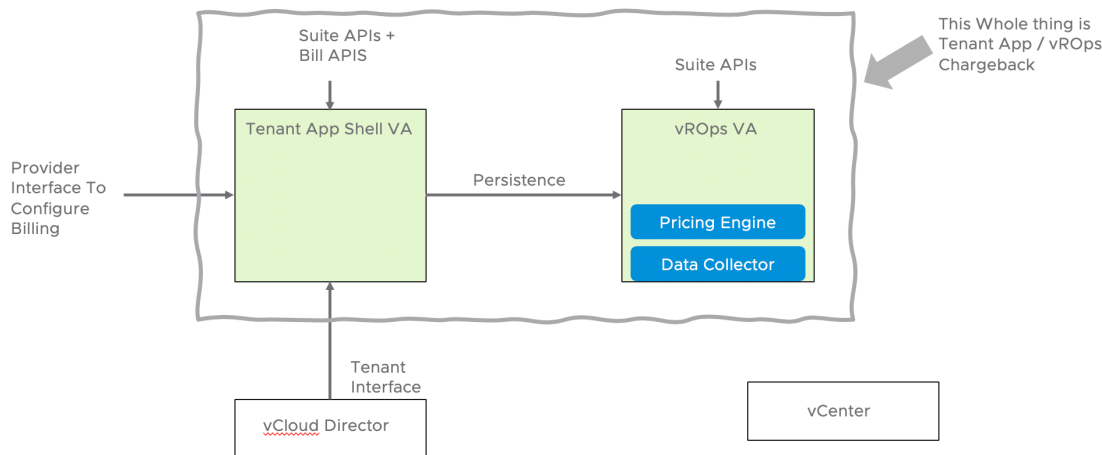
Pricing policies have several variants such as their infrastructure scope of application (e.g.: Allocation pool, PAYG, Reservation pool), charge rates for different resources (e.g.: 2$/vCPU/Day, 1$/GB RAM configuration/Day) and conditions for applying the rates (E.g.: Only when powered on, slabbed rate or overage). Associating pricing policies to org VDCs sets up a combination that can be used henceforth for all metering and billing. Bills are created on-demand based on provider's request and contain a detailed result of applying a pricing policy on and Org-VDC. Reports are customizable entities containing historical data about pricing and usage. They can be scheduled and exported to formats such as CSV and PDF. A plugin to VCD allows these bills and usage data to be exposed to tenants. In addition, Tenant App provides a set of dashboards that can be exposed to tenants.

Rest of this paper expands on the above notions and details out each of them.

Licensing

Tenant App works in one of the two license modes.

- Chargeback License: This license mode enables basic functionalities of Tenant App including metering for Cloud Director, vCenter and NSX based infrastructure. The license key is applied from vROps UI, post which the UI of vROps is turned off and can be used only as a headless data collection and pricing engine.
- vROps entitled mode: If the partner is entitled to any variant of vROps already, he can continue to use the same vROps as a backend for Tenant App. In such cases, the partner gets additional flexibility of using vROps UI and perform customizations such as custom reports and dashboards based on his entitlement.

Architecture and Dataflow
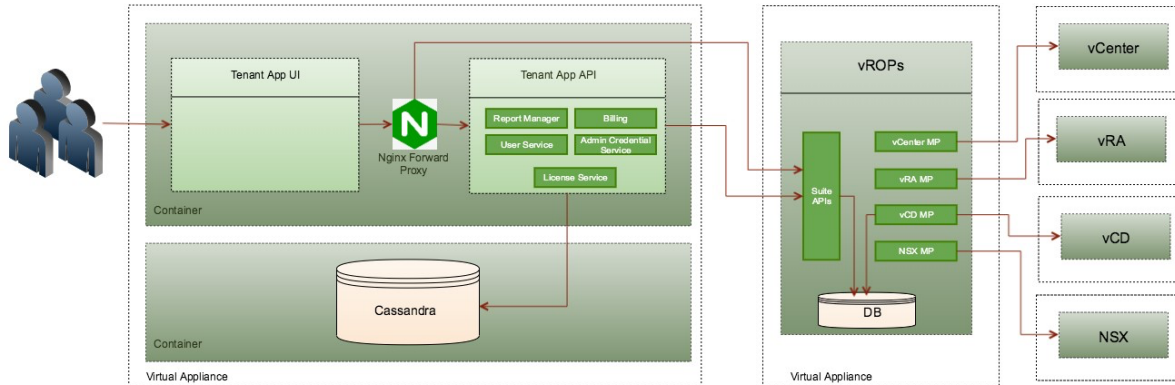
As can be seen in the diagram, combination of Tenant App appliance and vROps appliance together help service providers meter their infrastructure. vROps acts as the data collection engine talking to endpoints such as vCenter and Cloud Director using its management packs. Installation and configuration of these management packs are covered in Administration Guide of Tenant App. Tenant App adds a pricing layer on top of these collected metrics by allowing configuration of the pricing engine. The pricing engine itself runs inside the vROps appliance and outputs the pricing metrics back into vROps. So in essence for a provider, Tenant App VA acts as the configuration interface for pricing policies, whereas vROps acts as the single source of metrics for all collected and processed information. Full list of collected and processed metrics can be found in the addendum at the end of this white paper.

Tenant App VA also acts as the User interface that can be configured and plugged into Cloud Director to be accessed by Tenant Administrators. It provides summary information of usage and metered charges to Tenants of a provider.

Virtual Machines are priced depending on how long they live in the environment. Tenant App and vROps can track VMs to a minimum granularity of 5 minutes and charge them i.e. even if the VM is alive only for 5 minutes, pricing engine will be able to associate a charge with this VM and roll it up.

Pricing Policies

This section provides details on various elements of pricing policy and how each of the components work in different scenarios, computation algorithm is described in detail.

Base Settings
Policy Name: Service provider admin will provide a relevant name to policy; one policy can be eventually assigned to multiple organization VDC. Each Organization in Cloud Director corresponds to one tenant, so pricing policy provides flexibility at much granular level (Org-VDC) so that differential charging can be done for different tenants (organizations) as well as multiple Org-VDCs within same tenant (organization).

Pricing Policy Type: This corresponds to types of allocation models (Allocation pool, Reservation pool and Pay-as-you-go) in VCD. This field is just used as an identifier only, so that when you create a policy you can assign a label to it so as to later associate it with appropriate organization VDC of same allocation model selected.

The choice here decides how you charge for CPU and memory. For details, refer to Table 1.1

Currency: This is the currency in which pricing is setup and bills are generated, this currency is same as set in vROps. In vROps navigate to Administration > Management > Global Settings > Currency to set this value. Please note that this can be set only once per installation and cannot be modified once set.

Policy Description: Any additional details to be mentioned about pricing policy

CPU Rate

Charge CPU based on: This is applicable when admin selects policy type as PAYG, where pricing happens at virtual machine level, and admin can choose to charge CPU based on either gHZ or based on vCPU count.

Charge Period: A specific price can be applied with different periodicity such as Hourly, Daily and Monthly. The base rate and fixed cost mentioned will get applied based on this frequency.

Charge Based on: For each allocation model in VCD admin can define specific rules based on which chargeback can happen, it can be based on resource allocation, usage or reservation (guaranteed resource) or max of two entities (usage vs allocation, usage vs reservation). The details of which value will be considered in computation based on this set rule is described in the below table.

