Globberry

Globberry Boreas NFVI Manager

Are CSPs ready for the new telco cloud reality?

2020 saw an unprecedented shift in the telco industry, brought about not least by necessity. Cloudification of the telco industry and specifically of the network has moved from the realm of “emerging trends'” and “future possibilities” into the reality of everyday operations. Cooperation and investment by vendors, operators, and standardization bodies reached critical mass so that

a fast, agile, less complex and highly cost-efficient cloud-based service delivery environment is now in sight not only for a few visionaries but also for the mainstream market.

Bringing new services online in a matter of minutes through a self-service portal has long been a dream, and the ultimate endpoint for network evolution: however, it requires a different approach and architecture. Red Hat’s Chief Architect, Azhar Sayeed, defines telco cloud as “heavily virtualized, software-defined, highly resilient infrastructure, allowing telcos to add services more quickly and centrally manage their resources”. While adoption of telco cloud now appears inevitable, many operators will soon find themselves speculating as to whether existing operational tools, processes, and infrastructure will be able to be adjusted or repurposed to support such a technological leap forward.

This white paper describes how **Globberry Boreas NFVI Manager** enables operators to easily and successfully implement NFVI management for the new telco cloud environment.

Will multiple operational challenges for telco cloud implementation mean that another great idea will risk failing over execution?

In telco cloud, Software-Defined Networking (SDN), Network Function Virtualization (NFV), automation, and analytics enable rapid scaling of CSP infrastructures and the ability to deliver distributed resources wherever they are needed. However, making those use cases a reality requires operators to find a simple way to manage the telco cloud and make it sufficiently operational to unlock all the potential for improved cost-effectiveness.

When examining the majority of NFV infrastructure architecture diagrams, operational tools are barely noticeable: this reflects a frequent attitude of cloud architects, where operational tools are viewed as relatively insignificant in comparison with MANO, SDN controller, or VIM. This results in underestimating the required investment, complexity, and effort needed to offer adequate monitoring, support, and configuration management.

The failure to properly satisfy NOC needs by offering a unified operational framework is one of the frequent impediments to practical and successful telco cloud implementations. Simply adjusting existing tools for a new paradigm is rarely feasible.

In order to evolve to delivering full operational support for telco cloud, including, but not limited to, monitoring, service assurance and remediation, data center inventory, topology visualization, capacity management, and many more, operators must face several challenges:

- **End-to-end visibility** a unified view of many domains (such as VNFs, computes, IP fabric, storage, etc.) in a multi-vendor and multicloud environment is an ongoing technical problem not addressed by vendor solutions and domain specialists
- **Growing complexity** while traditional networks are already complex, the use of different workload management strategies and combination of legacy bare-metal, VMs, and containers from multiple vendors in a single environment adds a further layer of complexity to operational routines
- **Dynamic nature of the telco cloud** this is caused by the flexibility of workload management, causing demanding requirements for real-time information updates in operational support systems
- **Need for automation** this is becoming more apparent as CSPs can no longer rely on an operator-executed manual or semi-automated set of workflows due to the dynamic nature and complexity of the telco cloud environment

