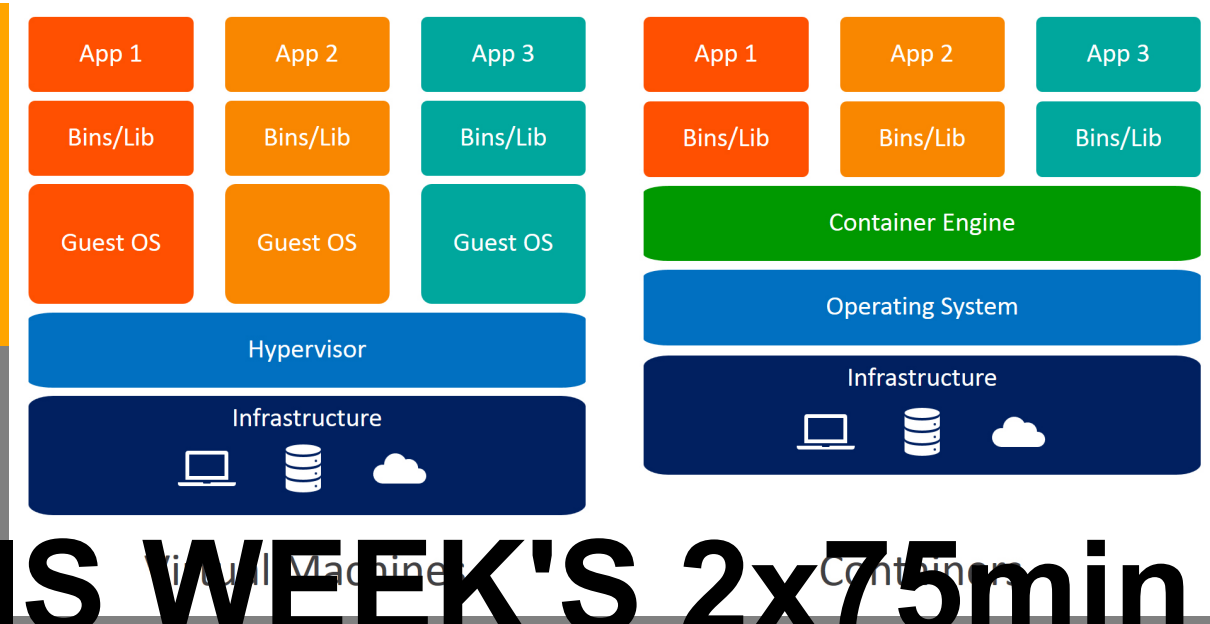
INTRO TO OPERATING SYSTEMS

VIRTUAL MACHINES/QUBES OS and CONTAINERIZATION/ORCHESTRATION



Virtual Machines Containers

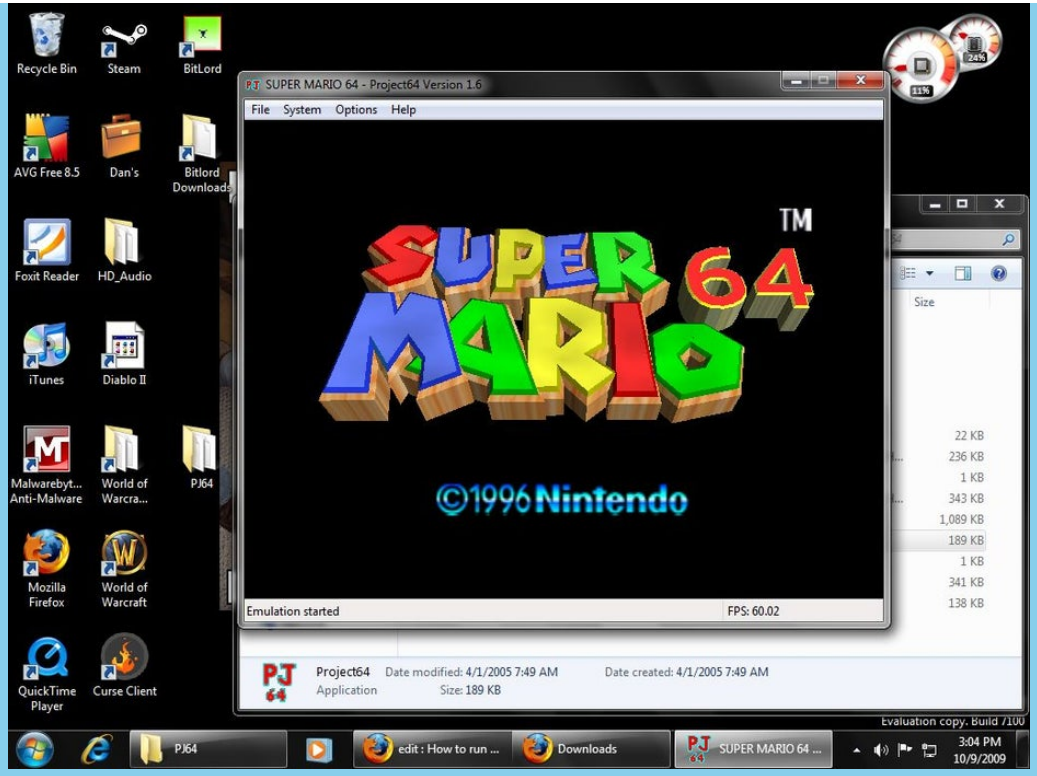
https://solutioncenter.apexsql.com/operating-system-os-performance-monitoring/