Table 1. 1

Pricing Policy Type / Allocation Model	Charge Based on	Power State	CPU	Memory
Allocation Pool	Charged on		Org-VDC	Org-VDC
	Allocation	Not Applicable / No Impact	CPU allocation (GHZ)	Memory allocation (GB)
	Reservation		CPU resources guaranteed (GHZ)	Memory resources guaranteed (GB)
	Usage		CPU Allocation Used (GHZ)	Memory Allocation Used (GHZ)
	Max (Allocation, Usage)		Usage can go beyond what is allocated, so take whichever is higher	Usage can go beyond what is allocated, so take whichever is higher
	Max (Reservation, Usage)		Usage can go beyond guaranteed, so take whichever is higher	Usage can go beyond guaranteed, so take whichever is higher
Reservation Pool	Charged on		Org-VDC	Org-VDC
	Reservation		Same as allocation, as 100% is guaranteed	Same as allocation, as 100% is guaranteed
	Usage		CPU Reservation used (GHZ)	Memory Reservation used (GB)
	Max (Allocation, Usage)		Usage can go beyond what is allocated, so take whichever is higher	Usage can go beyond what is allocated, so take whichever is higher

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	Max (Reservation, Usage)		Usage can go beyond guaranteed, so take whichever is higher	Usage can go beyond guaranteed, so take whichever is higher
Pay As You Go	Charged on		VM	VM
	Allocation		Amount of configured CPU ghz at a VM level	Amount of configured Memory GB at a VM level
	Usage		CPU demand at the VM level	Memory demand at the VM level

Default Base rate: Specific the rate or price at which you would like to charge the resource under consideration, this value will be multiplied accordingly with resource metered value to arrive at final charge to tenant in the bill generated.

Charge Based on Power State: This rule is applicable for PAYG type of polices, where charging is done at virtual machine level and chargeback can be done based on three available options: Always, Only when powered-on, Powered-on at least once.

- **Always**: do not consider VM uptime, charge irrespective of that
- **Only when powered-on**: Charge will be prorated based on uptime

E.g. if daily charge is 10$ per gHZ for CPU and specific VM was only 20 min a day, then charge will be prorated based on the fraction (20/1440), where 1440 is total minutes in day.

- **Powered-on at least once:** In this case full charge is applied even if VM is switched on at least once for minimum duration of minute.

Charge Overage: This rule is applicable only to allocation pool model, where guaranteed resources are some % of total available resources. In this case till guaranteed %, normal base rate will be applied. If usage goes beyond guaranteed %, the rate mentioned in overage will be applied (for the delta usage which is higher than guaranteed).

E.g. in allocation pool model for specific Org-VDC if allocated CPU is 10 gHZ and guaranteed is 50%, which is 5 gHZ, the normal base rate is 3$ per gHZ and overage base rate is 4$, then if usage is found to be 6.5 gHZ, then for 1.5 gHZ the overage rate of 4$ is applicable and below which normal base rate of 3$ will be applicable.

Base Rate Slab: The service provider may want to charge differently based on the volume of resources consumed.

E.g. If usage is under 2 vCPUs, then default Base Rate $4 per vCPU will be applied for whole usage. If usage is greater than 2 vCPU, then Base Rate $6 per vCPU will be applied for whole usage.

Fixed Cost: This price is applied to resource under consideration irrespective of resource metering. The difference between base rate and fixed cost is that base rate gets multiplied with resource metered quantity, if there is no resource consumption/allocation base rate will not be applied whereas fixed cost gets applied irrespective of metered resource. Fixed cost follows the charge period.

E.g. charge period = If the per vCPU rate is $2 and a fixed cost of $10 is specified for a VM that has 4 vCPUs, charges will be computed as 4vCPUs*$2 + $10 = $18

Memory Rate
Please refer to the "CPU rate" section, as all the fields and rules are similar in nature except that resource under consideration will be memory metered in MBs.

Price based on Sizing Policy
There may be Service Providers that do not want to charge per vCPU or per GB RAM, instead they want standard pricing templates for charging their customers (similar to the concept in AWS where they have Small, Medium, Large, T2 Small, R2 Large etc.)

Sizing policies are predefined templates that are present in Cloud Director wherein you create a combo of vCPU and memory sizes and enter a rate against it.

In this, the price is based on VM Size instead of per CPU or Memory GB Charge individually.

Storage Rate
Charge Storage based on: Admin has two options here, Storage policies and Default rate.. When 'storage polices' option is selected, admin can do a 'differential' pricing based on storage tiers as set in VCD, for specific Org-VDC. When 'Default rate' is selected, for all the datastore same base rate mentioned will be applicable irrespective of storage tiers (Default Rate is a legacy option and will be deprecated soon).

E.g. if the storage policies created in Cloud Director are Gold, Silver and Bronze tiers, a differential price of 4$, 3$ and 2$ per GB per month can be applied based on storage tiers.

Storage charges are not only applicable at the Org-VDC and VM level. But, they are also applicable for independent disks, media files, vApp templates.

Charge Based on: VMs can be charged based on configured storage by selecting 'Limit' as an option or based on the actual storage consumed by them based on 'Usage' as the option in pricing policy.

Base Rate Slab: The service provider may want to charge differently based on the storage consumed by the VM. So, in Storage also, we can charge based on the slab of consumption. Many Service providers provide a discounted rate if the consumption by VMs is higher

E.g. If you want to charge a VM consuming 100GB of storage at a lower rate ($1 per month) compared to a VM consuming 50GB of storage that is charged at $1.5 per GB per month. In such a case, base rates will be configured as "greater than or equal to:50GB", "base rate:1", "default base rate:1.5". In such a case, a VM having 150GB of storage will be charged $150 a month and a VM having 30GB of storage will be charged $45 a month.

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Pricing Settings: There are two types of Storage Pricing Policy Settings

1. Aggregate storage charges from Storage profiles for PAYG Org-VDCs - this is the default mode for Storage Policy settings, and it includes overhead storage such as swap disks and log disks
2. Aggregate storage charges from VMs, media, vApp templates and independent disks for PAYG Org-VDCs – When the provider doesn't want to charge the overheads to the users

Please refer to the "CPU rate" section for other configuration parameters and rules, as all the fields and rules are similar in nature except that resource under consideration will be storage metered in GBs.

Network Rate
Tenant app charges network only at edge gateway level and not at the individual VM level.

Tenant App can charge for Edge gateways that are backed either by NSXV or NSXT. The same pricing rate card fields are used for charging either of these networks. The details of which metrics will be used in each case are given in the metrics table towards the end of this document.

External Network Transmit: Tenant app captures the egress data from edge gateway which in turn is associated with specific Org-VDC. Admin can apply a specific base rate 'per mb' of data transfer. The data is measured per edge gateway. All the traffic going through the network is charged here regardless of whether it's going through the internet or not

External Network Receive: Tenant app captures the ingress data from edge gateway which in turn is associated with specific Org-VDC. Admin can apply a specific base rate 'per mb' of data transfer. The data is measured per edge gateway. All the traffic going through the network is charged here regardless of whether it's going through the internet or not

 Note: Charging VMs for the network consumption is not available today. But, it's a part of the roadmap

Network Transmit Rate (Bandwidth):

There are 3 ways of charging bandwidth here

1. **Conservative** – In this this case the Service Providers charge for the average bandwidth consumed by the customer. This is more in favour of the customer and less in that of the Service Provider

   E.g. - You have a 10 GBPS line and the rate is $10 per GBPS. But your average bandwidth usage is 5GBPS. Here you'll be charged $50

2. **Aggressive** – Here, the Service Provider charges the whole usage at the peak bandwidth usage. This is more in favour of the Service Provider and less in that of the Customer

   E.g. - The consumption rate is $10 per GBPS. If the average bandwidth usage is 5GBPS. But, the peak bandwidth used is 8GBPS. In this case, the tenant be charged $80 and not $50

3. **Moderate** – In this case, the Service Provider would charge at the 95th Percentile value of the bandwidth.

