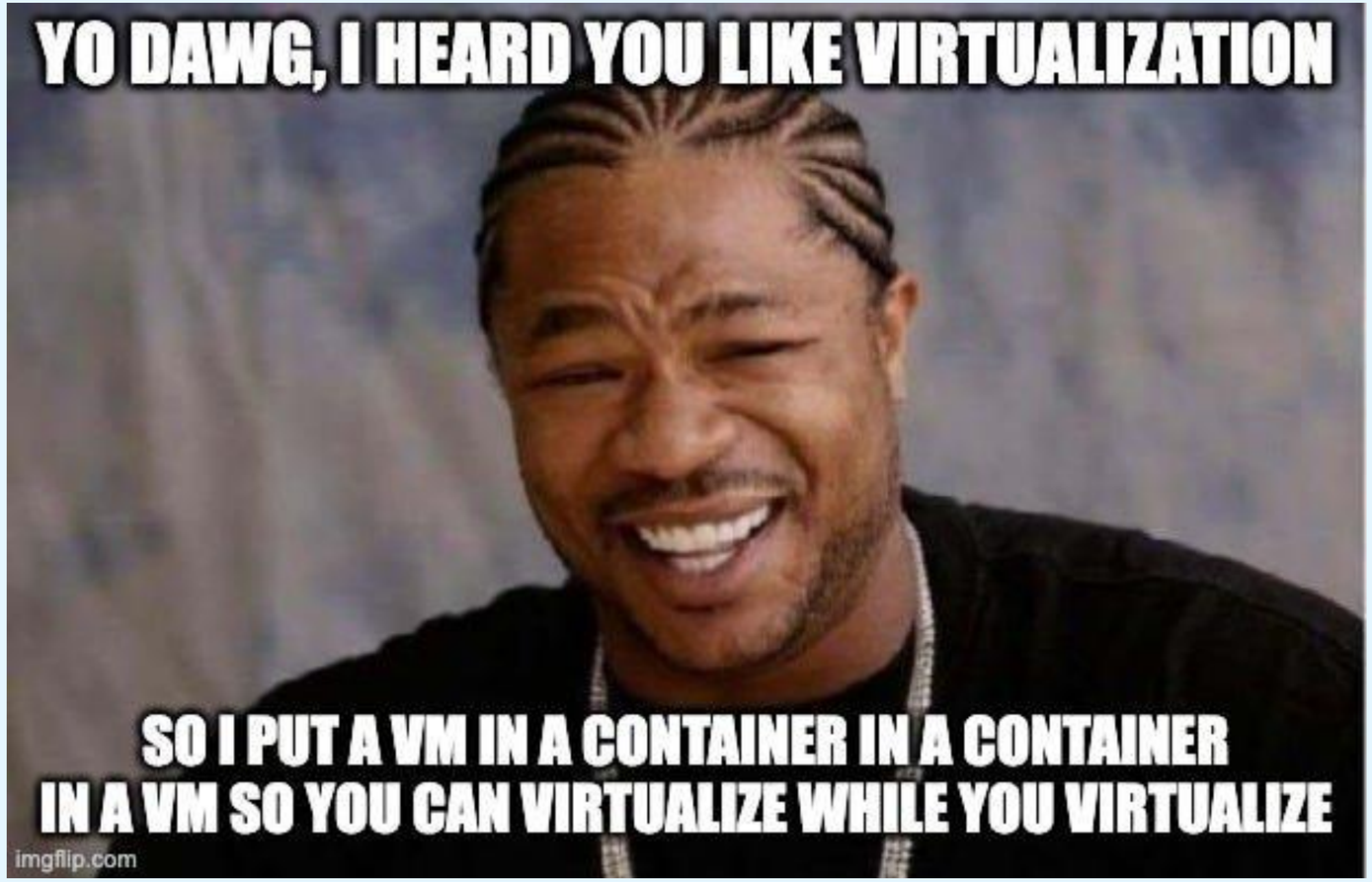
I heard you like Virtualization



ALL CHARACTERS AND
EVENTS IN THIS SHOW--
EVEN THOSE BASED ON REAL
PEOPLE--ARE ENTIRELY FICTIONAL.
ALL CELEBRITY VOICES ARE
IMPERSONATED.....POORLY. THE
FOLLOWING PROGRAM CONTAINS
COARSE LANGUAGE AND DUE TO
ITS CONTENT IT SHOULD NOT BE
VIEWED BY ANYONE

Who am I

Gergő Huszty

Kubernetes enjoyer since the early days.

Working at IBM Cloud, building the Virtualization story.



The cloud provider’s perspective

- Generic features, no snowflakes
- Backward compatibility
- Balance between stability and new features

```
$ k get no
NAME             STATUS   ROLES    AGE      VERSION
10.185.137.105   Ready    <none>   6y191d   v1.35.9+IKS
10.185.137.107   Ready    <none>   6y191d   v1.35.9+IKS
10.185.137.122   Ready    <none>   6y14d    v1.35.9+IKS
10.185.137.67    Ready    <none>   6y157d   v1.35.9+IKS
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$
```

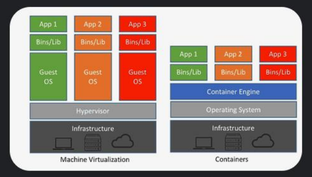
Red Hat OpenShift Virtualization Service on IBM Cloud

“In May 2026, IBM announced the Red Hat OpenShift Virtualization Service on IBM Cloud, a managed virtualization offering designed to run virtual machines on Red Hat OpenShift deployed on IBM Cloud infrastructure. The service is built on Red Hat OpenShift Virtualization technologies including KubeVirt and the KVM hypervisor, and is delivered as an IBM-managed service on IBM Cloud VPC bare metal servers.”

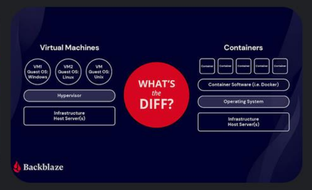
Wikipedia

Agenda

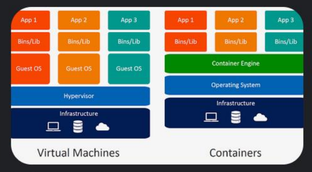
- WHY
- How
  - Compute
  - Storage
  - Network
  - Migration
  - Maintenance
  - Disaster recovery
  - Backup and restore



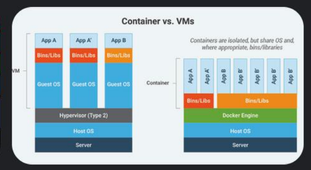
Containers vs. Virtual Machines (VMs)...
NetApp



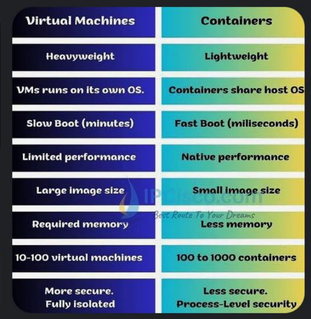
Docker Containers vs. VMs: A Look at...
Backblaze



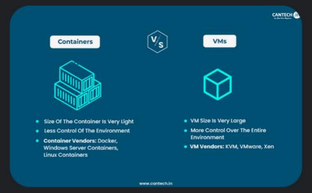
Virtual Machines (VMs) vs Containers:...
BMC Software



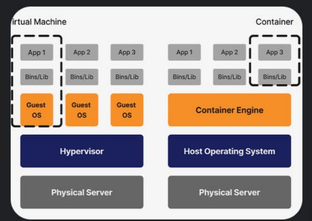
Containers vs VM & Virtual Machines |...
eG Innovations