THIS WEEK'S 2x75min 4p-5:15p

- Emulation (5m)
- Virtual Machines (40m)

- Load Balancing (15m)
- Containerization (20m)
- Guest: Kubernetes/Docker/Rancher (60m)

- Emulation (5m)



https://www.instructables.com/id/How-to-run-a-game-emulator/

♦ Emulation (10m)

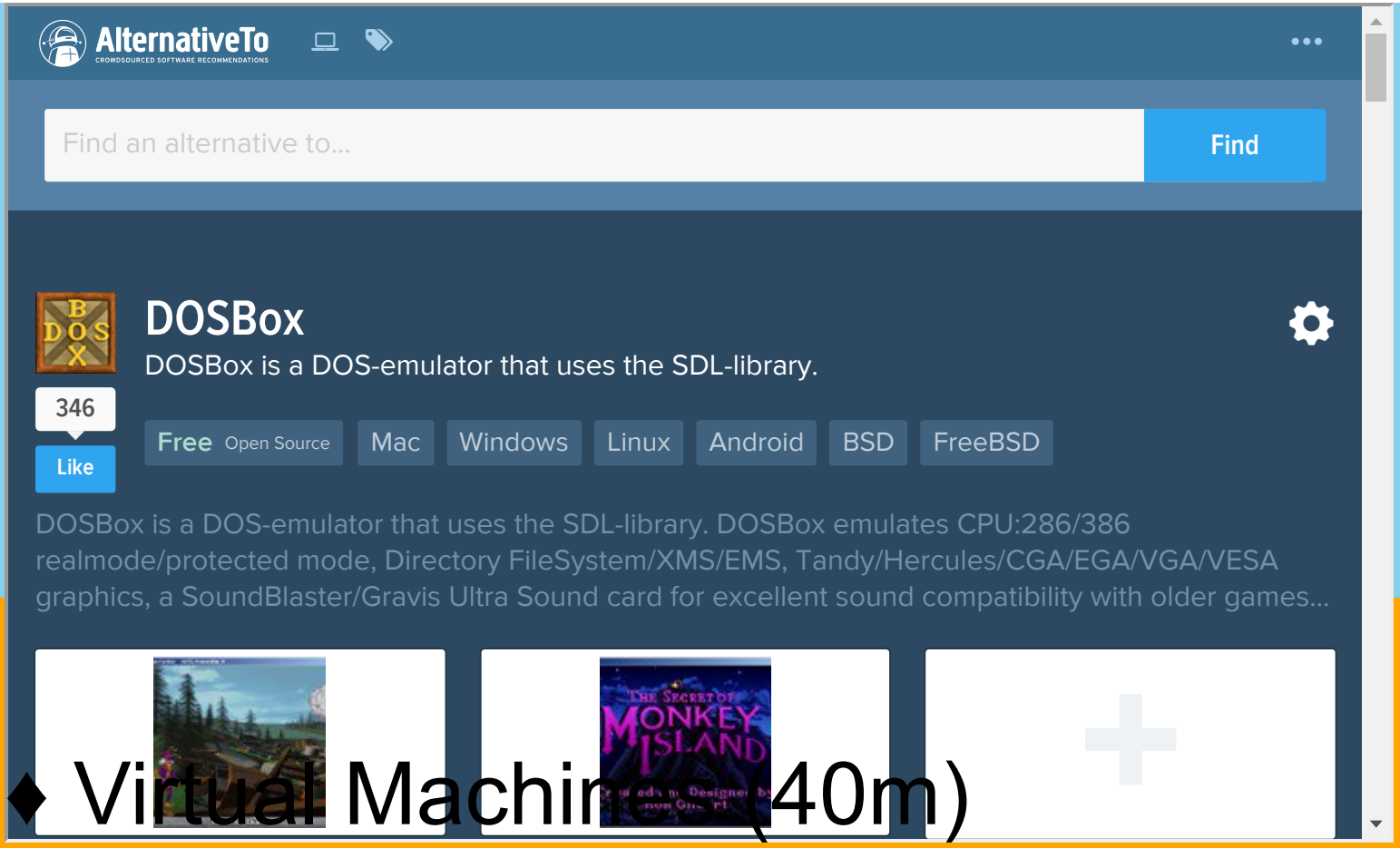
♣ Pick OS on Pr1mos: Like SQL server on Linux (mostly file system emu)

♣ Early Retro Gaming: Timing Problems

♣ DOSBox W3.1, W95 for current

♣ Cygwin: Early Linux-on-Windows (NT, W95)