   E.g. – The user has had 100 usage samples of Bandwidths 1 to 100 GBPS each respectively. In this case, the peak bandwidth is 100 GBPS and average bandwidth is 50 GBPS. But, in a moderate pricing mechanism, the charge would be calculated on the basis of 95th percentile i.e. with respect to 95 GBPS.

Network Receive Rate (Bandwidth): Similar to Network Transmit rate, 95th percentile of ingress data is considered to charge for network receive bandwidth. These stats are retrieved via NSX manager APIs

There are 3 ways of charging bandwidth here

1. **Conservative** – In this this case the Service Providers charge for the average bandwidth consumed by the customer. This is more in favour of the customer and less in that of the Service Provider

   E.g. - You have a 10 GBPS line and the rate is $10 per GBPS. But your average bandwidth usage is 5GBPS. Here you'll be charged $50

2. **Aggressive** – Here, the Service Provider charges the whole usage at the peak bandwidth usage. This is more in favour of the Service Provider and less in that of the Customer

   E.g. - The consumption rate is $10 per GBPS. If the average bandwidth usage is 5GBPS. But, the peak bandwidth used is 8GBPS. In this case, the tenant be charged $80 and not $50

3. **Moderate** – In this case, the Service Provider would charge at the 95th Percentile value of the bandwidth.

   E.g. – The user has had 100 usage samples of bandwidths 1 to 100 GBPS each respectively. In this case, the peak bandwidth is 100 GBPS and average bandwidth is 50 GBPS. But, in a moderate pricing mechanism, the charge would be calculated on the basis of 95th percentile i.e. with respect to 95 GBPS.

Advanced Network Rate

Edge Services: Apart from the basic data transfer, there are additional value added services offered in Cloud Director in combination with NSX.

All the network services associated with specific edge such as HA, DHCP, IPV6, IP Sec, Load Balancer, NAT, SSL VPN, L2 VPN, Firewall, Static Routing, BGP Routing, OSPF Routing are considered for charging based on these services are 'Enabled' or not. If services are enabled for specific day and base rate is applied for that service, then that particular service gets charged for that specific day. If the service is disabled on any day then base rate will not get applied.

IP Count: These are the unique IP counts available on the external network of the Org-VDC. Pricing can be performed based on the count of these IPs.

Edge Gateway Sizes: Tenant app understands the size of the edge gateway (Compact, Large, Extra Large and Quad Large) and differential price can be assigned based on the edge size.

Guest OS Rate

Guest OS for a specific VM can be charged to apply based on licensing costs. The Guest OS name should be mentioned as displayed in the VCD for specific VM.

In future, Guest OS name will be a dropdown in tenant app policy creation for the admin to select from the available list.

Cloud Director Availability

Cloud Director availability services can be priced on the basis of replication objects that are created in a Cloud Director availability solution.

Replication objects occupy certain amount of storage and have special qualities dependent on SLA profile that they belong to.

E.g. If the storage policies created in Cloud Director are Gold, Silver and Bronze tiers, a differential price of 4$, 3$ and 2$ per GB per month can be applied based on storage tiers. These prices for the replication objects will be the same depending on the storage profile the belong to.

Replication objects are also charged on the basis of the SLA profiles that they belong to. SLA profile defines attributes of these replication objects such as how frequently is the backup taking place, how many back-ups are preserved etc. Based on these SLA profiles, you can add additional costs on top of it.

E.g. If it is a 'High frequency' SLA profile, then you may want to charge an additional $100 per month for the given replication object.

These repliction objects will now be visible in the bill with their corresponding charges.

VCenter Tag Rate

If a VM is tagged with specific key (tag category) and value (tag value) in vCenter then this key-value can be specified to charge a VM or bunch of VMs differentially. Any VM having the specific tag will get this charge applied based on charge period.

vCenter tag based charges that are added can be individually saved or obtained based on a setting 'meteringTagDetailedMetricsEnabled'. When this setting is enabled, you can see each of the charges added here in this vCenter tag based section as an individual metric in vROps and hence in Tenant app as well.

How to use the config file

In EACH NODE within the vROps cluster should be performed the following steps:

1. Connect the vROps node via SSH.

2. Open and add/edit appropriate configuration in "*$ALIVE_BASE/user/conf/analytics/advanced.properties*" file.

3. Restart the analytics service via "*service vmware-vcops restart analytics*" command.

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A flag to enable/disable the publishing particular tag specific prices as metrics on VMs

Config name	meteringTagDetailedMetricsEnabled
Default value	false
Possible values	true/false
Example	*meteringTagDetailedMetricsEnabled=true*

These can be used when you want to apply additional charge for the applications running on the VM

E.g. – You want to charge additional $10 if there is an SQL server installed (across all VMs). In this case you can set a tag like "SQL Server = True" for these VMs in vCenter. Then, in Tenant App's Pricing Policy, add a tag "SQL Server" with the value "True" and a rate of "$10" per month. This would apply an additional charge of $10 per month for all the VMs with the tag "SQL Server = True"

Alternate Pricing Policy: Within vCenter Tag rate, there is an ability to configure 'Alternate Pricing Policy', that allows the user to configure an additional charge for each vCPU that may have value added services enabled.

E.g. – For all VMs that have SQL server, you want to charge a different rate per vCPU per month. Say, a VM is charged at $1 per vcpu per month and you want to charge the SQL enabled VMs at $2 per vcpu per month. Here, you can create an alternate pricing policy like 'SQL Server pricing policy' that charges $2 per vCPU and $2 per GB RAM. In Tenant App Pricing Policy, you can apply a condition that if 'SQL Server' tag = 'True' then the Alternate pricing policy should be 'SQL server pricing policy'

VCD Metadata Rate
Very similar to VM Tags (as defined in the vCenter), admin can make use of VCD specific tags which are known as VCD Metadata. Objects with which specific metadata is associated will get the charge based on pricing attached to it in VCD metadata rate section of pricing policy.

These can be used when you want to apply additional charge for the applications running on the VM

Metadata based charges that are added can be individually saved or obtained based on a setting 'meteringTagDetailedMetricsEnabled'. When this setting is enabled, you can see each of the charges added here in this metadata based section as an individual metric in vROps and hence in Tenant app as well. <x ref to section above>

E.g. – You want to charge additional $10 if there is an SQL server installed (across all VMs). In this case you can use a VCD metadata like "SQL Server = True" for these VMs in VCD. Then, in Tenant App pricing policy, add the metadata tag "SQL Server" with the value "True" and a rate of "$10" per month. This would apply an additional charge of $10 per month for all the VMs with the tag "SQL Server = True"

Alternate Pricing Policy: Within VCD Metadata, there is an ability to configure 'Alternate Pricing Policy', that allows the user to configure an additional charge for each vCPU that may have value added services enabled.