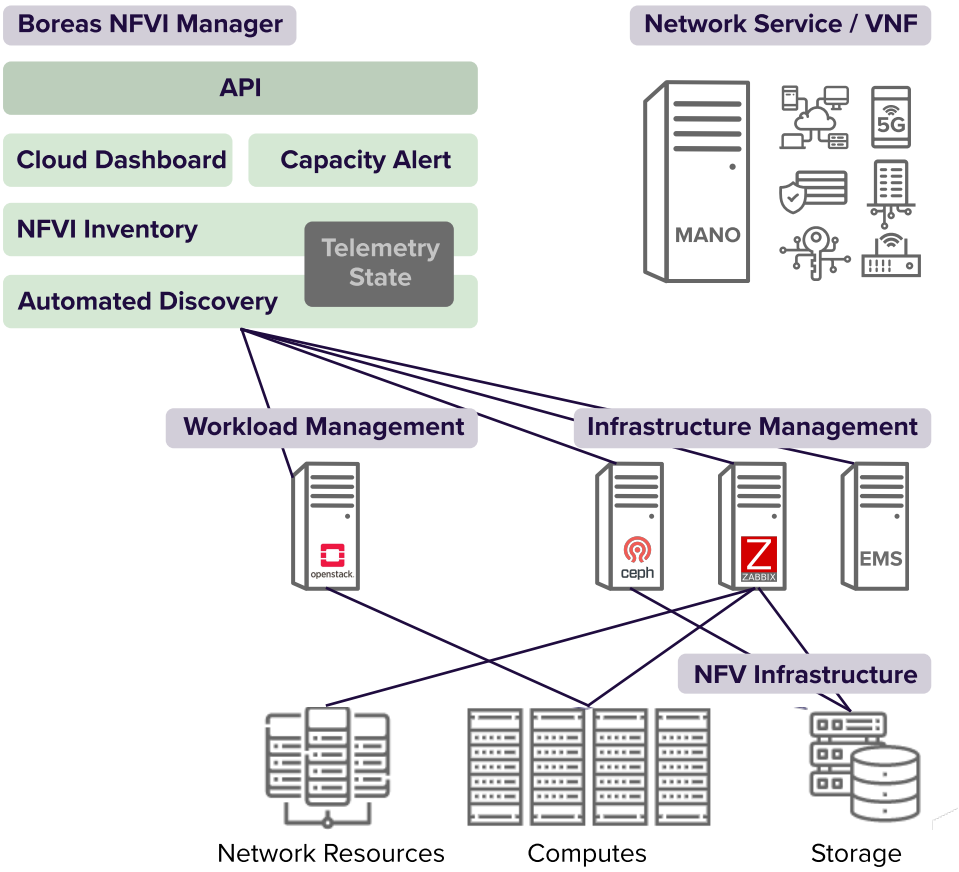
Globberry Boreas NFVI Manager helps avoid telco cloud operational hurdles

OpenStack has become the NFV infrastructure standard, and Boreas NFVI manager provides a lightweight solution for cloud dashboard, inventory, and capacity management for an OpenStack-based telco cloud. Boreas NFVI Manager enables end-to-end visibility, reducing complexity and enabling proactive and well-informed decision making by the NOC/SOC personnel and CSP senior management. The product is vendor-agnostic and provides a single pane of glass over multi-vendor and multicloud environments. Boreas NFVI Manager is:

- Specifically designed for telco cloud and OpenStack. It is not general-purpose inventory, therefore it requires less customization, and is easier to deploy and integrate into the telco cloud context
- Pre-integrated with the most popular products in the modern telco cloud tech stack, including OpenStack, MANO, Ceph and Zabbix
- A top to bottom view of the cloud, from VNFs to NFVI elements, with overarching coverage of NFVI components (computes, storage, and networks) across different domains and vendors

			Boreas NFVI Manager
4. **Improve**	E2E Visibility Informed Decision Making Cost Optimization	Cloud Dashboard	 Modern UI, widget based, configurable Enegineer and Executive perspectives
3. **Execute**	On-demand infrastructure Proactive Planning No dely in deployments	Capacity Analytics	 Closed-loop Capacity Management Workflow automation, alert and reporting
2. **Structure**	E2E coverage Single point of truth OSS Enabler	NFVI Inventory	 Datacenter Infrastructure IP Fabric, links, interfaces VNF Inventory
1. **Collect**	Real-time Always up-to-date Reliable	Automated Discovery	 OpenStack, MANO, Ceph EMS discovery Equipment discovery

Architecture Overview and Key Concepts



In order to achieve a unified view across multiple domains, the Boreas NFVI Manager integrates with different levels of telco cloud architecture:

- Key elements of physical NFVI infrastructure: compute, storage, and networking
- OpenStack and virtual machines
- Network Services and VNFs

Boreas NFVI Manager implements several key technical architectural concepts:

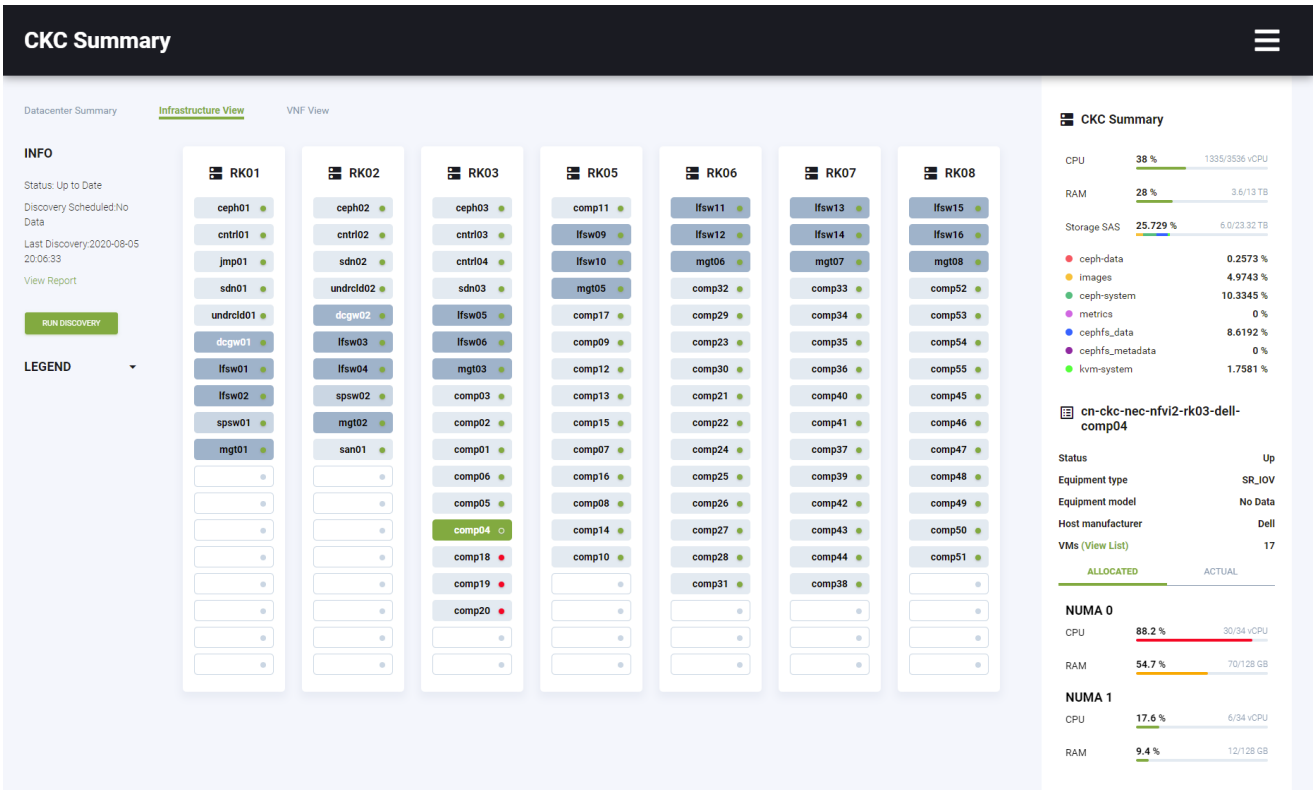
- **Cloud-native** application, based on the **microservice** architecture: the application supports both container and VM-based deployment and horizontal scaling
- Built according to the **'open source first'** principle to reduce OPEX associated with running applications, with no costly third party components requiring licensing
- **Diverse integration approach,** including generic integration layer with REST and GraphQL API, OpenStack adapter for distributed OpenStack deployment, and Apache NiFi and Minify as data flow management framework
- Apache Spark and Apache Druid are the **big data engines of choice** for telemetry processing

NFVI Manager Features

NFVI Inventory

NFV Infrastructure Inventory documents, visualizes, and manages compute, network, and storage components of infrastructure. The inventory provides a solid foundation upon which to build, providing a single point of truth for many operations support systems and functions. Boreas NFVI Manager information model follows the typical telco cloud architecture as described by ETSI standards and established industry practices (for example data center networks have standardized on the leaf-spine architecture). NFVI physical inventory provides a comprehensive data center view including:

- Racks, computes, and compute properties
- Network equipment and its properties and interfaces (DC gateways, leaf and spine switches)
- DC total and each node resource allocation and utilization details
- NUMA node level allocation and utilization
- Storage usage and consumption information