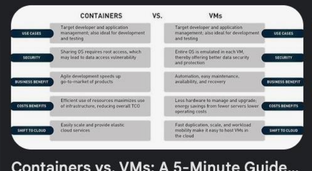
Container vs Virtual Machine · | VM...
IPCisco



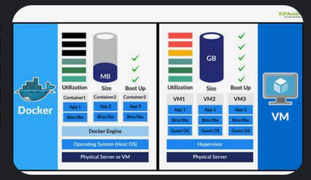
Containers vs VMs: Key Differences &...
Cantech



Containers vs VMs: A Practical Guide t...
Naviteq



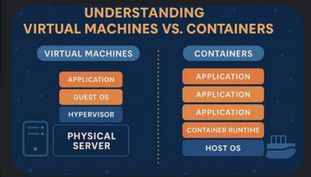
Containers vs. VMs: A 5-Minute Guide...
HPE Developer Portal



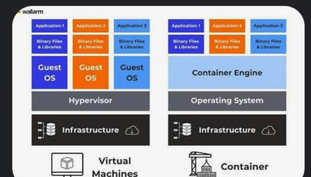
Containers vs Virtual Machines: Key...
K21 Academy



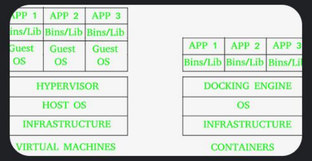
VMs vs. Containers: What's the...
Simform



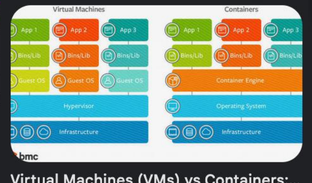
Understanding Virtual Machines vs....
DEV Community



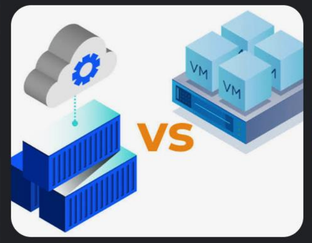
Containers vs. Virtual Machines - The...
Wallarm



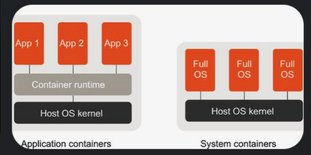
Difference between Virtual Machines...
GeeksforGeeks



Virtual Machines (VMs) vs Containers:...
BMC Software



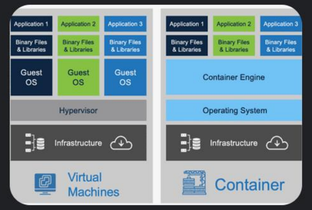
Containers vs VMs: A Practical Guide t...
Naviteq



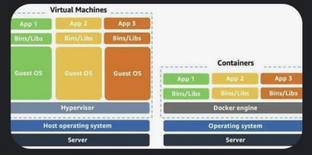
About containers and VMs - Incus...
Linux Containers



Containers vs. virtual machines |...
Microsoft Learn



What's the difference between VMs &...
AKF Partners



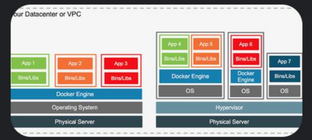
Containers vs. Virtual Machines:...
LinkedIn



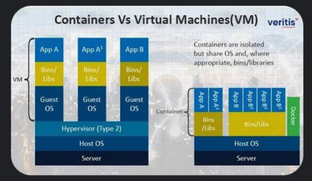
Containers vs Virtual Machines:...
AWS Builder Center



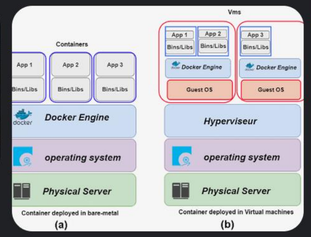
Containers vs virtual machines: Key...



Containers and VMs Together | Docker
Docker



Containers Vs VMs: Glance at 'Securit...
Veritis



Container Deployed in VMs VS...

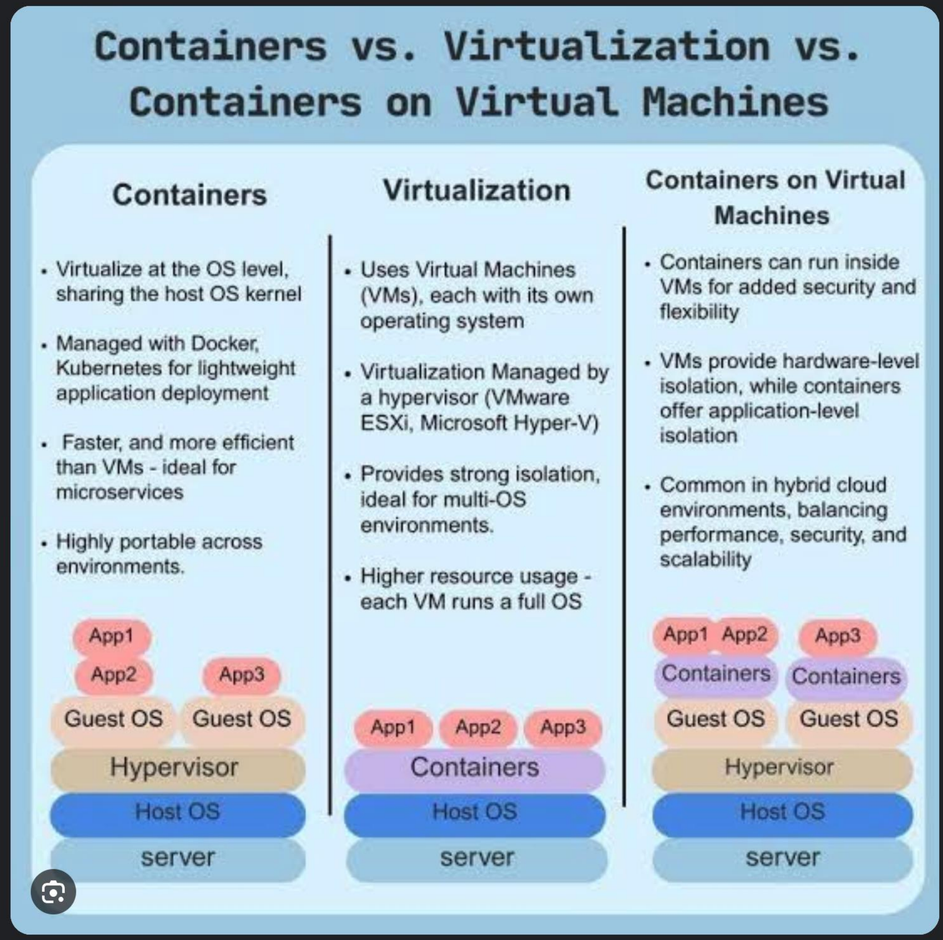


Kapcsolódó keresések



vm vs container diagram

Facebook



🚀 Containers vs. Virtualization vs. Their Hybrid Combination Choosing the right infrastructure approach is crucial for optimizing performance,...

Felkeresés ›

Megosztás | Mentés

Putting VMs into Containers.
Cool... but WHY?