E.g. – For all VMs that have SQL server, you want to charge a different rate per vCPU per month. Say, a VM is charged at $1 per vcpu per month and you want to charge the SQL enabled VMs at $2 per vcpu per month. Here, you can create an alternate pricing policy like 'SQL Server pricing policy' that charges $2 per vCPU and $2 per GB RAM. In Tenant App Pricing Policy, you can apply a condition that if 'SQL Server' tag = 'True' then the Alternate pricing policy should be 'SQL server pricing policy'

Note: This mechanism can effectively be used when charging for FLEX Org-VDCs

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One Time Fixed Cost

One time fixed cost is a charge levied by the Service Providers for the events (service or resource provisioning) that happen at a point in time (not regularly or periodically).

E.g. The charge of a new VM creation can be added as a 'one time fixed cost'.

Or, the Service Provider may address a support ticket that can be charged additionally, every time there's a ticket that is addressed. This can also be configured with tags i.e. whenever you address a service request, you can add the tag (or VCD metadata)'SR addressed', the value 'true' on the VM. In Tenant App, if you have configured the Pricing Policy to add a 'one time fixed cost' when 'SR Addressed' = 'True' and one time fixed cost = '$50', then the VM will get an additional 'one time fixed cost' of '$50' in the bill. This one time fixed cost will be added every time the VM gets a tag 'SR Addressed' = 'True'

Note: In the above example, if the Service Provider intends to add 'SR Addressed' = 'True' cost every time an SR is addressed, then the recommended way is to set the tag 'SR addressed =True', leave it for a period of time (e.g. 2 hours) and then remove the tag.

Rate Factors
Rate factors are used to either bump up or discount the prices either against individual resources consumed by the Virtual Machines, or whole charges against the Virtual Machine.

E.g. 1. Discount overall charge on VM by 50% (Rate Factor 0.5) for all VMs tagged with Promo=True. So, if the cost of VM as per the base rate is $100 then after applying the Rate Factor for promotional VMs (or Promo = True), it'll be $50

E.g. 2. Increase Storage rate by 100% (Rate Factor 2) for all VMs backed up by Avamar with tag 'Avamar_Backed_Up = True'. In this case, the storage cost of VM as per the base rate is $100, then after applying the mentioned tag, it'll become $200.

Additional Fixed Cost
This section is used to add any other costs that are to be applied at Org-VDC level. This can be used for charges such as overall tax, overall discounts etc. These can be applied to selective Org-VDCs based on Org-VDC metadata

E.g.

1. In the above screenshot, any Org-VDC with the above Pricing Policy enabled will be charged with $50 as an additional fixed cost per month
2. Additionally, if the Org-VDC is tagged with the metadata 'Snapshots Enabled = True' will be charged $10 per day
3. Also, if the Org-VDC has the 'Installation Charge = True' tag enabled, then an additional charge of $100 will be applied as a one-time fixed cost.

Reports and Bills

Once these rates are set using the billing policy, they can be applied to organization VDCs in two different ways.

1. You can assign a pricing policy to an organization VDC once, and vROps starts automatically calculating price metrics for the given Org-VDC and its resources using the assigned pricing policy. Subsequently, either customized reports can be created in vROps containing usage and price metrics, or prebuilt reports can be accessed from Tenant App. The advantage of setting

up reports is that they can be scheduled and exported to formats such as PDF and CSV. You can also generate reports for the tenants to view directly at their end and send an email notification when reports become available.

2. You can generate an On-Demand Bill by selecting an organization VDC and a pricing policy. This calculates the prices of Org-VDC and associated resources as per the values of the Pricing Policy at that point in time and presents a Bill inside Tenant App. This bill can be also shared with tenants.

3. You can schedule bill generation, by selecting an Organization-VDC, a pricing policy and enable Schedule Bill setting. Then define the Recurrence (Monthly or Weekly), and detailed days of the billing period.

Note: This bill is typically used by the Service Providers via an API to read the details and feed to their own billing systems

Alerts

You can enable and select the type of alerts to be shared with the customer to view at their end. An email notification is also triggered to the tenants on the alerts enabled for them.

Differences between Tenant App and Chargeback Manager / Usage Meter

vRealize Operations Tenant App today does not present rollups of usage in units of MB.hours, but in terms of $ cost. This can be worked around by setting a cost of $1/MB.hr. vRealize Operations has all the individual data points, which can be accessed through the Tenant App APIs. A detailed description of the metrics used for the bill creation and API usage examples can be found in the Appendix.

However, the collection interval, collection methods and rollup methods of vRealize Operations differs from Chargeback Manager / Usage Meter.

Appendix

vROps metrics for Metering the Infrastructure

vROps and Tenant App Appliance together enable metering and charging of infrastructure offered by service providers to their consumers. vROps collects a series of metrics from vCenter with the help of vCenter adapter, and from Cloud Director with the help of Cloud Director management pack. These metrics are typically used by service providers that want raw metering metrics to feed into their own billing systems.

Context

vROps and Tenant App Appliance together enable metering and charging of infrastructure offered by service providers to their consumers. vROps collects a series of metrics from vCenter with the help of vCenter adapter, and from Cloud Director with the help of Cloud Director management pack. These metrics are typically used by service providers that want raw metering metrics to feed into their own billing systems.

Tenant App Appliance adds charging on top of these metrics wherein a rate card can be assigned against these collected metrics and Bills can be generated. These are used by service providers who want to perform billing in addition to metering the infrastructure using VMware solutions.

The third category of service providers consume the data from billing metrics but as a summary instead of using raw metrics using what is called $1 rate mechanism. For example, if a service provider wanted to know the number of vCPU hours used under an Org-VDC within a month, only when VMs were powered on, first category of service providers would depend on the raw data of used vCPU metric and power state metric to create this number. However, using $1 rate card mechanism, a service provider can configure $1/hour as the vCPU charge based on power state, and simply use the output dollars to mean the number of vCPU hours.

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Below we first describe general mechanisms to query a resource in vROps and obtain any metric on the resources. Next, the table describes typical metrics used by service providers for metering the infrastructure. These serve as definitive sources to the meaning of the metric and mechanism to obtain them for metering purposes.

Resource Query API - How to Query Objects in vROps (e.g.: VMs, Org-VDCs, Orgs)

Stats Query API - How to Query metrics on the Objects in vROps and Summarize them

