WHITEPAPER
FOR
eNlight 360°

VERSION 8.9

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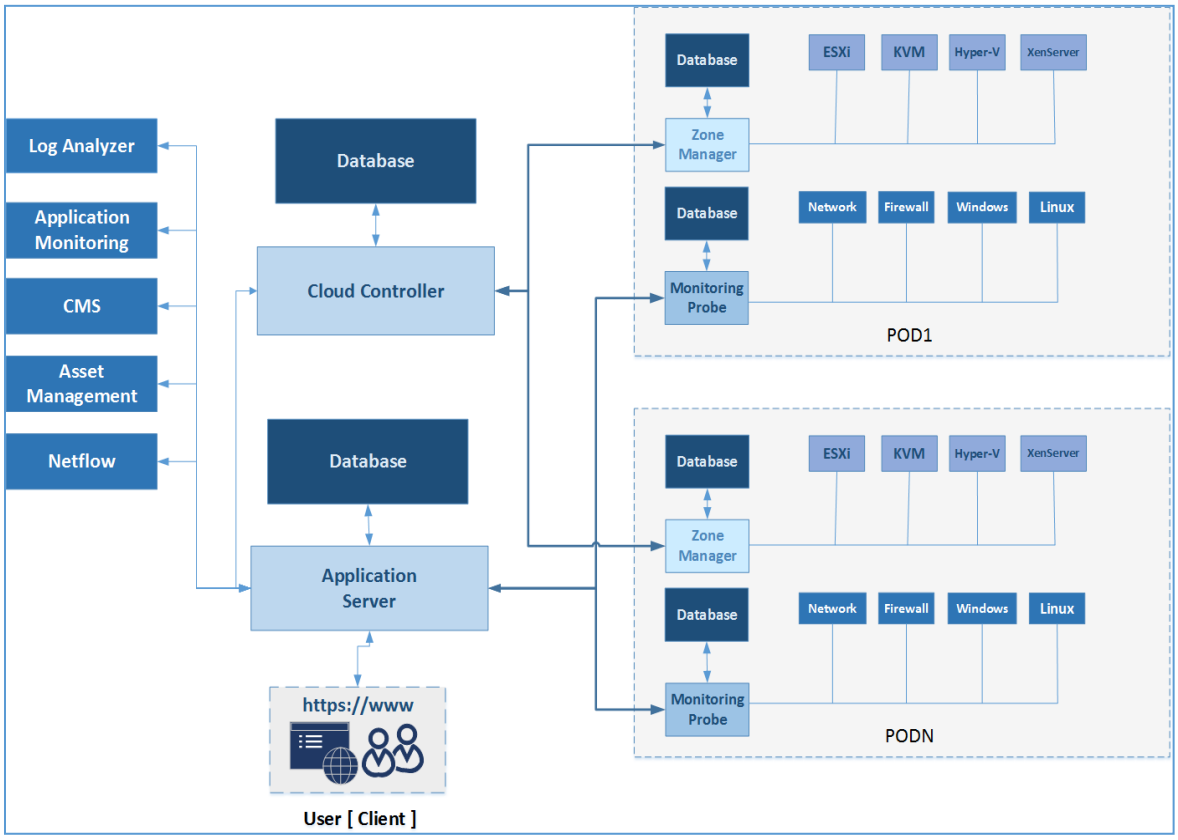
1 Introduction to eNlight Cloud Services

ESDS' eNlight 360° cloud solution comes with Hybrid Cloud Orchestration along with complete Datacentre Management Suite that makes it the unique offering in the market today. It is a next-generation technology that supports multiple hypervisor management and can be setup in a user's own premise, thus giving the customer security of a Private Cloud and scalability like a Public Cloud.

eNlight 360° interfaces with the underlying infrastructure through open source or vendor provided drivers thus making it universal in its application. This standardized abstraction helps prevent customers from being locked into a specific technology or tool, which saves time, money and effort for the customer. eNlight 360° provides additional services such as identity management, cloud orchestration and metering; all managed in the same programmatic manner through API. eNlight 360° is not anexclusive to a hypervisor, but it supports multiple hypervisors through an abstraction layer. The software supports popular commercial and open-source hypervisors including VMware and Xen. These hypervisors can be installed on x86 Architecture based Intel or AMD servers. It deals with three main streams – Orchestration, Monitoring, Inventory as well as logs and reports.