Because

You get

- Orchestration
- Resource management
- Abstracted network
- Abstracted storage
- Extendible API
- RBAC

For free

VMware LLC is an American cloud computing and virtualization technology company headquartered in Palo Alto, California, U.S.[2] On November 22, 2023, Broadcom acquired VMware in a cash-and-stock transaction valued at $69 billion,[3] with the End-User Computing division of VMware then sold to KKR and rebranded to Omnissa. VMware was the first commercially successful company to virtualize the x86 architecture.[4]

VMware's desktop software runs on Microsoft Windows, Linux, and macOS. VMware ESXi, its enterprise software hypervisor, is an operating system[5] that runs on server hardware.[6]

History [edit]

Early history [edit]

Technical background [edit]

Virtualizing the x86 architecture was widely considered impractical in the late 1990s. Unlike the IBM System/370 mainframe architecture, which had supported virtualization since the 1960s, the x86 instruction set contained seventeen instructions that did not meet the Popek and Goldberg requirements for classical virtualization, behaving differently in privileged and unprivileged modes without generating traps that a virtual machine monitor could intercept.[7]

VMware's technical approach grew out of the Disco research project at Stanford University, led by Mendel Rosenblum, which had virtualized the MIPS architecture for large ccNUMA multiprocessors in the mid-1990s.[7] The founders' key insight was that x86 could be virtualized by combining direct execution of user-mode code with binary translation of kernel-mode code, dynamically rewriting problematic instructions at runtime.[7]

VMware LLC

vmware® by Broadcom



Entrance to campus headquarters, Palo Alto, California

Formerly	VMware, Inc. (1998–2023)
Type	Subsidiary
Traded as	NYSE: VMW (2007–2023)
Industry	Cloud computing Virtualization Computer software
Founded	February 10, 1998; 28 years ago Palo Alto, California, U.S.
Founders	Mendel Rosenblum Diane Greene Scott Devine Ellen Wang Edouard Bugnion
Headquarters	Stanford Research Park Palo Alto, California, U.S.
Key people	Raghu Raghuram (CEO)
Products	ESXi · Fusion · Horizon · Infrastructure · Player ·

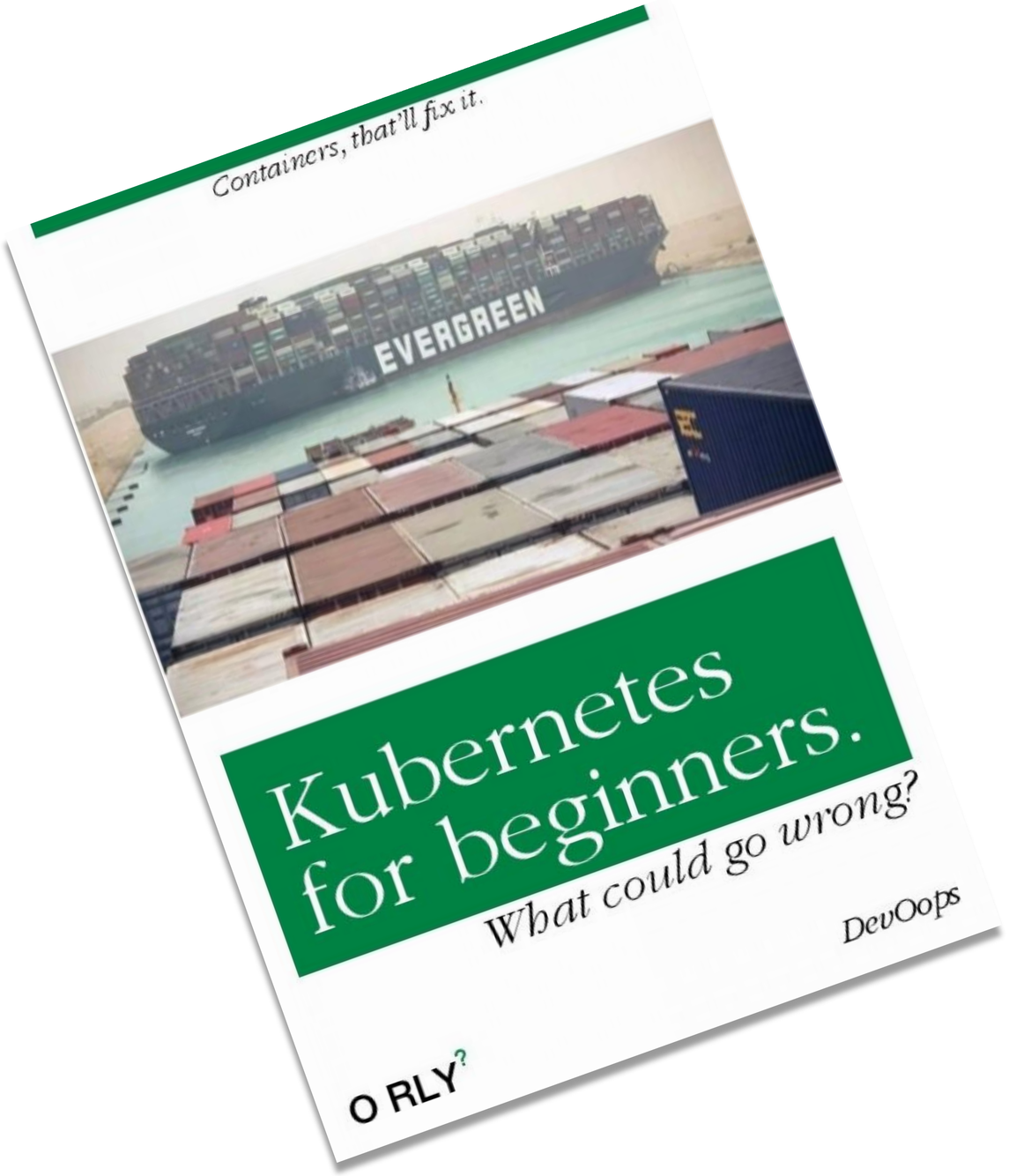
Meet Kubevirt



The KubeVirt project started in Red Hat at the end of 2016, with the question: Can virtual machines (VMs) run in containers and be deployed by Kubernetes?

kubevirt.io

- Started in 2016
- CNCF Sandbox in 2019
- v1.0 in 2023


Containers, that'll fix it.
EVERGREEN
Kubernetes for beginners.
What could go wrong?
DevOops
O RLY?

Workload is searching for a new platform to run on, in the cloud

Any public cloud's native VPC

Pros

- Hypervisor is not your problem
  - You don't monitor it
  - You don't pay for it
- 100% PAYG

Cons

- Noisy neighbour
- Another vendor lock-in
- VM refacrtoring, or image conversion

Openshift Virtualization, hosted "anywhere"

Pros

- Same Openshift experience, workload portability
- Container workload can co-exist with VMs
- Can migrate the workload with supported tools