SL NO	METRIC	ENTITY	BASED ON	DESCRIPTION	VROPS STATS KEY	METRIC OR PROPER TY	SOURCE VC OR VCD OR NSX	STATS QUERY API RESPONSE (TIMESTAMPS & DATA)	COMMENTS	SUMMARY PARAMETER
1	CPU	Virtual Machine	Reservation	CPU|Effective limit (MHz)	cpu|effective_limit	Metric	VC	5 mins Interval	The response contains 5 mins sample measured by averaging 20 sec samples collected directly from ESXi box. This is the minimum of allocated MHz, Reserved MHz at VM level, Reserved MHz at resource pool of VM. This is the actual CPU limit for the VM. It's minimum of VM configured CPU capacity and CPU limit.	Average (AVG)
			Allocation	Total Capacity (MHz)	cpu|vm_capacity_provisioned	Metric	VC	5 mins Interval	This represents the allocate no of CPU MHz for the VM measured at 5 mins interval. CPU MHz is derived based on the no of vCPUs allocated to the VM & the CPU speed of ESXi hosting the VM. Configured capacity in MHz based on nominal (static) frequency of the CPU.	
			Usage	CPU|Usage (MHz)	cpu|usagemhz	Metric	VC	5 mins Interval	The response contains 5 mins sample measured by averaging 20 sec samples collected directly from ESXi box . The amount of CPU resources descendant virtual machines would use if there were no CPU contention or CPU limit.	
2	vCPU	Virtual Machine	Usage	Configuration|Hardware|Number of CPUs (vCPUs)	config|hardware|num_Cpu	Metric	VC	5 mins Interval	This is configured the No of vCPU for the VM collected at 5 mins interval. It counts both the vSocket and vCore. A VM with 2 vSockets x 4 vCores each has 8 vCPU.	Average (AVG)
3	Memory	Virtual Machine	Reservation	Memory|Effective limit (KB)	mem|effective_limit	Metric	VC	5 mins Interval	The response contains 5 mins sample measured by averaging 20 sec samples collected directly from ESXi box. This is the minimum of allocated MB, Reserved MB at VM level, Reserved MB at resource pool of VM. This is the actual memory limit for the VM. It's minimum of VM configured memory capacity and memory limit.	Average (AVG)
			Allocation	Memory|Total	mem|guest_p	Metric	VC	5 mins Interval	This represents the allocate amount of memory for the VM (in KB) measured at 5 mins interval.	

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			Capacity (KB)	rovisio ned					
			Usage	Memory|C onsumed (KB)	mem|c onsum ed	Metric	VC	5 mins Interval	The response contains 5 mins sample measured by averaging 20 sec samples collected directly from ESXi box. Amount of memory utilized by the Virtual Machine. Reflects the guest OS memory required (for certain vSphere and VMTools versions) or Virtual Machine consumption.	
4	Stora ge	Virtua l Machi ne	Usage	Disk Space|Virt ual Machine used(GB)	disksp ace|us ed	Metric	VC	5 mins Interval	Used disk space by the VM as measured by the hypervisor (Not Guest OS). Space used by virtual machine files.	
			Allocati on	Configurat ion|Hardw are|Disk Space (GB)	config| hardw are|dis kSpace	Metric	VC	5 mins Interval	Configured disk space for the VM.	
			Allocati on Split by Storag e Profile	Storage Profiles:<S torage Profile Name>|us age	Storag e Profiles :<Stora ge Profile Name> |usage	Metric	VC D	10 mins Interval	Configured disk space per storage profile allocated to the VM.	Average (AVG)
5	CPU	Org VDC	Usage	CPU|Used (MHz)	cpu|us ed	Metric	VC D	5 mins Interval	This is the sum of no of vCPUs per VM in use with in this OVDC multiplied by 1000 MHz. For example, if an OVDC has 5 VMs of 2 vCPU each and only 3 of them are powered on at the point of collection, value of this metric at the OVDC level will be 3x2x1000 MHz.	Average (AVG)
			Allocati on	CPU|Alloc ation (MHz)	cpu|all ocatio n	Metric	VC D	5 mins Interval	Allocated CPU MHz to this OVDC in Cloud Director. For the PAYG OVDC is always 0.	Average (AVG)
			Reserv ation	CPU|Reser ved (MHz)	cpu|res erved	Metric	VC D	5 mins Interval	Reserved CPU MHz to this OVDC in Cloud Director. For the PAYG OVDC is always 0.	Average (AVG)
6	vCPU	Org VDC	Usage	VCPU|Use d	vcpu|u sed	Metric	VC D	5 mins Interval	This is the sum of no of vCPUs per VM in use with in this OVDC. For example, if an OVDC has 5 VMs of 2 vCPU each and only 3 of them are powered on at the point of collection, value of this metric at the OVDC level will be 3x2.	Average (AVG)
			Usage	Memory|U sed (MB)	memor y|used	Metric	VC D	5 mins Interval	This is the sum of amount of memory MB configured per VM in use with in this OVDC. For	Average (AVG)

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7	Memory	Org VDC							example, if an OVDC has 5 VMs of 2GB Memory each and only 3 of them are powered on at the point of collection, value of this metric at the OVDC level will be 3x2x1024 MB.	
			Allocation	Memory|Allocation (MB)	memory|allocation	Metric	VCD	5 mins Interval	Allocated memory MB to this OVDC in Cloud Director. For the PAYG OVDC is always 0.	Average (AVG)
			Reservation	Memory|Reserved (MB)	memory|reserved	Metric	VCD	5 mins Interval	Reserved memory MB to this OVDC in Cloud Director. For the PAYG OVDC is always 0.	Average (AVG)
8	Storage	Storage Profile	Usage	Storage|Used (MB)	storage|used	Metric	VCD	5 mins Interval	Under every ODVC one Storage profile object is created for every storage profile OVDC has access to. This metric represents storage used by the OVDC on this storage profile.	Average (AVG)
			Limit	Storage|Limit (MB)	storage|limit	Metric	VCD	5 mins Interval	It's just the storage Limit we collect, not at the profile level.	Average (AVG)
15	Count Of Networks	Org VDC	Usage	General|Number of Organization VDC Networks	others|Number of Organization VDC Networks	Metric	VCD	5 mins Interval	Total no of OVDC network configured on this OVDC.	
16	Media	Media	Storage	General|Storage (bytes)	General|storageB	Metric	VCD	5 mins Interval	Total Storage used by media file	Average (AVG)
17	vApp Template	vAPP Template	Storage	General|Storage (Kilobytes)	General|storageKB	Metric	VCD	5 mins Interval	Total Storage used by vApp Template	Average (AVG)
18	Enabled IPSec VPN Tunnel Count	Edge Gateway	Usage	Services:ipsec|Enabled	services:ipsec|enabled	Metric	VCD	5 mins Interval	Count of VPN Tunnels on edge device	
19	NAT Service	Edge Gateway	Usage	Services:nat|Enabled	services:nat|enabled	Metric	VCD	5 mins Interval	Boolean stating NAT enabled on edge device	

20	DHCP Service	Edge Gateway	Usage	Services:dhcp|Enabled	services:dhcp|enabled	Metric	VCD	5 mins Interval	Boolean stating DHCP is enabled on edge device	
21	FIREWALL Service	Edge Gateway	Usage	Services:firewall|Enabled	services:firewall|enabled	Metric	VCD	5 mins Interval	Boolean stating Firewall Service is enabled on edge device	
22	Load Balancer Service	Edge Gateway	Usage	Services:loadbalancer|Enabled	services:loadbalancer|enabled	Metric	VCD	5 mins Interval	Boolean stating Load balancer is enabled on edge device	
23	Static Routing Service	Edge Gateway	Usage	Services:staticRouting|Enabled	services:staticRouting|enabled	Metric	VCD	5 mins Interval	Boolean stating Static routing is enabled on edge device	
24	Gateway HA Enabled	Edge Gateway	Usage	Services:highavailability|Enabled	services:highavailability|enabled	Metric	VCD	5 mins Interval	Boolean stating Gateway is enabled on edge device	
25	Full Gateway Configuration	Edge Gateway	Usage							
26	External Network Transmit	Edge Gateway	Usage	Statistics|Uplink|Data OUT (bytes)	statistics|uplink|out	Metric	VCD	5 mins Interval	This represents the amount of outward traffic as measured on this edge device at a 5 mins interval	Sum (SUM)
27	External Network Receive	Edge Gateway	Usage	Statistics|Uplink|Data IN (bytes)	statistics|uplink|in	Metric	VCD	5 mins Interval	This represents the amount of inward traffic as measured on this edge device at a 5 mins interval	Sum (SUM)