The main USP of this revolutionary product is that it gives a 360-degree cover to all the IT infra of the company and thus is deemed as the CIO's Veto Power. All applications can be monitored under one umbrella with a unified Interface, Single License and the only Skillsets, which is required to operate the system. You can literally manage everything about your private or hybrid Cloud on Premise through this Single Software. It's called a 360-degree product because it is a full-blown software suite packed with cloud orchestration and end-to- end management of every DC technology component in your it infrastructure including the Physical devices, virtual devices, storage, network, compute, connectivity, users, business work flows and much more. There is no need ofa second tool for managing or monitoring and IT ecosystem if eNlight 360° is deployed.

2 Global Infrastructure



3 Security and Compliances

eNlight 360° complies with highest security standards that all products and services in ESDS are subjected to, security being the top-most priority. The IT services that eNlight 360° provides to its customers are designed and managed in alignment with best security practices. The Hybrid Cloud Orchestration layer provides security-specific tools and features across network security, configuration management and access control. It has been designed keeping in mind the threats of today's online ecosystem. With eNlight360° you can be sure that your application, website and data are all protected against threats. Moreover, we assure that our customers' data is kept highly confidential and we are certified and competent to ensure total security against data theft and information leakages.

eNlight360° is compliant with ISO 9001, ISO 22301 ISO 20000/BS 15000, ISO 27001/BS 7799standards to ensure maximum security.eNlight360° stores data on enterprise storages having multiple security layers. These security layers are further strengthened by the best practices followed to store data, including isolation of storage from public network and secure provisioning of storage to negate sharing. Proper data isolation and logical storage segregation forms the basis of thesoftware's security promise. eNlight360° is based on hardware virtualization technology isolating cloud servers at the hypervisor layer for additional data security. This explicit virtualization of the physical resources leads to a clear separation between guest and hypervisor, resulting in additionalsecure separation between the two.

The software offers a comprehensive, centrally managed platform to help you simplify security operations. It provides Network virtualization techniques that separate different networks on the same hardware and therefore, partition resources accordingly. This ensures excellent isolation along with regulated network resource sharing within different users.

eNlight 360° environments are continuously audited, with certifications from accreditationbodies. The eNlight 360° infrastructure puts strong safeguards in place to help protect yourprivacy. All data is stored in highly secure ESDS data centers.

3.1 Hypervisor level

eNlight 360° can detect and prevent advanced attacks by offering real-time detection at the hypervisor layer. Leveraging the hypervisor to tap directly into raw memory hypervisor-levelsecurity solutions can secure workloads from outside the operating system. eNlight360°'s hypervisor- level security systems protects against malicious techniques and most importantly isolates the security virtual appliance from guest VMs that may be housing malware.

3.2 Network level

At the network layer in eNlight 360°, virtual networks, routers and other virtualized networking components are safeguarded eliminating all the risk factors. We ensure confidentiality and integrity of the client's data-in- transit apart from ensuring proper accesscontrol (authentication, authorization, and auditing) to all the resources that are used at ESDS. Preventive controls are taken in the form of network access control like firewalls and encryption of data with SSL and IPsec. eNlight 360° is also equipped with detective controlsincluding aggregation of security event logs (security incident and event management, or Log Analyzer), network- based intrusion detection system/intrusion prevention system.

3.3 Storage level

On the storage level, eNlight 360° follows a no compromise principal in confidentiality, integrity and availability. It involves various types or categories of controls, such as technical, procedural/administrative and physical. Also, servers that are responsible for storage in the eNlight 360° Cloud are fully isolatedfrom the public network; this reduces the threat of any attacks, because hackers can'taccess the private network on which the storage servers are hosted. Furthermore, ouremployees are limited to viewing the metadata of the client's files only and will not haveaccess to the contents of your eNlight 360° account. Regulated routing policies are alsoimplemented that specify the users who are allowed to access the cloud resources. eNlight 360° also utilizes a high security Tier III data center that is based around a corenetwork, which features no black holes or single points of failure. Multiple Tier IIIconnections are responsible for adding a level of redundancy to our core networkguaranteeing fast connection speeds for all customers.Hardware failure is totally prevented with the use of equipment from well- known brands such as Cisco and HP. The network utilizes Border Gateway Protocol v4 (BGP4) over dark fiber and long haul wavelengths, the switches used in the eNlight 360° Cloud are connectedto the core router via fiber.

The cloud provides security at all levels; these levels being the operating system of the hostmachine, the OS running on the VM and the firewall. The following is a list of compliances with which eNlight 360° conforms with:

1. MIETY empanelled Cloud Service Provider.
2. PCI DSS Certified.
3. Uptime Institute Certified – Tier III design.
4. STQC Audited.