Cons

- You must learn some Kubernetes
- Paradism shift in ops

Quick facts about the internals of Kubevirt – you create a VirtualMachine CR, you get a Pod

```
bash-3.2$ kubectl exec -n mss-test    virt-launcher-centos-0b25dac0-fzf42 -- ps aux
USER         PID %CPU %MEM    VSZ   RSS TTY      STAT START   TIME COMMAND
qemu           1  0.0  0.0 1677588 13212 ?       Ssl  14:12   0:00 /usr/bin/virt-launcher-monitor --qemu-timeout 295s --name centos-0b25dac0 --uid 56314130-e814-40
97-8a0a-52827ce69976 --namespace mss-test --kubevirt-share-dir /var/run/kubevirt --ephemeral-disk-dir /var/run/kubevirt-ephemeral-disks --container-disk-dir /var/r
un/kubevirt/container-disks --grace-period-seconds 45 --hook-sidecars 0 --ovmf-path /usr/share/OVMF --disk-memory-limit 2000000000 --run-as-nonroot
qemu           8  0.1  0.0 5443408 81796 ?       Sl   14:12   0:30 /usr/bin/virt-launcher --qemu-timeout 295s --name centos-0b25dac0 --uid 56314130-e814-4097-8a0a-
52827ce69976 --namespace mss-test --kubevirt-share-dir /var/run/kubevirt --ephemeral-disk-dir /var/run/kubevirt-ephemeral-disks --container-disk-dir /var/run/kubev
irt/container-disks --grace-period-seconds 45 --hook-sidecars 0 --ovmf-path /usr/share/OVMF --disk-memory-limit 2000000000 --run-as-nonroot
qemu          23  0.1  0.0 1363348 33040 ?       Sl   14:12   0:36 /usr/sbin/virtqemud -f /var/run/libvirt/virtqemud.conf
qemu          24  0.0  0.0  32756 15504 ?        S    14:12   0:00 /usr/sbin/virtlogd -f /etc/libvirt/virtlogd.conf
qemu          66  0.4  0.2 5399248 948528 ?      Sl   14:12   1:30 /usr/libexec/qemu-kvm -name guest=mss-test_centos-0b25dac0,debug-threads=on -S -object {"qom-typ
e":"secret","id":"masterKey0","format":"raw","file":"/var/run/kubevirt-private/libvirt/qemu/lib/domain-1-mss-test_centos-0b25/master-key.aes"} -machine pc-q35-rhel
9.6.0,usb=off,vmport=off,dump-guest-core=off,acpi=on -accel kvm -cpu Cascadelake-Server,vmx=on,pdcm=on,hypervisor=on,ss=on,tsc-adjust=on,mpx=on,umip=on,pku=on,md-c
lear=on,stibp=on,flush-l1d=on,arch-capabilities=on,xsaves=on,ibpb=on,ibrs=on,amd-stibp=on,amd-ssbd=on,rdctl-no=on,ibrs-all=on,skip-l1dfl-vmentry=on,mds-no=on,pscha
nge-mc-no=on,tsx-ctrl=on,sbdr-ssdp-no=on,psdp-no=on,fb-clear=on,gds-no=on,rfds-no=on,vmx-activity-wait-sipi=on,vmx-xsaves=on,vmx-tsc-scaling=on,vmx-exit-clear-bndc
fgs=on,vmx-entry-load-bndcfgs=on,vmx-eptp-switching=on,hle=off,rtm=off -m size=4194304k,maxmem=16777216k -overcommit mem-lock=off -smp 2,sockets=1,dies=1,clusters=
1,cores=2,threads=1 -object {"qom-type":"memory-backend-ram","id":"ram-node0","size":4294967296} -numa node,nodeid=0,cpus=0-1,memdev=ram-node0 -uuid 745f169f-ed45-
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9f-ed45-4a08-97a5-a6ec6cc386ae,family=ca-tor damek15r0sp0sdieje4g gergo-0918 -no-user-config -nodefaults -chardev socket,id=charmonitor,fd=21,server=on,wait=off -m
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:15:2a:c7","bus":"pci.3","addr":"0x0","romfile":""} -add-fd set=0,fd=20,opaque=serial0-log -chardev socket,id=charserial0,fd=18,server=on,wait=off,logfile=/dev/fds
et/0,logappend=on -device {"driver":"isa-serial","chardev":"charserial0","id":"serial0","index":0} -chardev socket,id=charchannel0,fd=19,server=on,wait=off -device
 {"driver":"virtserialport","bus":"virtio-serial0.0","nr":1,"chardev":"charchannel0","id":"channel0","name":"org.qemu.guest_agent.0"} -audiodev {"id":"audio1","dri
ver":"none"} -vnc vnc=unix:/var/run/kubevirt-private/56314130-e814-4097-8a0a-52827ce69976/virt-vnc,audiodev=audio1 -device {"driver":"VGA","id":"video0","vgamem_mb
":16,"bus":"pcie.0","addr":"0x1"} -global ICH9-LPC.noreboot=off -watchdog-action reset -incoming defer -device {"driver":"virtio-balloon-pci-non-transitional","id"
:"balloon0","free-page-reporting":true,"bus":"pci.8","addr":"0x0"} -sandbox on,obsolete=deny,elevateprivileges=deny,spawn=deny,resourcecontrol=deny -msg timestamp=
on
qemu        1395  0.0  0.0   7028  3344 ?        Rs   19:31   0:00 ps aux
bash-3.2$
```

Containerized Data Importer

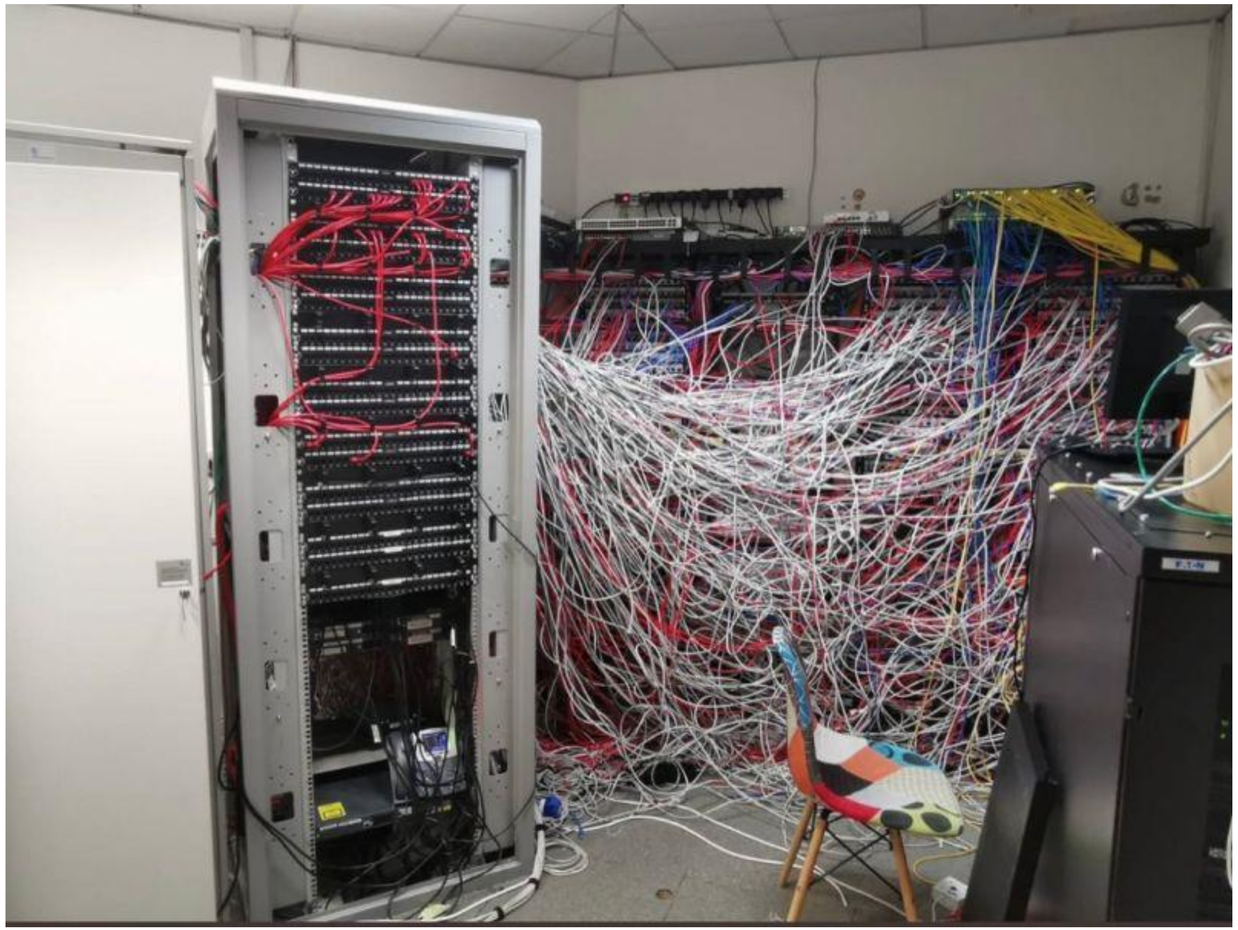


The Containerized Data Importer (CDI) project provides facilities for enabling Persistent Volume Claims (PVCs) to be used as disks for KubeVirt VMs by way of DataVolumes. The three main CDI use cases are:

- Import a disk image from a web server or container registry to a DataVolume
- Clone an existing PVC to a DataVolume
- Upload a local disk image to a DataVolume

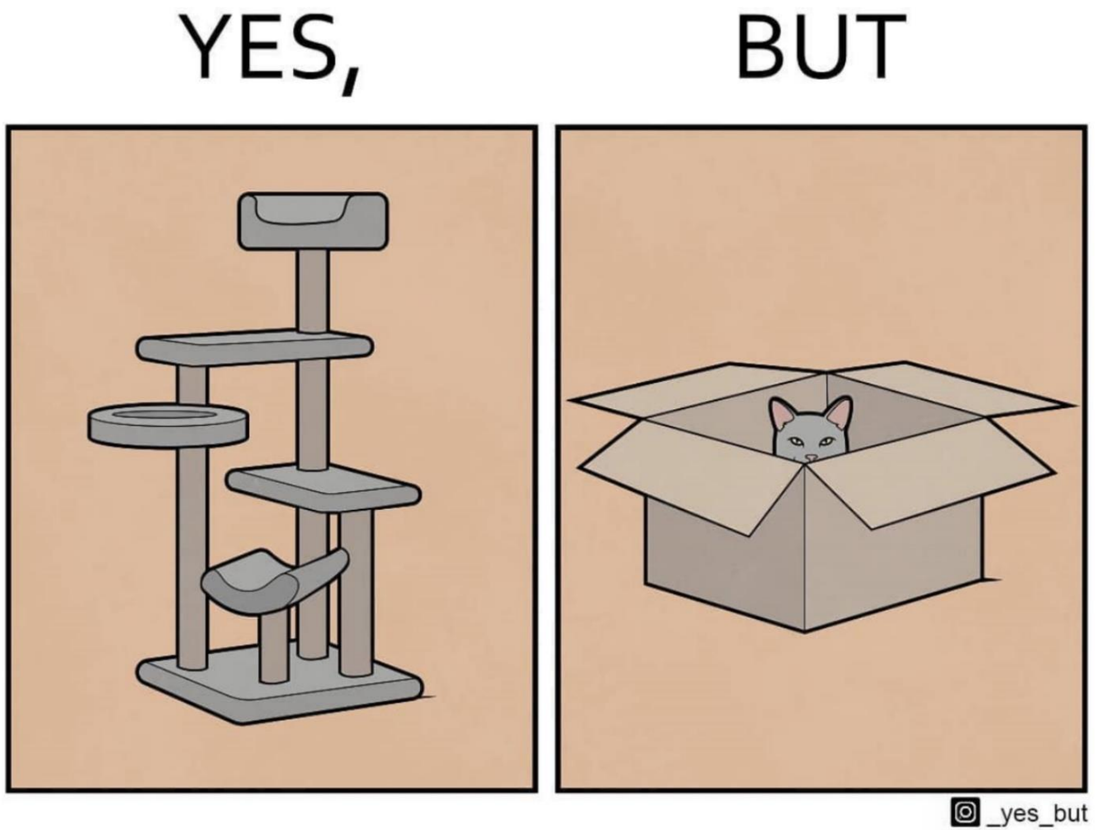
You need bare-metal, and
decent storage, period.

Let’s talk about networking



Running VMs on Kubernetes is cool because

- VMs will co-exist with containers
- VMs are on the Pod network
- VMs are Service endpoints
- VMs scaled just like a Deployment
- VMs in the service mesh



Networking: challenges

- More than one network interface to the VMs
- MTU 1500 (or more) on the VM network(s)
- Static IP addresses
- Hot-plug interfaces
- Isolated network segments
- Inter-connected network segments
- 3rd party VNFs in VMs



Networking: solutions

OVN-Kubernetes CNI

- Open vSwitch inside, fully managed by OVN
- User defined networks (UDN)
  - Multiple attachments
  - Overlay or direct infrastructure connection



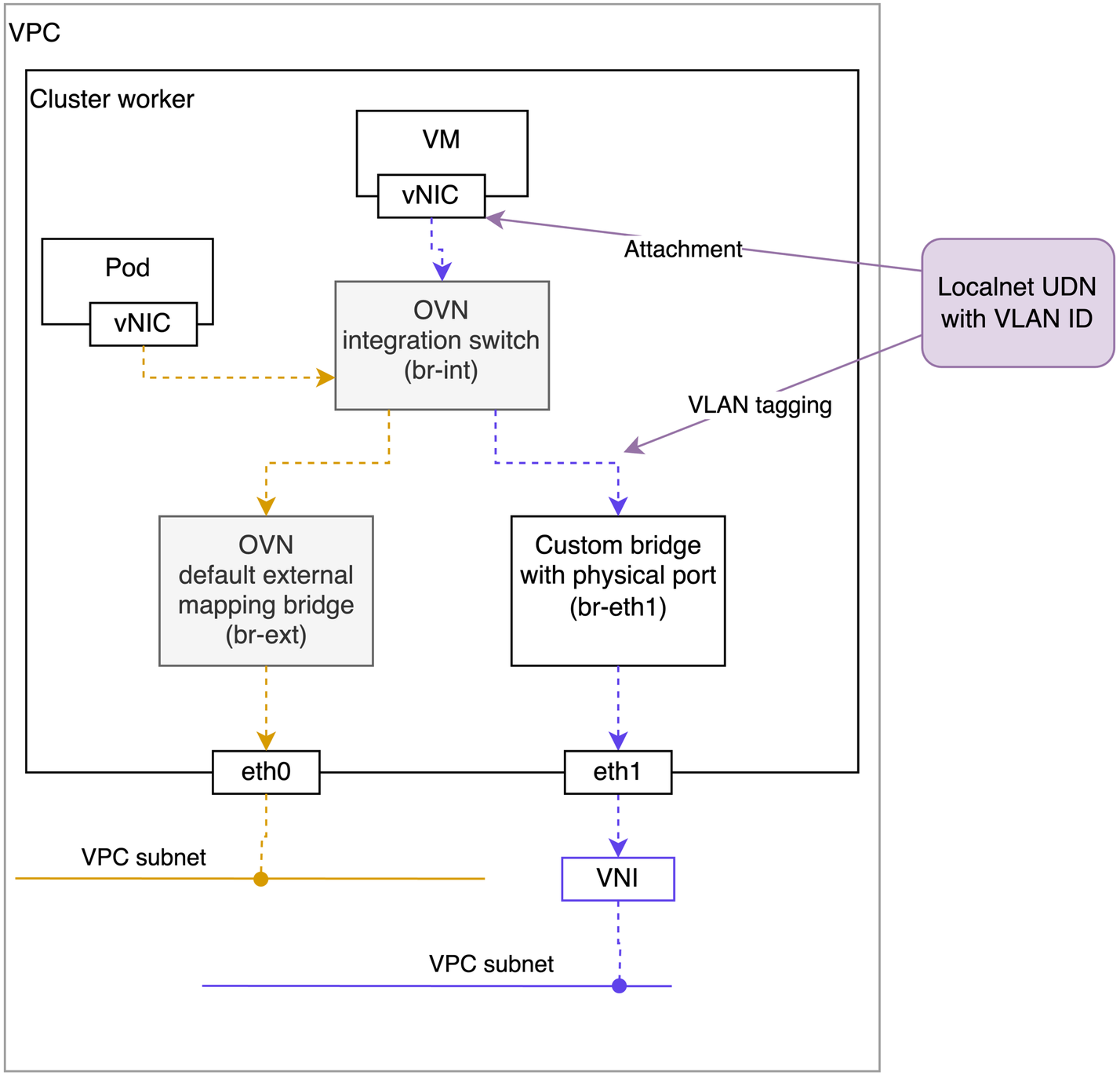
IaaS integration

- First class network resources to the VMs
  - No NAT
  - Jumbo frames
  - Floating after the workload

- Nmstate operator
  - Network manager controller



Localnet UDN in the cloud!