28	External Network Transmit Rate	Edge Gateway	Usage	Statistics|Uplink|Bandwidth OUT (MBps)	statistics|uplink|Bandwidth Out	Metric	VCD	5 mins Interval	This represents the speed of outward traffic as measured on this edge device at a 5 mins interval	Max/Percentile 95/Average
29	External Network Receive Rate	Edge Gateway	Usage	Statistics|Uplink|Bandwidth IN (MBps)	statistics|uplink|Bandwidth In	Metric	VCD	5 mins Interval	This represents the speed of inward traffic as measured on this edge device at a 5 mins interval	Max/Percentile 95/Average
30	Dynamic Routing OSPF	Edge Gateway	Usage	Services:ospfRouting|Enabled	services:ospfRouting|enabled	Metric	VCD	5 mins Interval	Boolean stating Dynamic routing OSPF is enabled on edge device	
31	Dynamic Routing BGP	Edge Gateway	Usage	Services:bgpRouting|Enabled	services:bgpRouting|enabled	Metric	VCD	5 mins Interval	Boolean stating Dynamic routing BGP is enabled on edge device	
32	L2 VPN	Edge Gateway	Usage	Services:l2vpn|Enabled	services:l2vpn|enabled	Metric	VCD	5 mins Interval	Boolean L2 VPN is enabled on edge device	
33	SSL VPN	Edge Gateway	Usage	Services:sslvpn|Enabled	services:sslvpn|enabled	Metric	VCD	5 mins Interval	Boolean stating SSL VPN is enabled on edge device	
34	Distributed Firewall	Edge Gateway	Usage						Boolean stating Distributed firewall is enabled on edge device	
35	Power Status	Virtual Machine		System|Powered ON	sys|poweredOn	Metric	VC	No of records based on Power State	Indicates 0 or 1 depending on power state of the VM	
36	Creation Date	Virtual		Configuration|Creation Date	config|createDate	Property	VC	Creation Date	VM creation date.	

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		Machine								
37	Uptime (Running)	Virtual Machine		Summary|Running	summary|running	Metric	VC	30 mins Interval	Indicates if the VM is powered on. The value is 1 if the VM is powered on and 0 otherwise.	
38	CPU	Organization	Usage	Aggregate|Organization VDC|CPU|Used (MHz)	Aggregate|VDC|cpu|used	Metric	VCD	5 mins Interval		
			Allocation	Aggregate|Organization VDC|CPU|Allocation (MHz)	Aggregate|VDC|cpu|allocation	Metric	VCD	5 mins Interval		
			Reservation	Aggregate|Organization VDC|CPU|Reserved (MHz)	Aggregate|VDC|cpu|reserved	Metric	VCD	5 mins Interval		
39	Memory	Organization	Usage	Aggregate|Organization VDC|Memory|Used (MB)	Aggregate|VDC|memory|used	Metric	VCD	5 mins Interval		
			Allocation	Aggregate|Organization VDC|Memory|Allocation (MB)	Aggregate|VDC|memory|allocation	Metric	VCD	5 mins Interval		
			Reservation	Aggregate|Organization VDC|Memory|Reserved (MB)	Aggregate|VDC|memory|reserved	Metric	VCD	5 mins Interval		
40	Storage		Usage	Aggregate|Organization	Aggregate|VDC|sto	Metric	VCD	5 mins Interval		

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		Organization		VDC|Storage|Used (MB)	rage|used					
			Allocation	Aggregate|Organization VDC|Storage|Allocation (MB)	Aggregate|VDC|storage|allocation	Metric	VCD	5 mins Interval		
			Limit	Aggregate|Organization VDC|Storage|Limit (MB)	Aggregate|VDC|storage|limit	Metric	VCD	5 mins Interval		
Metering Metrics (That can be used for Billing or $1 rate mechanism)										
41	Organization	Metering		Summary|Metering|Total Cost	summary|metering|value	Metric	VCD	24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval	
42	Org VDC	Metering		Summary|Metering|additional	summary|metering|additional	Metric	VCD	24 Hours Interval	Response contains the Additional price of the resource collected at 24 hours interval. Additional cost contains cost of TAGs, Custom properties, Guest OS, Network related items, metadatas, etc	
				Summary|Metering|cpu	summary|metering|cpu			24 Hours Interval	Response contains Price of CPU of the resource collected at 24 hours interval. This will be calculated based on the configurations(*Charge period, Charge based on and power state*) provided in the pricing policy. If vCPU is selected, then base rate will be calculated based on the count of the vCPU or if CPU is selected then base rate will be calculated based on the GHz(used/allocated) for the CPU	
				Summary|Metering|memory	summary|metering|memory			24 Hours Interval	Response contains the Price of memory of the resource collected at 24 hours interval. This will be calculated based on the configurations(*Charge period, Charge based on and power state*) provided in the pricing policy	
				Summary|Metering|partialPrice	summary|metering|partialPrice			24 Hours Interval	Response shows whether the calculated price is partial for the resource (TRUE or FALSE), collected at 24 hours interval Partial price is always TRUE in scope of VCD	

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				Summary|Metering|storage	summary|metering|storage			24 Hours Interval	Response contains the Price of storage of the resource collected at 24 hours interval. This will be calculated based on the configurations(*Charge period, Charge based on and power state*) provided in the pricing policy	
				Summary|Metering|Total Cost	summary|metering|value			24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval	
43	vApp	Metering		Summary|Metering|additional	summary|metering|additional	Metric	VCD	24 Hours Interval	Response contains the Additional price of the resource collected at 24 hours interval. Additional cost contains cost of TAGs, Custom properties, Guest OS, Network related items, metadatas, etc This cost/price will propagate to OVDC cost	
				Summary|Metering|cpu	summary|metering|cpu			24 Hours Interval	Response contains Price of CPU of the resource collected at 24 hours interval. This will be calculated based on the configurations(*Charge period, Charge based on and power state*) provided in the pricing policy. If vCPU is selected, then base rate will be calculated based on the count of the vCPU or if CPU is selected then base rate will be calculated based on the GHz(used/allocated) for the CPU This cost/price will propagate to OVDC cost	
				Summary|Metering|memory	summary|metering|memory			24 Hours Interval	Response contains the Price of memory of the resource collected at 24 hours interval. This will be calculated based on the configurations(*Charge period, Charge based on and power state*) provided in the pricing policy This cost/price will propagate to OVDC cost	
				Summary|Metering|partialPrice	summary|metering|partialPrice			24 Hours Interval	Response shows whether the calculated price is partial for the resource (TRUE or FALSE), collected at 24 hours interval Partial price is always TRUE in scope of VCD	
				Summary|Metering|storage	summary|metering|storage			24 Hours Interval	Response contains the Price of storage of the resource collected at 24 hours interval. This will be calculated based on the configurations (*Charge period, Charge based on and power state*) provided in the pricing policy This cost/price will propagate to OVDC cost only if "PROPAGATE_STORAGE_PROFILE_PRICE" is set to FALSE in vROps or Tenant App	