4 System Features

Following are Features of eNlight 360°:

4.1 Storage level Multi Tenancy & Identify Management

Multi Tenancy refers to the architecture in which a single instance of software runs on a server and serves multiple tenants. A tenant is a group of users that share a common accesswith specific privileges to the software instance. eNlight 360° supports multi tenancy, whichis beneficial for all types of organizations or enterprises.

4.2 User Management

User Management allows users in creating various user, projects, groups, assigning roles and permission to them. The User Dashboard allows user to enable and disable the functionalities on Management dashboard, Main dashboard, Network devices, Servers and Network topology. Devices can be assigned to particular user or multiple users depending upon the requirement and the selected respective project which is assigned to user. Users can customize the specific data through this module. TOTP as a multi- factor authenticationhas been used to add an extra layer of security to the application, user is required to authenticate his identity in order to access it.

4.3 Dashboards

Dashboards provide a visual representation of real-time information. The newly integrated device dashboard provides a clear view of device details as well as real-time health and performance status. On the same page, the user may quickly perform all device-related operations. Currently, eNlight 360° offers a unified device dashboard with real-time monitoring and a holistic picture of the monitoring, allowing users to keep an eye on all of the device's attributes. A graphical dashboard which displays real-time graphs of all monitoring parameters makes easier for user to analyze it easily.

Along with the real time dashboards, eNlight 360° also provides the importance rating for the devices. This rating shows the criticality of the devices. It shows the importance of the devices based on which user can check the device priority as per rating.

4.4 Topology

eNlight360°'s topology monitoring monitors network and system devices and creates easy topological view from where all the devices can be mapped. This view gets refreshed everyfew seconds and gives the status of the devices and services to datacentre managers.

4.5 Auto Discovery

Auto-discovery of network devices through SNMP protocol is possible in eNlight 360°. If SNMP is enabled you can discover its hardware details, network details and its IP details. Once device is added to eNlight 360° bandwidth, service, health, process monitoring can beenabled on device.

4.6 Rack View

eNlight 360° Rack view function performs monitoring of entire IT infrastructure including application and services. The virtual layout of the datacenter can be seen in the rack view function. The location of the device can be easily traced out on the rack by viewing the rackview of datacenter.

The alerts can be easily seen and noticed as the color next to the devicein the rack changes. With this advanced feature, datacenter managers can perform suitablecapacity management.

4.7 Monitoring

DCM (Data Center Management) tools include a set of applications that help system and network administrators manage a datacenter's IT infrastructure in a manner to achieve higher application availability and performance delivery. eNlight 360° enables functions like adding devices with automated method of discovery, managing IT assets like hardware andsoftware, monitoring all resources of the devices like RAM, CPU, and Disk. NIC bandwidth which measures bandwidth of any physical port of any device present, disk, capacity management, generating various alerts based on thresholds as well as troubleshooting system, network, database and even application. In addition, newly added feature of Nmap,monitors a single host as well as vast networks that encompasses hundreds of thousands ofdevices and multitudes of subnets. It monitors open ports in the system and sends out alerts accordingly if any changes occur in the system. In this, the basic monitoring parameters forthe devices are already enabled user need not to enable the monitoring parameters separately.

Project wise severity level heatmap: This feature gives user the representation of severity of levels of all the projects in project wise heatmap within the Management Dashboard. The projects wise heatmap will update dynamically according to the severity in the projects. The specific colors are used to show the severity level in the projects.

Multiple Server CPU graphs: This feature gives user the monitoring information about the vCPUs in the server. These graphs will display the core utilization of the vCPUs. This will help users to get insight about the utilization of CPU from time to time with the help of these graphs.

4.7.1 Time Sync Monitoring

A new parameter in eNlight 360° of health check monitoring is introduced viz Time sync monitoring which works on SNMP protocol. In this type of monitoring, systems check the time of the server and compares it with the time of the monitoring system. When the timedifference set in crosses the time sync threshold system generates alerts and notifies the user.

4.7.2 Multi Threshold option in Health check monitoring

eNlight 360° does the monitoring of all resources of the devices like RAM, CPU.. etc. For the various Health check parameters like RAM and CPU, the user can add a particular threshold.If the parameter's usage in the system crosses the set threshold, the user is notified. The thresholds are set according to severity viz Attention (low severity), Warning (medium severity) and Critical (high severity), and if none of the thresholds is crossed then the system is running normally.

4.8 Compute Host Discovery

Previously cloud POD dashboard for compute displayed only the master node and its information. The functionality Compute host discovery is introduced in eNlight 360° which helps the user in discovering the salve of master automatically using this functionality. Once master details are submitted, slaves will get added automatically without user intervention.