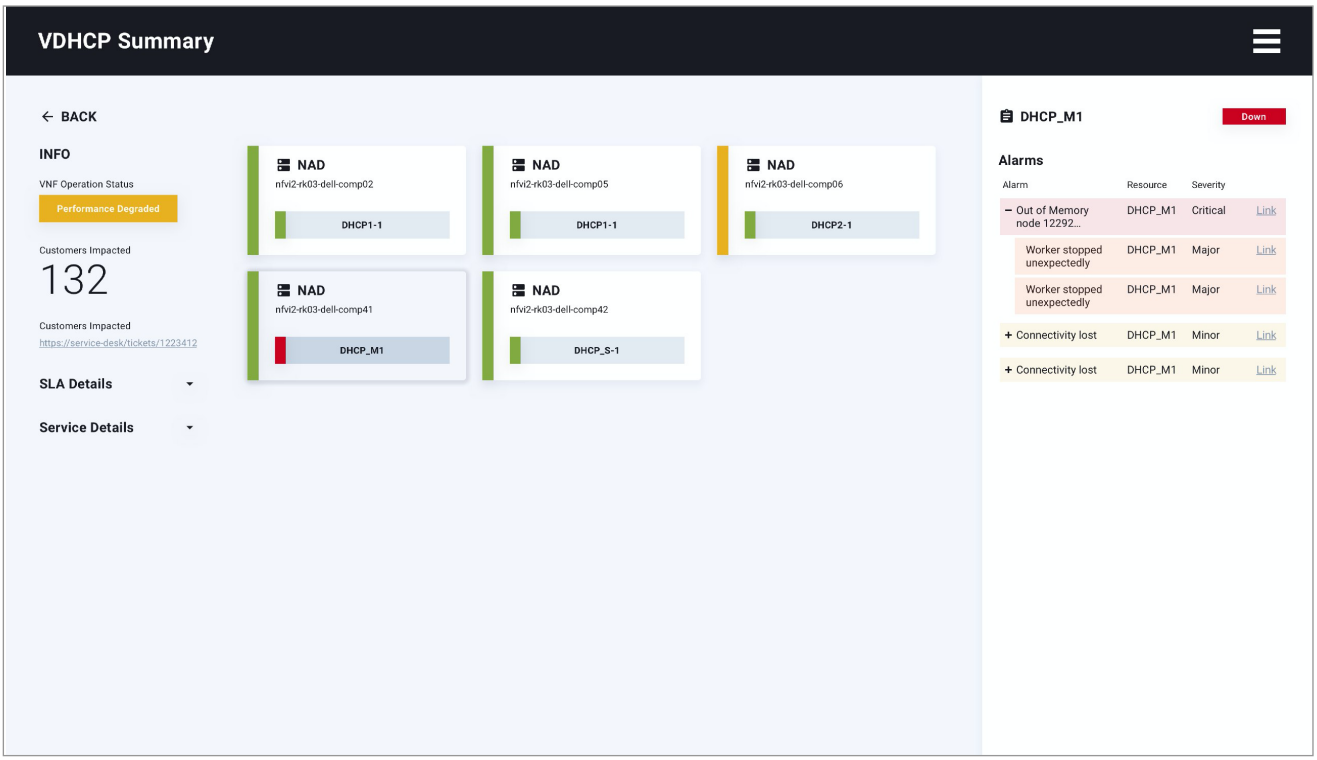


NFVI Logical Inventory helps NOC engineers to determine and understand complex and dynamic data center networking by mapping logical entities to the underlying physical equipment. Logical Inventory provides:

- Logical and physical interfaces for network equipment including their properties, configuration, traffic statistics, load telemetry, and history
- Uplink utilization summary
- Logical entities (EVPN, VLAN, VXLAN, etc.)

VNFI Inventory documents information about Network Services and VNFs deployed in the telco cloud. VNF Inventory helps engineers understand what VMs each VNF is composed of, how such VMs are distributed across multiple data centers, theresource profiles of VMs, and the real utilization of allocated resources.

One of the key requirements for a comprehensive NFVI inventory solution is top-to-bottom (VNF to NFVI) visibility of infrastructure resources allocation and actual consumption. This link is crucial for network and infrastructure planning, capacity management, assurance, usage accounting, and chargeback functions. Boreas NFVI maintains such relationships, providing visualization and drill-down capabilities from the Network Service/ Virtual Network Function through VMs down to specific computes and links and back up. Additionally, it is possible to manually map VMs to VNF in the event they were deployed manually bypassing the standard MANO-orchestrated deployment.