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				Summary|Metering|Total Cost	summary|metering|value			24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval This cost/price will propagate to OVDC cost	
44	VM	Metering		Summary|Metering|additional	summary|metering|additional	Metric	VCD	24 Hours Interval	Response contains the Additional price of the resource collected at 24 hours interval. Additional cost contains cost of TAGs, Custom properties, Guest OS, Network related items, metadatas, etc This cost/price will propagate to VAPP cost	
				Summary|Metering|cpu	summary|metering|cpu			24 Hours Interval	Response contains Price of CPU of the resource collected at 24 hours interval. This will be calculated based on the configurations (*Charge period, Charge based on and power state*) provided in the pricing policy. If vCPU is selected, then base rate will be calculated based on the count of the vCPU or if CPU is selected then base rate will be calculated based on the GHz (used/allocated) for the CPU This cost/price will propagate to VAPP cost	
				Summary|Metering|memory	summary|metering|memory			24 Hours Interval	Response contains the Price of memory of the resource collected at 24 hours interval. This will be calculated based on the configurations (*Charge period, Charge based on and power state*) provided in the pricing policy This cost/price will propagate to VAPP cost	
				Summary|Metering|partialPrice	summary|metering|partialPrice			24 Hours Interval	Response shows whether the calculated price is partial for the resource (TRUE or FALSE), collected at 24 hours interval Partial price is always TRUE in scope of VCD	
				Summary|Metering|storage	summary|metering|storage			24 Hours Interval	Response contains the Price of storage of the resource collected at 24 hours interval. This will be calculated based on the configurations (*Charge period, Charge based on and power state*) provided in the pricing policy This cost/price will propagate to VAPP cost only if "PROPAGATE_STORAGE_PROFILE_PRICE" is set to FALSE in vROps or Tenant App	
				Summary|Metering|Total Cost	summary|metering|value			24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval This cost/price will propagate to VAPP cost	

				Storageprofile|instance|usage	storageprofile/instance/usage	Metric	VCD	24 Hours Interval	configured storage of the VM hard disk under selected storage profile	
45	Edge Gateway	Metering		Summary|Metering|value	summary|metering|value	Metric	VCD	24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval This cost is derived from additional cost - summary|metering|additional This cost/price will propagate to OVDC cost	
46	Storage Policy	Metering		Summary|Metering|value	summary|metering|value	Metric	VCD	24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval This cost is derived from storage cost - summary|metering|storage This cost/price will propagate to OVDC cost only if "PROPAGATE_STORAGE_PROFILE_PRICE" is set to TRUE in vROps or Tenant App	
47	vApp Template	Metering		Summary|Metering|value	summary|metering|value	Metric	VCD	24 Hours Interval	Response contains the Total price of the resource (Sum of all price components) collected at 24 hours interval This cost is derived from storage cost - summary|metering|storage This cost/price will propagate to VAPP cost	
48	Cloud Director availability Actual Usage	Virtual Machine		StorageProfiles|actualusage	Storage_profiles|actualusage	metric	VCD	5 minutes	The sum of real hard disk usage of a VM per storage profile	
49	Cloud Director availability Limit (configured)	Virtual Machine		StorageProfiles|Configured	storage_profiles|usage	metric	VCD	5 minutes	The sum of configured hard disk storage of a VM per storage profile	

Advanced Network Metrics

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Advanced Network Metrics for NSXV

Edge Service	NSXV Object	Metric	VCD Management Pack Metric
HA	Edge Service Gateway	service|status	Services:HA|Enabled
DHCP	DHCPEdgeService	service|status	Services:DHCP|Enabled
IPV6	A property under NSX Manager > Network		Services:ipv6|is_enabled
IP Sec	IPSecEdgeService	service|status	Services:Ipsec|Enabled
LB	LoadBalancerEdgeService	service|status	Services:Load Balancer|Enabled
NAT	NATEdgeService	service|status	Services:NAT|Enabled
SSL VPN	SSLVPNEdgeService	service|status	Services:SSLVPN|Enabled
L2 VPN	L2VPNEdgeService	service|status	Services:L2VPN|Enabled
Firewall	FirewallEdgeService	status|service_status	Services:firewall|Enabled
Static Routing	RoutingEdgeService	service|status	Services:Routing|Enabled
BGP Routing	RoutingEdgeService	bgp|enabled	Services:BGP|Enabled
OSPF Routing	LogicalRouter,EdgeServicesGateway	ospf|enabled	Services:OSPF|Enabled

Note: The metrics are available via the NSX-V Management Pack as well as collected by VCD Management Pack. The pricing engine makes use of the metrics collected by VCD Management Pack

Advanced Network Metrics for NSXT

Edge Service	NSXT Object	Metric
Data IN	Edge Gateway	Statistics|Uplink|Data IN
Data IN	Edge Gateway	Statistics|Uplink|Data OUT
HA	Logical Router	Services Enabled|HA Status Per Transport Node|<Transport-NodeID>|HA Status
DHCP	Logical Router	Currently, metric isn't collected by MP
IPV6	Logical Router	Currently, metric isn't collected by MP
IP Sec	Logical Router	Services Enabled|IPSEC VPN Enabled
LB	Logical Router	Services Enabled|Load Balancer Enabled
NAT	Router Service(NAT Rules)	Summary|NAT Rule count
SSL VPN	Not Supported in NSXT	
L2 VPN	Logical Router	Services Enabled|L2VPN Enabled
Firewall	Logical Router	Services Enabled|Firewall Enabled

Static Routing	Router Service (Static Route)	Enabled by default
BGP Routing	Router Service(BGP Service)	Summary|Status
OSPF Routing	Not Supported in NSXT	

Note: The above metrics are collected by NSX-T Management Pack. Pricing is not supported on these metrics as of Tenant App 2.5

Advanced Network Metrics from Cloud Director

Edge Service	VCD Object	Metric
IP Count	vCloud Edge Gateway	Summary|IPCOUNT
Edge Gateway Size	vCloud Edge Gateway	Summary|Size

Configurations

Charge Period - Charge period can be Hourly/Daily/Monthly. Specified base rate will be applied based on the selected option

Charge Based on - Charge based on can be Usage/Reservation/Max from Usage and Reservation. Specified base rate will be applied based on the selected option

Charge Based on Power State - Power state can be Always/Only when powered on/Powered on at least once. Specified base rate will be applied based on the selected option

Tenant App - API usage

The Tenant App provides a REST API to access pricing policies, bills and other services. The API documentation can be found on *https://{{tenant-app}}/tenant-app-api/swagger-ui.html*.

It's also possible to access vROps API endpoints through the *https://{{tenant-app}}/suite-api* URL.