Agenda

- WHY
- How
  - Compute
  - Storage
  - Network
  - Migration
  - Maintenance
  - Disaster recovery
  - Backup and restore

Migration challenges

- Drivers
- Guest management tools
- Metrics and health exposure
- Environment discovery



Meet Forklift

Toolkit for migrating VMs from VMware, OVA, EC2, HyperV, oVirt and OpenStack to KubeVirt



Operands

- Provider
- Plan

Features:

- Support cold and warm migration
- Prepares the guest (Linux and Windows) to run on qemu-kvm
- Handles network and storage mapping
- Handles limited command execution on first boot

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Node maintenance



Challenge:

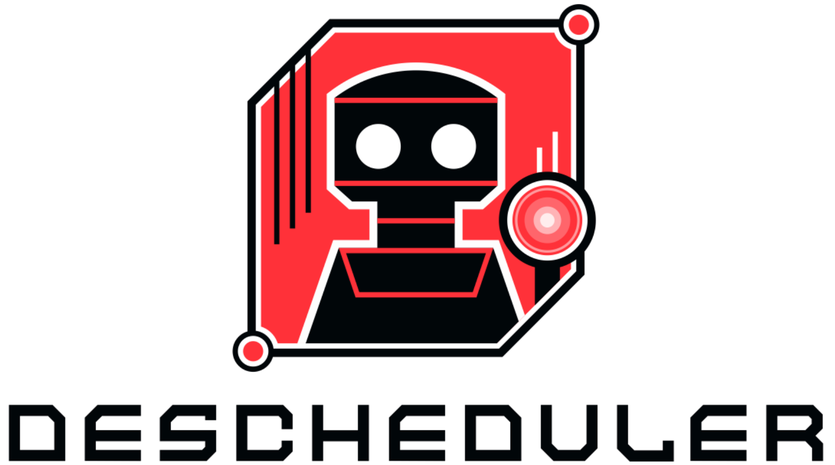
VMs being stateful workloads, they cannot be drained like regular Pods.

Solution: Node Maintenance Operator (NMO)



Descheduler

Scheduling in Kubernetes is the process of binding pending pods to nodes, and is performed by a component of Kubernetes called kube-scheduler.
[...]
Consequently, there might be several pods scheduled on less desired nodes in a cluster. Descheduler, based on its policy, finds pods that can be moved and evicts them.



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Fleet management and disaster recovery

Challenges:

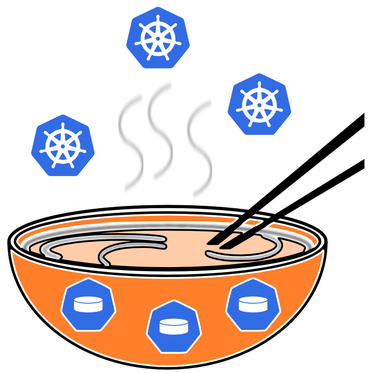
- Kubernetes cluster is self-contained by nature
- Multi-region cluster deployment is not an option
- No built-in higher level construct for composite applications
- Disaster recovery requires:
  - Central high level view of the fleet
  - Health monitoring
  - Replicated storage

Open Cluster Management

Solution:

“Open Cluster Management (OCM) is a powerful, modular, extensible platform for Kubernetes multi-cluster orchestration.”

“Ramen DR provides Kubernetes-native disaster recovery and data mobility for containerized workloads and virtual machines across multiple clusters”



Environment discovery

What if you have static IP addresses configured in the Guest OS, that needs to be updated:

- During the initial migration
- Post migration, on disaster recovery

Potential generic solutions:

- Pre-stage scripts to the OS that acts when needed and:
  - Mount a ConfigMap with cluster specific data
  - Use cluster-wide SMBIOS values to tell the script where it is running

```
[root@centos-250268 ~]# dmidecode -t system
# dmidecode 3.6
Getting SMBIOS data from sysfs.
SMBIOS 2.8 present.

Handle 0x0100, DMI type 1, 27 bytes
System Information
  Manufacturer: Red Hat
  Product Name: OpenShift Virtualization
  Version: 4.21.17
  Serial Number: 360408d4-8637-4fd8-9a04-6330fb8b78a2
  UUID: a2acc814-b1b1-44ff-9c45-d11c9f21d460
  Wake-up Type: Power Switch
  SKU Number: 9.6.0
  Family: us-south Primary

Handle 0x2000, DMI type 32, 11 bytes
System Boot Information
  Status: No errors detected
[root@centos-250268 ~]#
```

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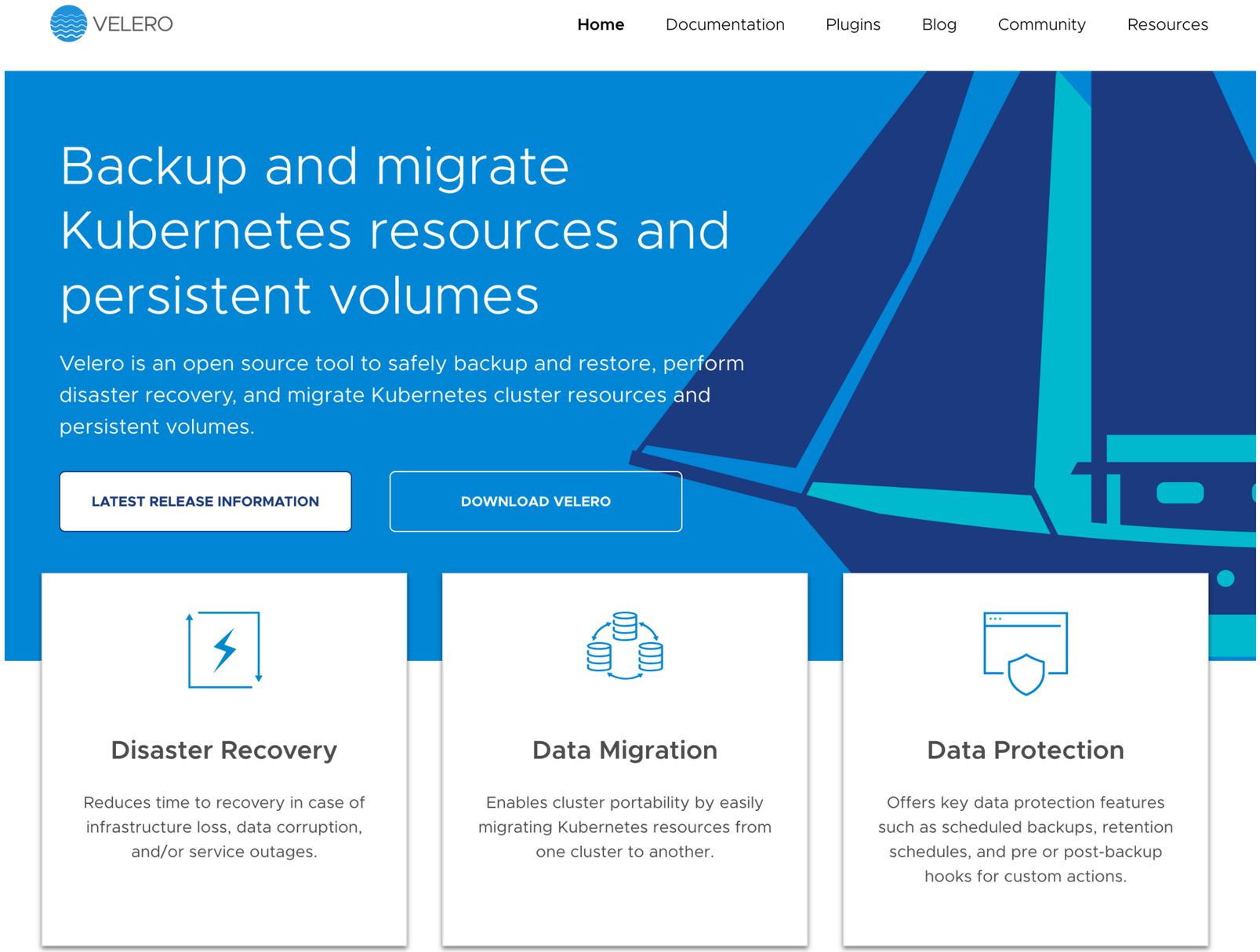
Backup and restore