4.9 Asset Lifecycle Management

eNlight360° DCM helps to manage the inventory of a datacenter IT infrastructure. Both the software and hardware inventory can be monitored and tracked using the DCM. Managingthe inventory

through remote office is also possible under this software. An alert mechanism has also been orchestrated to notify datacenter managers whenever there is any change in the IT inventory.

Asset and Notification Transfer: eNlight 360° v8.9 introduces a powerful new feature that allows admin/super-admin to effortlessly transfer all their assets and associated notifications from one user to another. This feature simplifies the process of transitioning ownership and ensures a seamless transfer of responsibilities within the platform.

With this feature, users can initiate the transfer process by specifying the source user (User1) and the target user (User2). Once the transfer is initiated, all assets owned by User1 are seamlessly transferred to User2 and both users receive an email regarding the transfer. All associated notifications and alerts that were previously sent to User1 are automatically redirected to User2 after the ownership transfer. This ensures that User2 stays informed about any important updates or events related to the transferred assets, maintaining effective communication and uninterrupted workflow.

4.10 IP Management

With this function data center, managers can overlook the IPs configured on every device. Management of IPs configured on any physical ports is also an added property

4.11 URL Monitoring

ESDS' URL monitoring tool is a reliable and efficient solution for monitoring the uptime and performance of a website. It provides real-time notifications and comprehensive reports tokeep users informed of any issues, allowing them to promptly address and resolve them, ensuring the website's accessibility for all users at all times.

With this tool, Users can set up checks for specific URLs, and receive alerts if the URL becomes unavailable or if the response time exceeds a certain threshold. This can help identify and troubleshoot issues with website availability and performance.

Additionally, the URL Monitoring tool also provides detailed performance reports that can help users understand how their website is performing over time so that users can have peace of mind knowing that the website is up and running smoothly at all times.

URL monitoring tools can be used to track various metrics, such as:

1. **SSL/Domain**: This feature allows a user to keep a track of when their SSL certificatewill expire and sends notifications in advance of the specified number of days before the expiration date. By monitoring the expiration date of the SSL certificate, a user can ensure that their website remains secure and that their visitors can trust the authenticity of their website. It also monitors domain expiry dates to ensure the availability and accessibility of awebsite. If a domain expires, the website and any associated services such as emailmay become unavailable, potentially disrupting the business or organization using the website. Monitoring domain expiry also helps identify potential security risks, asexpired domains may be re-registered by third parties with malicious intent.
2. **URL Health**: It facilitates the assessment of the URL's performance using key metricssuch as DNS resolution time, page size, response time, connection time, SSL handshake time, and first-byte time. These metrics provide insight into various aspects of the website's performance, including how quickly the website loads, howlong it takes for the server to respond to requests, and how long it takes to establisha secure connection.

3. **Web Content**: This feature allows for regularly checking a website's content to ensure that it provides a good user experience and meets the desired standards. This includes tracking changes to the content, monitoring keywords, and detecting potential security threats. By performing regular web content monitoring, web administrators can ensure the stability and performance of their website, maintain good SEO practices, protect the organization's reputation, and quickly resolve any issues before they impact customers.

4.12 Basic IP firewall rules

Firewall rules define what kind of traffic is allowed or blocked. A Security Group is a collection of such firewall rules. Applying a Security Group to VM essentially configures setsthose firewall rules for that VM. As the user selects IP pool while creating VM or VIF similarly, user should also be able to select the security groups (web security group, database security group etc.) which is to be applied to the respective VM. While editing VIFuser can edit or apply these changes to security groups.

These groups define L4 security rules. Each of these security groups have particular set of predefined rules. Currently, we can allow; IPv4 & Ipv6 IP address and can be removed. Bulkping check option is also available for both types of IPs (IPv6 & IPV4).

4.13 Netflow

Netflow is a network protocol, which collects and monitors network data traffic that is generated by routers and switches. IT professionals use Netflow to analyze the networktraffic and volume to ascertain where the traffic is coming from, where it is leading, and what amount of traffic is being generated. It provides the ability to collect IP network trafficas it arrives into an interface or leaves an interface.

4.14 Product IPv6 Compatibility

eNlight360° is now compatible with IPV6 for these features:

1. Hardware Discovery
2. Software Discovery
3. Monitoring using SSH & SNMP protocols
4. IPSLA Monitoring

4.15 Log Analyzer

Log Collection: Universal Log Collection is a challenging requirement for enterprises who intend to deploy a Log Analyzer solution. eNlight360°'s Log Analyzer has the ability to accumulate logs from different sources (Windows systems, Unix/Linux systems, applications, databases, routers, switches and other devices) at a central location. The benefit of eNlight 360°'s unique Universal Log Collection feature is that it collects and analyzes all type of log data format from all types of sources. Meanwhile, using agents or not depends on the security policies that engaging enterprises follow.