These are the steps to get metrics for individual objects:

- Get an Authorization Token
- Get the identifier of the object using the Resources query API
- Get the metrics using the Stats query API

Get an Authorization Token

POST Request: https://{{

tenant-app}}/ suite-api/api/auth/token/acquire

Request Body:
```
{
  "username" : "{{user}}",
  "authSource" : "local",
  "password" : "{{pass}}"
}
```

Request Response:

```
{
    "token": "5d318488-fed1-4581-914d-ae51a110fe22::fdf29e35-91d6-467b-a976-000e2452f34c",
    "validity": 1588317978927,
    "expiresAt": "Friday, May 1, 2020 7:26:18 AM UTC",
    "roles": []
}
```

The token value can then be used in the following calls:

Resources query API

GET Request: *https://{{tenant-app}}/suite-api/api/resources*

possible request parameters:

- **adapterKind** - vCloud, VMWARE
- **resourceKind** - none, ORG, ORG_VDC, VAPP, VirtualMachine, PRO_VDC
- **name** - "Name of the Entity" (like match)
- **adapterInstanceId** - "ID of Adapter Instances"
- **parentId** - "ID of direct parent"

Examples: To get VMs with name containing (vAPP_91_VM1)

https://{{tenant-app}}/suite-api/api/resources?adapterKind=VMWARE&resourceKind=VirtualMachine&parentId=1b71001a-a643-4a35-bb85- ade906891f72&name=vAPP_91_VM1

RequestHeader:
Authorization: vRealizeOpsToken 5d318488-fed1-4581-914d-ae51a110fe22::fdf29e35-91d6-467b-a976-000e2452f34c
Accept: application/json

Sample Response: (find the highlighted text for Resource ID)

GET RESOURCE RESPONSE
```
{
    "pageInfo": {
        "totalCount": 1,
        "page": 0,
        "pageSize": 1000
    },
    "links": [
        {
            "href": "/suite-api/api/resources?adapterKind=VMWARE&amp;resourceKind=VirtualMachine&amp;parentId=1b71001a-a643-4a35-bb85-ade906891f72&amp;name=vAPP_91_VM1&amp;page=0&amp;pageSize=1000",
            "rel": "SELF",
            "name": "current"
        },
        {
            "href": "/suite-api/api/resources?adapterKind=VMWARE&amp;resourceKind=VirtualMachine&amp;parentId=1b71001a-a643-4a35-bb85-ade906891f72&amp;name=vAPP_91_VM1&amp;page=0&amp;pageSize=1000",
            "rel": "RELATED",
            "name": "first"
```

```
        },
        {
            "href": "/suite-api/api/resources?adapterKind=VMWARE&amp;resourceKind=VirtualMachine&amp;parentId=1b71001a-a643-4a35-
bb85-ade906891f72&amp;name=vAPP_91_VM1&amp;page=0&amp;pageSize=1000",
            "rel": "RELATED",
            "name": "last"
        }
    ],
    "resourceList": [
        {
            "creationTime": 1575881661389,
            "resourceKey": {
                "name": "vAPP_91_VM1",
                "adapterKindKey": "VMWARE",
                "resourceKindKey": "VirtualMachine",
                "resourceIdentifiers": [
                    {
                        "identifierType": {
                            "name": "VMEntityInstanceUUID",
                            "dataType": "STRING",
                            "isPartOfUniqueness": false
                        },
                        "value": ""
                    },
                    {
                        "identifierType": {
                            "name": "VMEntityName",
                            "dataType": "STRING",
                            "isPartOfUniqueness": false
                        },
                        "value": "vAPP_91_VM1"
                    },
                    {
                        "identifierType": {
                            "name": "VMEntityObjectID",
                            "dataType": "STRING",
                            "isPartOfUniqueness": true
                        },
                        "value": "vm-72"
                    },
                    {
                        "identifierType": {
                            "name": "VMEntityVCID",
                            "dataType": "STRING",
                            "isPartOfUniqueness": true
                        },
```

```
            "value": "b92a41a0-ef91-4dd9-8420-ff96fa52db1d"
        },
        {
            "identifierType": {
                "name": "VMServiceMonitoringEnabled",
                "dataType": "STRING",
                "isPartOfUniqueness": false
            },
            "value": ""
        }
    ]
},
"resourceStatusStates": [
    {
        "adapterInstanceId": "b285d5d8-2747-44c6-957b-40be595a6e9f",
        "resourceStatus": "DATA_RECEIVING",
        "resourceState": "STARTED",
        "statusMessage": ""
    },
    {
        "adapterInstanceId": "152b29ff-9e10-4447-b06c-781f47527f1e",
        "resourceStatus": "DATA_RECEIVING",
        "resourceState": "STARTED",
        "statusMessage": ""
    }
],
"resourceHealth": "GREEN",
"resourceHealthValue": 100.0,
"dtEnabled": true,
"badges": [
    {
        "type": "TIME_REMAINING",
        "color": "GREEN",
        "score": 366.0
    },
    {
        "type": "CAPACITY_REMAINING",
        "color": "GREEN",
        "score": 100.0
    },
    {
        "type": "EFFICIENCY",
        "color": "GREEN",
        "score": 100.0
    },
    {
```

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```
            "type": "RISK",
            "color": "GREEN",
            "score": 0.0
        },
        {
            "type": "HEALTH",
            "color": "GREEN",
            "score": 100.0
        },
        {
            "type": "WORKLOAD",
            "color": "GREEN",
            "score": 0.0
        },
        {
            "type": "COMPLIANCE",
            "color": "GREY",
            "score": -1.0
        }
    ],
    "relatedResources": [],
    "links": [
        {
            "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3",
            "rel": "SELF",
            "name": "linkToSelf"
        },
        {
            "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3/relationships",
            "rel": "RELATED",
            "name": "relationsOfResource"
        },
        {
            "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3/properties",
            "rel": "RELATED",
            "name": "propertiesOfResource"
        },
        {
            "href": "/suite-api/api/alerts?resourceId=3b4c649a-5bed-42eb-8da3-931d5c9971f3",
            "rel": "RELATED",
            "name": "alertsOfResource"
        },
        {
            "href": "/suite-api/api/symptoms?resourceId=3b4c649a-5bed-42eb-8da3-931d5c9971f3",
            "rel": "RELATED",
            "name": "symptomsOfResource"
```

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```
            },
            {
                "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3/statkeys",
                "rel": "RELATED",
                "name": "statKeysOfResource"
            },
            {
                "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3/stats/latest",
                "rel": "RELATED",
                "name": "latestStatsOfResource"
            },
            {
                "href": "/suite-api/api/resources/3b4c649a-5bed-42eb-8da3-931d5c9971f3/properties",
                "rel": "RELATED",
                "name": "latestPropertiesOfResource"
            },
            {
                "href": "/suite-api/api/credentials/",
                "rel": "RELATED",
                "name": "credentialsOfResource"
            }
        ],
        "identifier": "3b4c649a-5bed-42eb-8da3-931d5c9971f3"
    }
  ]
}
```

You can use this resource id (value of "**identifier**" from the above response) to get the metrics.

Stats Query API

Sample request to get CPU metrics

POST Request*: https://tenant-app/suite-api/api/resources/stats/query*

Payload

```
{
      "resourceId": ["3b4c649a-5bed-42eb-8da3-931d5c9971f3"],
      "statKey":["cpu|demandmhz"],
      "begin":1578227562000,
      "end":1578313962000,
      "metrics":true
}
```

vmware®

To get the rolled-up metric values "rollUpType" parameter has to be added in the payload to get rolled up metric:

Payload with rollUpType

```
{
      "resourceId": ["3b4c649a-5bed-42eb-8da3-931d5c9971f3"],
      "statKey":["cpu|demandmhz"],
      "begin":1578227562000,
      "end":1578313962000,
      "metrics":true,
      "rollUpType": "SUM" //possible values - SUM,AVG, MIN, MAX, NONE, LATEST, COUNT
}
```

Suite-api Response
| ```
{
   "values": [
      {
         "resourceId": "3b4c649a-5bed-42eb-8da3-931d5c9971f3",
         "stat-list": {
            "stat": [
               {
                  "timestamps": [
                     1578227790954,
…
}
``` |