Agenda

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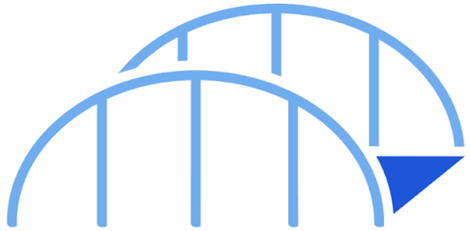
Recap





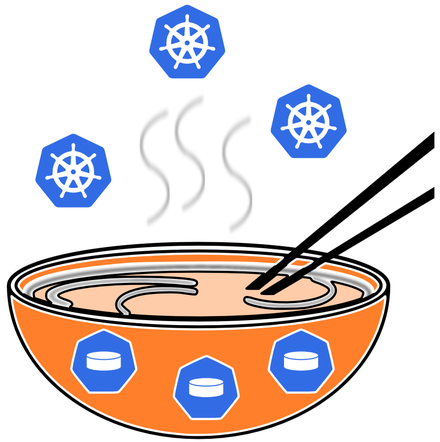


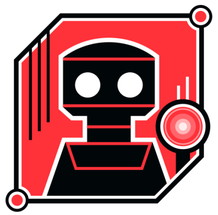
KubeVirt



nmstate



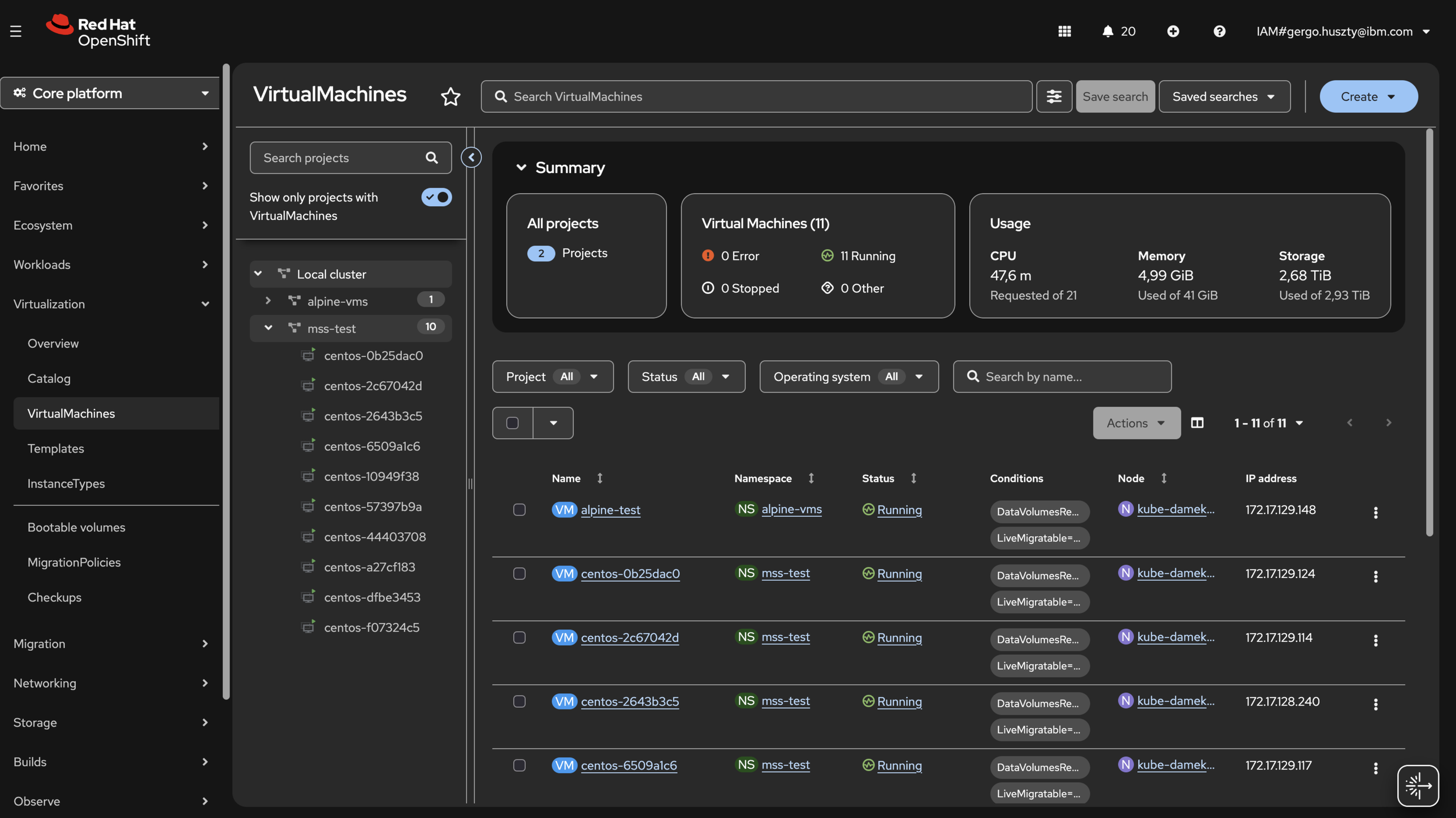








Open Cluster Management


Red Hat OpenShift
20
IAM#gergo.huszty@ibm.com
Core platform
Home
Favorites
Ecosystem
Workloads
Virtualization
Overview
Catalog
VirtualMachines
Templates
InstanceTypes
Bootable volumes
MigrationPolicies
Checkups
Migration
Networking
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Builds
Observe
VirtualMachines
Search VirtualMachines
Save search
Saved searches
Create
Search projects
Show only projects with VirtualMachines
Local cluster
alpine-vms 1
mss-test 10
centos-0b25dac0
centos-2c67042d
centos-2643b3c5
centos-6509a1c6
centos-10949f38
centos-57397b9a
centos-44403708
centos-a27cf183
centos-dfbe3453
centos-f07324c5
Summary
All projects
2 Projects
Virtual Machines (11)
0 Error
11 Running
0 Stopped
0 Other
Usage
CPU
47,6 m
Requested of 21
Memory
4,99 GiB
Used of 41 GiB
Storage
2,68 TiB
Used of 2,93 TiB
Project All
Status All
Operating system All
Search by name...
Actions
1 - 11 of 11
Name
Namespace
Status
Conditions
Node
IP address
VM alpine-test
NS alpine-vms
Running
DataVolumesRe...
LiveMigratable=...
kube-damek...
172.17.129.148
VM centos-0b25dac0
NS mss-test
Running
DataVolumesRe...
LiveMigratable=...
kube-damek...
172.17.129.124
VM centos-2c67042d
NS mss-test
Running
DataVolumesRe...
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kube-damek...
172.17.129.114
VM centos-2643b3c5
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Running
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kube-damek...
172.17.128.240
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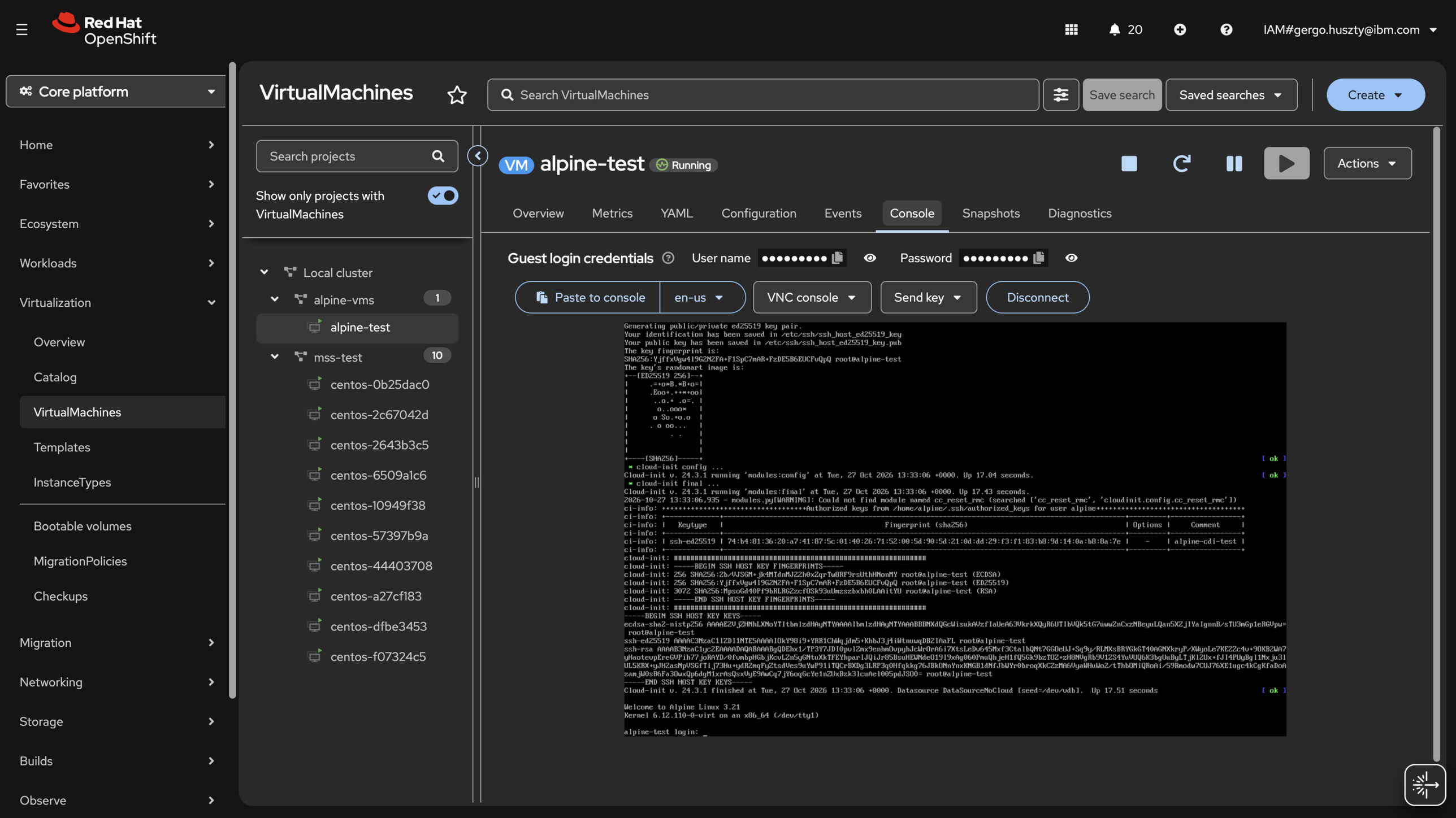
LiveMigratable=...
kube-damek...
172.17.129.117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Create
Search projects
Show only projects with VirtualMachines
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centos-10949f38
centos-57397b9a
centos-44403708
centos-a27cf183
centos-dfbe3453
centos-f07324c5
VM alpine-test Running
Actions
Overview
Metrics
YAML
Configuration
Events
Console
Snapshots