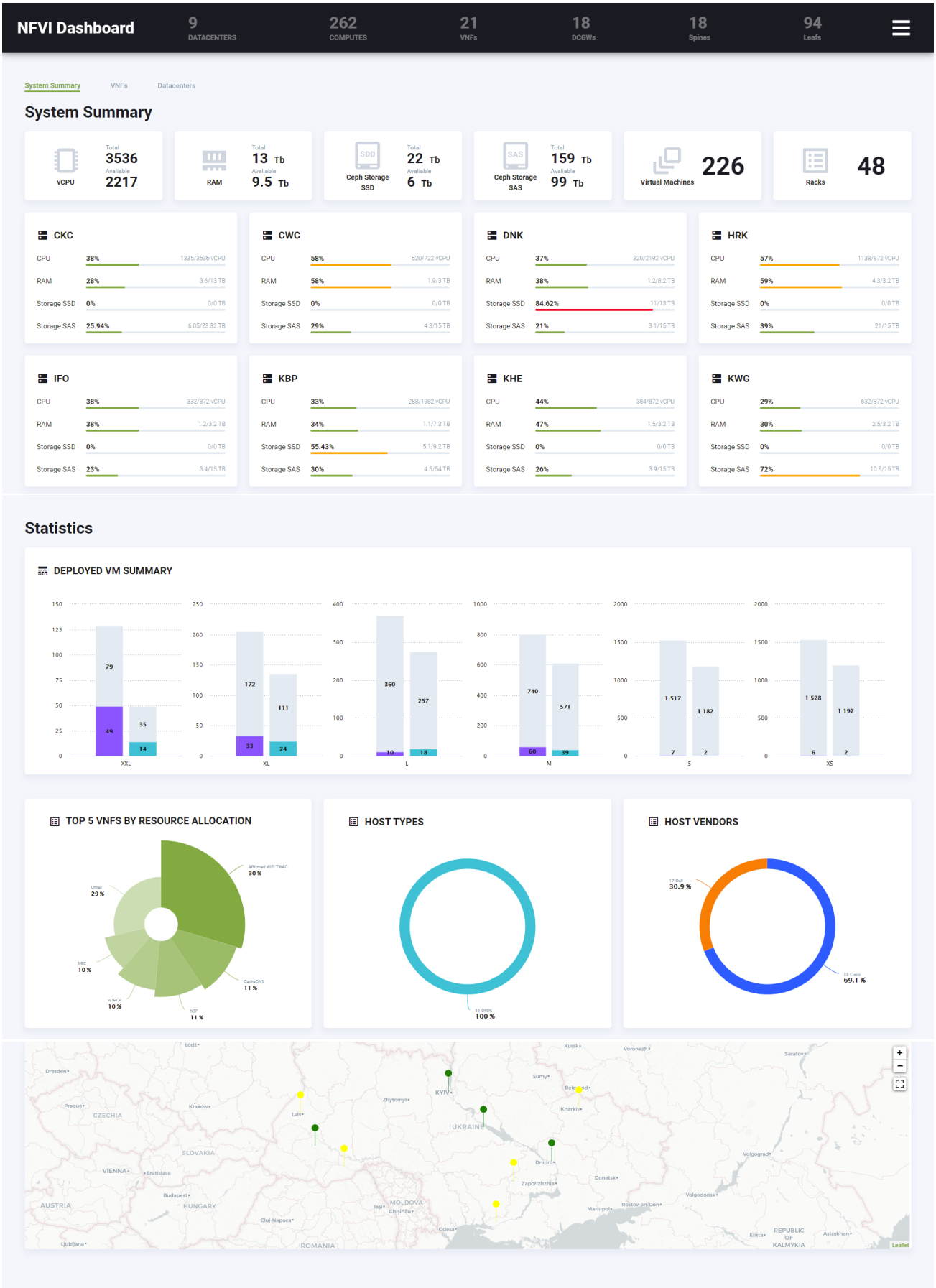


Automated Discovery collects and synchronizes inventory data from multiple sources such as MANO, OpenStack, and element managers, as well as directly from equipment, thus fulfilling key NFVI management requirements for data reliability and real-time availability. Automated discovery provides several tools for data collection such as scheduler, templates, data consistency validation, and data conflict resolution, in order to ensure that NFVI Inventory is 'the single point of truth' while minimizing the load on the monitored systems.

Cloud Dashboard

With the complexity of the environment and the variety of parameters to follow, building a balanced visual representation of the telco cloud requires detailed consideration. Either extreme of an airplane cockpit level complexity or an overly simplistic high-level summary should be avoided. Boreas NFVI Manager provides a **Cloud Dashboard** incorporating a solid foundation of UX research and multiple customer feedback iterations, providing both executive-level summaries with key metrics and breakdowns as well as more detailed views of VNFs and datacenters.