Log Analysis: IT admins test log data displayed on dashboard for better understanding of user activity, network threats and event trends within a short span of time. Examining unprocessed log data and generating intelligence for IT security in actual time is the base of eNlight 360°'s log analyzer. The unprocessed log data is examined and applicable security data is represented in convenient charts, graphs and reports.

Event Correlation: Real-time Event Correlation is mainly about proactively handling threats. Correlation of events allows network admins advance network security by processing innumerable events concurrently to track peculiar events on the network. Correlation is based on log search, rules and alerts. In eNlight 360°, network policies are used to frame the correlation rules and alerts.

Log Forensics: eNlight 360°'s log analyzer solution can help you to conduct log forensic investigation by permitting them to go through a root cause analysis and then track down anetwork intruder or any event activity that has caused a network problem. The log forensicprocess is very user-friendly, allowing IT administrators to search through the unprocessedlog data easily. Log search queries once entered by the IT administrator instantly points outthe exact log entry that caused the security breach, finds the exact time of occurrence, reconstruct what happened and in what order.

4.16 Agent Based Monitoring

Agent Based Monitoring is a method, which is used to monitor devices. In ABM, EMSCA protocol is used send passive checks from external application (device) to monitoring sever and EMRPE protocol is used to execute defined set of commands to remote device. Basically used to monitor local resources like CPU, Memory, and Disk. EMSCA is popularly known as passive monitoring whereas EMRPE is known as Active Monitoring. Main purpose of EMSCA Protocol is to monitor devices when server is reachable from device but not vice-versa. AndEMRPE is used when device is reachable from Monitoring Server. In SDN enabled network,ABM is the only way of monitoring devices.

4.17 Application Monitoring

The main goal of monitoring is providing best experience to the end-users ever. Applications in eNlight 360° allows user to manage and access application hosts. The end objective of an application monitoring in any business is to guarantee that the supply of services to end users is continuous and quality of conveyed end user experience is incomparable. There are various types of applications available, viz Database, Web Server, Application Server & Mail Server.

Applications Monitoring offers numerous analytical capabilities to measure and track database utilization as well as database performance trends. Database mainly includes:

- MYSQL
- MSSQL
- Oracle
- SAP HANA
- Postgre SQL

Web Server- eNlight 360° has web server monitoring which assists user and helps them to monitor web server performance and availability. Currently Web server / Services includes:

- IIS
- Apache

Application Server- To ensure optimal performance of business applications, it is importantto employ application server monitoring tools that offers insights into the health and uptime of your applications. It mainly consists of:

- JBoss
- Active Directory

- Tomcat & HA Proxy

Mail Server- This feature enables the monitoring of response time and other important parameters of the server and notifies the user if it finds anything beyond the threshold limits. It also ensures availability and health through automated event escalation via email,SMS etc. Currently eNlight 360° has MS-Exchange application under Mail server monitoring.

4.18 Change Management System

Change Management System is not just a nice thing to have in the cloud, it is now extremely imperative. In eNlight 360° it is an important process used for ensuring that standardized procedures are practiced to reduce the number and impact of incidents and ultimately increase efficiency in handling all the 'changes' in order to control the IT infrastructure. Thesystems direct change requests to the most appropriate queue. Designated approvers can request additional information, reject, or approve changes. It allows an organization to establish a baseline from which it can plan, implement, and measure. It is used to demonstrate compliance and to measure improvement and to ensure that all changes are assessed, approved, implemented and reviewed in a controlled manner. The CMS is composed of the raising and recording of changes, assessing the impact, cost, benefit and risk of proposed changes, developing business justification and obtaining approval, managing and coordinating change implementation, monitoring and reporting onimplementation, reviewing and closing change requests.

The CAB is a team of committed professionals from several business areas who evaluate changes from the ticket initiation stage through the post-implementation stage, offering a variety of viewpoints, suggestions, and course corrections as necessary. User canselect CAB for reviewing and approving the change request initiated by him.

4.19 Multi Hypervisor Support

With multi hypervisor support eNlight 360° helps in managing all the resources and different hypervisors from a single screen or dashboard.