Diagnostics
Guest login credentials
User name
Password
Paste to console
en-us
VNC console
Send key
Disconnect
Generating public/private ed25519 key pair.
Your identification has been saved in /etc/ssh/ssh_host_ed25519_key
Your public key has been saved in /etc/ssh/ssh_host_ed25519_key.pub
The key fingerprint is:
SHA256:YjffxVgw4l9G2N2FA+F1SpC7mAR+FzDE5B6EUCFvQpQ root@alpine-test
The key's randomart image is:
+--[ED25519 256]--+
+----[SHA256]-----+
[ok]
* cloud-init config ...
Cloud-init v. 24.3.1 running 'modules:config' at Tue, 27 Oct 2026 13:33:06 +0000. Up 17.04 seconds.
[ok]
* cloud-init final ...
Cloud-init v. 24.3.1 running 'modules:final' at Tue, 27 Oct 2026 13:33:06 +0000. Up 17.43 seconds.
2026-10-27 13:33:06,935 - modules.py[WARNING]: Could not find module named cc_reset_rmc (searched ['cc_reset_rmc', 'cloudinit.config.cc_reset_rmc'])
ci-info: ++++++++++++++++++++++++++++++++++++Authorized keys from /home/alpine/.ssh/authorized_keys for user alpine++++++++++++++++++++++++++++++++++++
ci-info: +----------+----------+----------+
ci-info: | Keytype | Fingerprint (sha256) | Options | Comment |
ci-info: +----------+----------+----------+
ci-info: | ssh-ed25519 | 74:b4:81:36:20:a7:41:87:5c:01:40:26:71:52:00:5d:90:5d:21:0d:dd:29:f3:f1:83:b8:9d:14:0a:b8:8a:7e | - | alpine-cdi-test |
ci-info: +----------+----------+----------+
cloud-init: ##
cloud-init: -----BEGIN SSH HOST KEY FINGERPRINTS-----
cloud-init: 256 SHA256:Zb/VJSGM+jk4MTdnMJ2Zh0xZqrTw8RF9rsUthHNonMY root@alpine-test (ECDSA)
cloud-init: 256 SHA256:YjffxVgw4l9G2N2FA+F1SpC7mAR+FzDE5B6EUCFvQpQ root@alpine-test (ED25519)
cloud-init: 3072 SHA256:MpsoGd40Pf9bRLRG2zcfOSk93uUmzszbxbh0LAAitYU root@alpine-test (RSA)
cloud-init: -----END SSH HOST KEY FINGERPRINTS-----
cloud-init: ##
-----BEGIN SSH HOST KEY KEYS-----
root@alpine-test
ssh-ed25519 AAAAC3NzaC1lZDI1NTE5AAAAIOkY98i9+YRR1ChWqjdm5+KhbJ3j4iWtnuwqDB2IAaFL root@alpine-test
-----END SSH HOST KEY KEYS-----
Cloud-init v. 24.3.1 finished at Tue, 27 Oct 2026 13:33:06 +0000. Datasource DataSourceNoCloud [seed=/dev/vdb]. Up 17.51 seconds
[ok]
Welcome to Alpine Linux 3.21
Kernel 6.12.110-0-virt on an x86_64 (/dev/tty1)
alpine-test login: _


FINALLY
END OF PRESENTATION
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