The dashboard contains a variety of customer-defined widgets with resource consumption, forecasting, different breakdowns (for example host aggregates, vendors, etc.), maps, alarms, and many more.

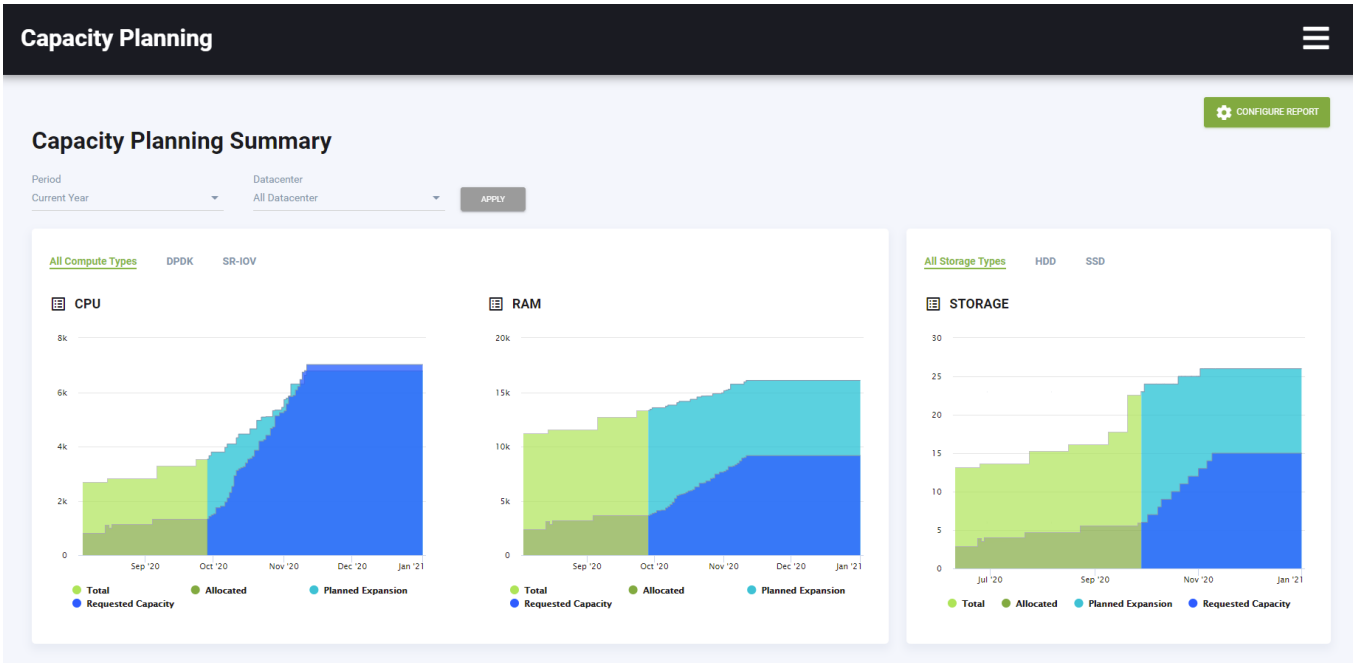

NFVI Dashboard
9 DATACENTERS
262 COMPUTES
21 VNFs
18 DCGWs
18 Spines
94 Leafs
System Summary
VNFs
Datacenters
System Summary
vCPU Total 3536 Available 2217
RAM Total 13 Tb Available 9.5 Tb
Ceph Storage SSD Total 22 Tb Available 6 Tb
Ceph Storage SAS Total 159 Tb Available 99 Tb
Virtual Machines 226
Racks 48
CKC
CPU 38% 1335/3536 vCPU
RAM 28% 3.6/13 TB
Storage SSD 0% 0/0 TB
Storage SAS 25.94% 6.05/23.32 TB
CWC
CPU 58% 520/722 vCPU
RAM 58% 1.9/3 TB
Storage SSD 0% 0/0 TB
Storage SAS 29% 4.3/15 TB
DNK
CPU 37% 320/2192 vCPU
RAM 38% 1.2/8.2 TB
Storage SSD 84.62% 11/13 TB
Storage SAS 21% 3.1/15 TB
HRK
CPU 57% 1138/872 vCPU
RAM 59% 4.3/3.2 TB
Storage SSD 0% 0/0 TB
Storage SAS 39% 21/15 TB
IFO
CPU 38% 332/872 vCPU
RAM 38% 1.2/3.2 TB
Storage SSD 0% 0/0 TB
Storage SAS 23% 3.4/15 TB
KBP
CPU 33% 288/1982 vCPU
RAM 34% 1.1/7.3 TB
Storage SSD 55.43% 5.1/9.2 TB
Storage SAS 30% 4.5/54 TB
KHE
CPU 44% 384/872 vCPU
RAM 47% 1.5/3.2 TB
Storage SSD 0% 0/0 TB
Storage SAS 26% 3.9/15 TB
KWG
CPU 29% 632/872 vCPU
RAM 30% 2.5/3.2 TB
Storage SSD 0% 0/0 TB
Storage SAS 72% 10.8/15 TB
Statistics
DEPLOYED VM SUMMARY
XXL 79 49 35 14
XL 172 33 111 24
L 360 10 257 18
M 740 60 571 39
S 1 517 7 1 182 2
XS 1 528 6 1 192 2
TOP 5 VNFS BY RESOURCE ALLOCATION
Other 29 %
30 %
10 %
11 %
10 %
11 %
HOST TYPES
100 %
HOST VENDORS
30.9 %
69.1 %
KYIV
UKRAINE
CZECHIA
SLOVAKIA
VIENNA
AUSTRIA
HUNGARY
MOLDOVA
ROMANIA
Leaflet

Capacity Analytics