- Citrix Xenserver
- Microsoft Hyper-V
- VMware ESX
- Ubuntu KVM

4.20 Auto Scaling

Vertical scaling is a patented (US 9176788) (UK GB2493812) and unique feature of eNlight 360° Cloud orchestration software. eNlight 360° automatically scales virtual machine resources on the fly. The resources of a virtual machine are scaled between the minimum and maximum resources assigned to it in proportion to load over it. This is done by an intelligent algorithm that monitors its resources and scales them up or down accordingly. This helps in cutting down the cloud expenses while providing consistent performance to users. It makes eNlight 360° a cost effective and one of its kind Cloud Orchestration software.

4.21 VM Lifecycle Management

With eNlight 360°, you can actually manage many operations of VMs such as:

- ✓ Create VM and Download Image

- ✓ VM Snapshot
- ✓ Start | Stop | Restart | Delete VM
- ✓ Edit running VM; allows user to change the ownership but not the resources.
- ✓ Multiple count acceptable during VM creation; enables user in creating more thanone VM, during VM creation based on resource Quota.
- ✓ Clone VM count; user can set the count of cloned VMs based on resource Quotawith this new feature.
- ✓ Clone VM with SDN; user can clone VM on SDN based network.
- ✓ Create | Delete additional disk of VM
- ✓ Disk QoS in VM allows user to manage the storage also, user can select and change its class. Similarly, user can edit the existing class of Disk QoS. This feature is applicable to both running and halted VMs. There are 3 categories: Silver, Gold & Platinum and so on. For Cloud Administrators, an option is provided where the corresponding IO limit can be specified for each tier. E.g. Silver = 100 IOPS, Gold =500IOPS, Platinum = 1000 IOPS. Additionally Monitoring parameter of Disk IOPS monitoring is added which is currently available for VMware & XEN
- ✓ Newly added feature of automatic POD selection checks availability of resources and allocates POD accordingly depending upon the historical data from the selected DC.
- ✓ Create | Delete additional network interface of VM
- ✓ Import VMs from existing infrastructure
- ✓ The enhanced advance search option helps user in filtering the VM's according to group, status, compute, tools installed and tags.
- ✓ Export and download the list of VMs based on the filtered or non-filtered data in form of PDF or CSV.
- ✓ Backup list management
- ✓ The new feature of outdated tools & listing gives the information of the tools and software of the VM along with its version under the basic information.
- ✓ Creating firewall only on those computes, which has firewall tag.
- ✓ Cloud_init allows user to assign an IP address, SSH keys, and a password to the virtual machine created by eNlight 360°. User can also create VMs with pre- requisites by using the required recipes while creating the VM.
- ✓ While creating VM users can create VM by tagging specific LUN.
- ✓ Added separate columns for VM Snapshot. User can see the count of screenshot under this column.
- ✓ VM deletion date will be maintained in the recycle bin and this list will be downloadable by the users. This information will shown along with the deletion dates. This list can be downloaded with pdf or CSV format.
- ✓ In VM List users can modify the selection of columns these columns can be hidden as per the user selection.

4.22 Vlan Allocation

In eNlight 360° whenever user creates account and starts using services, before creating VM Vlan is automatically allocated to this new user from the available Vlans in the network.

4.23 Cloud Advisor

Cloud Advisor in eNlight 360° acts as a platform, which benefits the users by scanning and recommending the changes in their resources depending on their current usage. With this dashboard results, the user will get an idea of whether resizing the underutilized or overutilized resources is necessary or not. Cloud advisor also finds the compute instances, which are no longer in use and it recommends the user accordingly. User also has the abilityto make the

changes and perform all the activities, which are suggested by the advisor instantly and is able to schedule as well. For example, if the advisor has advised the user tocut down his VM's RAM by 2 GB, the user can perform this action on the same dashboard. However, here, the VM will first halt, and then the operation will be performed.

Another new functionality of Cloud Audit gives details of VMs, which are of users account, but these are displayed in admins account. Only admin has permission to move those VMsto the respective users accounts and bill it accordingly. Based on different parameters like group ID and Vlan of VM admin can find out in whose account VMs are currently present. Admin can see all VMS along with its client tags bill it accordingly.

4.24 Device Group Feature

The Device Group feature of eNlight 360° helps user to group devices based on logical criteria. A group can be based on some criteria or could be just a random collection of devices. In this user can group devices and perform various operations in bulk for the groupas a whole.

4.25 Tags

A new feature of tags is introduced in eNlight 360°.eNlight cloud tagging allows user to add metadata to resources like Compute and Storage, which enables user to define key values and associate them with the resources. These tags can be used to organize and list resources based on one's business requirements. Resources that can be tagged are VMs, templates, computes & storage. Resources can be searched based on these tags.