The telco cloud domain presents additional challenges over and above those of capacity management for the data center, which is a relatively solved issue. Telco cloud capacity management is a more complicated task than just counting CPUs, RAM, and storage. For NFV infrastructure, capacity management is not only about providing necessary resources, but also about matching the right resources to specific VNF design requirements such as host aggregates, IOPS throughput, colocation or separation of components, etc. It is therefore crucial to have a closed loop capacity management process that includes and balances the VNF design, actual utilization, and infrastructure expansion planning.

The Capacity Analytics component of Boreas NFVI Manager leverages the inventory topology and resource utilization data gathered through automated discovery, workflows facilitating VNF planning, and equipment expansion, to enable proactive capacity management in a telco cloud environment. The key capabilities of the Capacity Analytics component are:

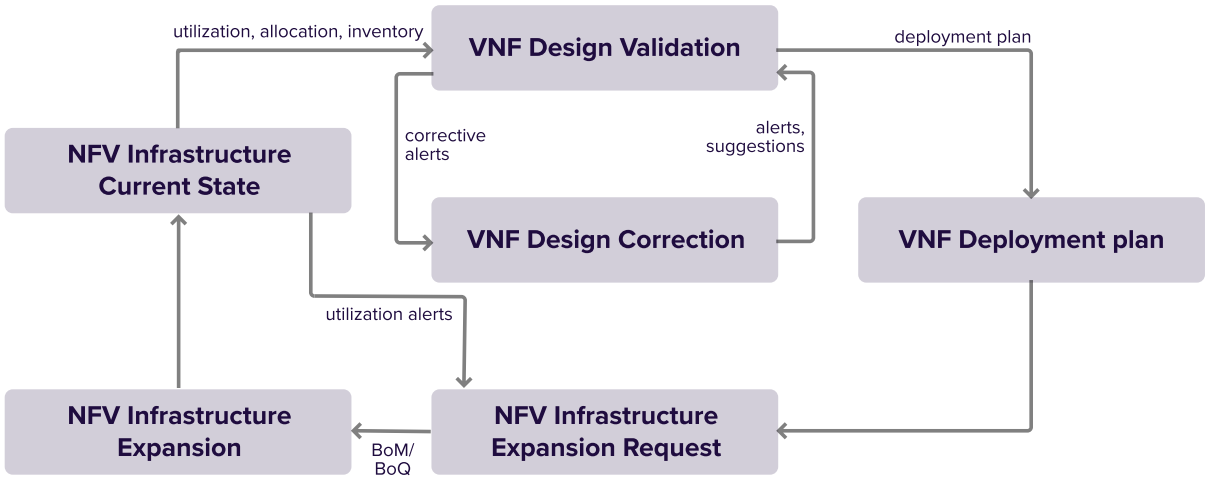
- Real-time capacity visualization
- Closed loop capacity management
- Automated and manual BoM/BoQ generation
- Configurable capacity alerts
- Scheduled and on-demand capacity reports



Real-Time Capacity Visualization

Capacity Analytics provides visualization tools for current, historical, and projected capacity utilization at all levels of resource inventory hierarchy. The capacity dashboard screens are composed of individually configurable widgets, designed to enable flexible customization of the look and feel of the dashboard to meet the needs of each customer. The capacity utilization data can be viewed in multiple ways, with breakdowns based upon data center, host aggregate, VNF, compute node, or NUMA node.

Closed Loop Capacity Management Capacity Analytics is designed to support a closed-loop capacity management process.



In addition to gathering and storing capacity utilization data obtained from the network, the Capacity Analytics component also allows users entering Capacity Requests to plan for future VNF onboarding and expansion. A Capacity Request is tied to the VNF planning workflow and represents the demand side of NFV Infrastructure. Capacity Requests are automatically evaluated against a set of business rules to check whether the NFV infrastructure is capable of supporting the requested onboarding or expansion activity. The following types of business rules are supported for a Capacity Request validation:

- Basic capacity (CPU, RAM, Storage)
- Host aggregate capacity
- NUMA node capacity
- Affinity Group: a requirement for a set of virtual machines to be deployed on the same physical host
- Anti-Affinity Group: a requirement for a set of virtual machines to be deployed on distinct physical hosts
- Dedicated Host: a requirement for a virtual machine to occupy all resources on a physical host
- Storage IOPS
- Network throughput

As a result of Capacity Request validation, the system may confirm the request, meaning that the requested capacity would be available on the requested date or, if validation of one or more business rules fails, alerts can be generated for the user to review and take one of the offered corrective actions.

Automated and Manual BoM/BoQ Generation
Expansion Request represents the supply side of NFVI capacity and can be generated automatically to meet existing demand. Depending on the configuration of capacity planning rules, an Expansion Request can be generated, containing the list and specifications of the equipment. The Expansion Request workflow facilitates the approval process as well as the BoM/BoQ generation.

Configurable Capacity Alerts
Capacity Analytics supports configurable alerts to notify the user of any projected NFVI resource deficits as well as pre-defined capacity utilization thresholds.

Scheduled and on-demand Capacity Reports
Boreas NFVI Manager includes reporting functions to provide management and operations teams with regular summaries of current and projected infrastructure capacity utilization. Reports can be generated on demand with user-configurable settings, or can be scheduled for periodic generation and distribution, as needed.

Integration Capabilities

Boreas NFVI Manager allows organizations to achieve the fastest possible time-to-market and reduce implementation effort by providing a set of integration adapters covering the de-facto NFVI Management stack:

- OpenStack adapter, based upon libvirt and nova API libraries, includes an agent installed next to the OpenStack director. This approach supports distributed OpenStack deployment, as well as circumventing blind spots in OpenStack Rest API
- Integration adapters, including MANO adapter, based on the ETSI RESTful TAM-MANO API specification, Ceph adapter and Zabbix adapter
- Custom integration: NFVI Manager supports generic API integration layers with RESTful and GraphQL API for third party integration scenarios

Conclusion

Boreas NFVI Manager is a specialized and powerful tool to manage NFV infrastructure, providing a proven, novel and agile approach to NFVI management. It combines rich functionality, a modern UI, and outstanding integration capabilities, resulting in quick and easy deployment and short time to market. NFVI Manager is used by end users and business stakeholders to streamline daily operational duties and improve business outcomes.

While transitioning to an era of telco cloud is not yet completely defined, Boreas NFVI Manager is a key tool tool to help CSPs evolve operational and management infrastructure to meet the new challenges the telco cloud service delivery environment presents.

About Globberry

Globberry is a telecom software vendor providing niche solutions for telecom service providers across the globe. We offer cutting edge solutions based on the latest technological advancements and our expertise in the telecommunication field including services in the domain of NFV/SDN. Our services include:

- **Consulting:** evaluation of existing solutions and target architecture of data integration and Governance stack definition
- **Implementation:** full cycle implementation from solution design to user acceptance testing, integration, and data migration services
- **Support:** operations and maintenance, 24/7 support, second-level, and product support

Please visit

https://globberry.com/nfvi-manager/

for more information about Globberry and Boreas NFVI Manager.

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