4.26 Remote Console Access

Using Remote console Access feature of eNlight 360° user will be able to get console for his remote machine from eNlight360° itself. User will be able to take SSH and RDP session usingthis. The best part of this feature is that admin will be able to provide console access of thedevice for any use without actually sharing the password.

4.27 Scheduling Management

Each action in the system is treated as a Job. And each such job can be scheduled to be executed in the future. This feature of eNlight 360° enables users to schedule a job or abatch of jobs to perform some coordinated task. Ever thought of automating your taskswhile you are asleep in your bed all night? With this feature, one can schedule andautomate any executable task in the cloud while not being physically or virtually present for the series. One cannot only automate one task, but a whole job sequence that affectsevery alternate task with eNlight 360°.

4.28 Access control & Workflow Management

With this feature user can define Access Control to permit or deny operation per group or per user. Workflow can be defined to escalate permission to group admins or system admins. VM ownership can also be defined to compartmentalize groups and users as per their grade.

4.29 IPAM

IPAM provides a centralized management approach to handle IP address assignment, tracking, and management for various network components, including SDN networks, routers, and floating IP addresses. By integrating with these components, IPAM ensures efficient utilization of IP addresses, reduces conflicts, and provides visibility and control over network resources.

SDN Networks: SDN allows for the centralized management and control of network infrastructure through software-based controllers. IPAM can integrate with SDN controllers to manage IP address allocation within the SDN environment. The IPAM system can communicate with the SDN controller to assign IP addresses to virtual machines or network functions within the SDN network. It ensures that IP addresses are properly allocated, tracked, and managed within the SDN infrastructure.

Routers: Routers play a crucial role in directing network traffic between different networks or subnets. IPAM systems can manage IP address allocation for routers by assigning specific IP addresses to their interfaces or interfaces connected to different networks. The IPAM solution keeps track of the allocated IP addresses for routers, ensuring efficient utilization and avoiding conflicts.

Floating IP Addresses: Floating IP addresses are typically associated with cloud environments and are used for load balancing or failover purposes. IPAM can manage floating IP addresses by assigning and tracking them within the cloud environment. The IPAM system can allocate floating IP addresses to virtual instances or resources dynamically based on the defined rules or requirements. It ensures that floating IP addresses are properly managed and utilized within the cloud infrastructure.

4.30 Quota Management

Quota management includes limiting resources according to defined policies and quotas are essentially operational limits. This prevents system capacities from being exhausted without notification. Quotas can be enforced on user level. System can generate policy non- conformance reports to show user or department capacity usage and over-utilization. Quota can be allocated per user or per group for Compute, Storage and Network independently.

4.31 Faas

Function as a service is a category that has been introduced in eNlight 360° which provides the user a platform and the ability to deploy a single function or a part of an application. FaaS simplifies deploying applications to the cloud. With serverless computing, users can install a piece of business logic, a “function,” on a cloud platform and the platform executesthe function on demand. End-users can access the functions added by the admins and superadmins.

4.32 Showback & Chargeback

This feature enables extracting resource utilization statistics in terms of monetary expenses allowing users to keep a track of their return on investments (ROI). Chargeback helps in generating invoices and bills, and charging them on department level as well as the user level.

4.33 Auto-Upgrade & Rollback

This feature enables users in upgrading their software to the latest version so that whenever there is update for software user can update it without help of administrator. Similarly, ifthe system is not compatible and lacks in resources it can roll back to its previous version.

4.34 Reports

eNlight 360° users can access elaborate reports to analyze the performance of every aspect

of the system and thus make informed decisions. These detailed reports can be accessed on deployed servers with the help of software installed on any of their devices. Monitoringof reports like resource usage viz average total usage of CPU & RAM of various devices of the users are generated, bandwidth details about which device is using what amount of bandwidth and other intricacies related to report creation can also be done with the help of eNlight 360°.

Scheduled reports: Using these feature users will also be able to leverage their resourcesby scheduling reports based on their needs and time, setting a frequency of receivingreports and related factors. One can also schedule reports on daily, weekly and monthly basis.

Customizable Reports: This feature enables user to choose various fields for the reports which will be easy to manage the virtual machines. With this customization ability the users can manage the columns in the report. These fields will be seen even after exporting them to CSV or pdf format.

4.35 SSL Certificate Alert

An SSL certificate is a digital certificate that authenticates a website's identity and enables

an encrypted connection. Whenever the SSL certificate is about to expire, the system will generate alert to user regarding this. Users have choice to set the time during which systemwill start sending the certificate expiration alert on users mail id. Validation for maximum SSL expiring days is up-to 90 days. If user has not enabled this alert by default system willconsider time of 15 days.

4.36 Bulk Alert Acknowledgement

With Bulk, acknowledgement user can acknowledge for more than one alerts at a time. With this user need not to acknowledge every single alert. The feature of bulk alertacknowledgement reduces the efforts in acknowledging every single alert.

Receive Email Alerts for New VMs: This feature will provide a collective information about the VM creation to the users as well as the project admin. This also gives added advantage to add other email ids which will would give this information to other users or stakeholders.

License Expiry Alert: This feature will gives information about the license expiry dates. Allowing user to take timely action. With this feature the user wiil receive the alerts and notifications about the expiry. The system automatically monitors the expiration of the licensing so that the user can continue using without any service interruption.

4.37 Alert Grouping Mechanism

Alerting is a functionality in which the system collects all the notification of a particular pattern and then couples it together to form a single alert. In eNlight 360° the alert groupingmechanism classifies alert of similar type into a single notification. This newly formed alertwill go to the user as a collation of multiple minor alerts. This especially helps during largeroutages when multiple systems face issues at once and enormous alerts firing starts simultaneously.

4.38 Notification

eNlight 360° also enables display of all notifications generated for the device and gives users the capability to set various kind of alert via email, SMS, messaging system, third party portals and more. All the alerts that have been generated and not read will be displayed onthe main dashboard in a separate section titled Unread Alerts/Notification. These alerts canbe enabled and disabled when system falls under the maintenance mode. This feature helpsfrom getting unwanted and false notifications. Along with these users can call back URL withthe headers provided. Whenever the system will trigger an email or a sms, the URL will alsobe hit. Due to this, whatever functionality is defined in the URL will be automatically executed.

4.39 VM Bulk Management

This feature gives admin user privileges to manage the bulk operations of the VM. The operations like start and stop on multiple VM added in the project. With this functionality the users can manage group of VM operations of start and stop in one click.

4.40 Cluster level Monitoring

This feature adds the monitoring capability of the Cluster level monitoring. With this feature user can have insights about the performance and health of the clusters. Administrators can easily manage the utilization of the entire cluster and also can manage monitoring on CPU, Memory and network details.

- **Real-time Monitoring**: Gain real-time insights into the cluster's performance with metrics and visualizations. Monitor total CPU and memory usage versus the utilized resources, both in absolute values and percentages.
- **Customizable Duration**: Specify the desired duration for monitoring, allowing you to focus on specific time periods or events.
- **Alert Configuration**: Set alerts for various parameters, such as CPU and memory usage. Customize threshold limits and provide an email address for notifications. An alert is generated if any metric exceeds its threshold, notifying the designated email address or selected notification method.
- **Alert Management**: Access the alert tab to view all generated alerts, enabling quick identification and resolution of critical events or system anomalies.

1. **Networks:** Obtain comprehensive information about the network of a specific cluster. Gain insights into network utilization and other network-related metrics.

2. **Storages:** Gain insights into storage utilization for the cluster. Monitor disk space usage, I/O performance, and storage health to ensure optimal storage management.

3. **Alerts:** The alerts tab consolidates all cluster-specific alerts and notifications. Easily review and manage alerts to promptly address any critical events or system anomalies.

4.41 Oauth and HTTPS Sharing

Implemented Oauth2 and HTTPS session sharing enhancing the security. This protocol helps to provide standardized authentication mechanism. User once logged in the portal will not be needed to have separate login credentials. This can manage user permission and roles ensuring a seamless and controlled user experience.

HTTPS Session sharing gives enhanced security and maintain integrity and confidentiality of shared sessions.

4.42 Helpdesk

The eNlight 360° system has been integrated with a Helpdesk function, which serves as a centralized channel for customers to report problems, request aid, or seek advice. By incorporating this feature, users can generate a support ticket and track the progress of their inquiries within the eNlight 360° platform. This integration aims to simplify the processof reporting issues and improve customer service by providing a robust platform forcustomers to seek assistance.

5 Conclusion

eNlight 360° delivers building blocks that users can bring together quickly to support virtually any workload. With this path-breaking software, users access a complete set of highly available services that are designed to work and composed to construct sophisticated scalable applications. Users can access high-performance compute, stable storage, complex network, manages applications, audit infrastructure, get uptime reports and much more. All this is available with eNlight 360° without paying an extra penny.

These facilities help enterprises move rapidly towards the Cloud First strategy, lower IT costs, and scale intelligently. eNlight360° is a trust-worthy product for large enterprises thatrealize a wide variability of workloads, including web and mobile applications, game development, data processing and warehousing, and many others.

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