- Emulation (10m)



♦ Virtual Machines (40m)

♣ Dual Boot is a Pain: Apple/Windows Linux/Windows (click)

♣ Configuration is a Pain: Tweaks, Libraries, Versions, Server Management (click)

♣ Reliability: Migrate OS Image to New Hardware (click)

♣ Cloning: Copy OS Image to New Hardware (click)

♣ StrongFencing/Sandboxing: Separate projects and users for security, SLA/performance (click)

https://www.makeuseof.com/tag/reasons-dual-boot-linux/ https://en.wikipedia.org/wiki/Ubuntu_version_history https://www.cloudwards.net/best-small-business-server/ https://pcparamediccharlotte.com/tag/disk-cloning/ https://www.slideshare.net/securityxploded/automating-malware-analysis

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♦ Virtual Machines ARE NOT:

♣ Virtual Reality

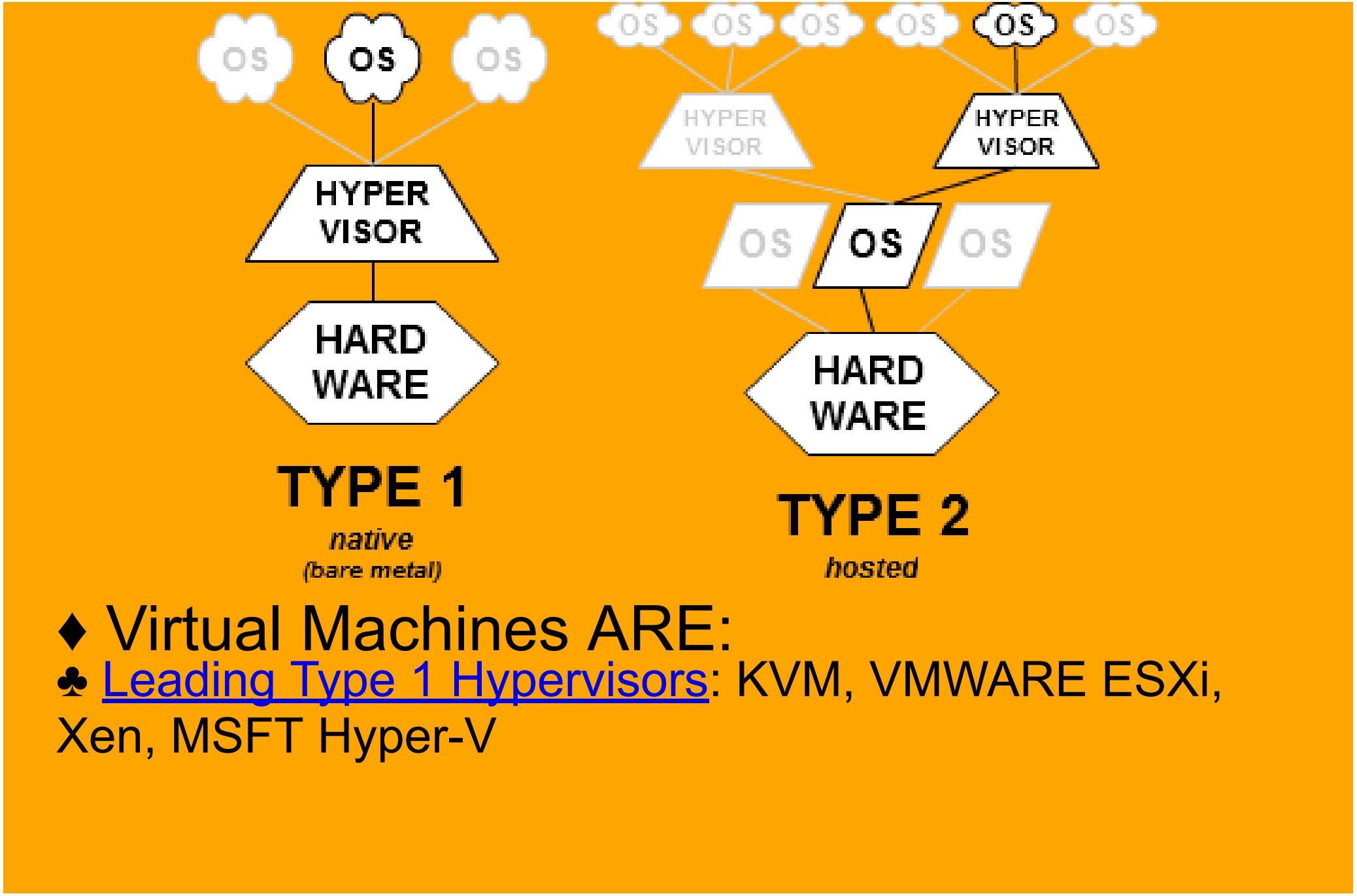
♣ Virtual Memory

♣ Virtual Desktop (similar)

♣ Java VM (AVM: Application Virtual Machine) (MRE: Managed Runtime Environment) (similar)

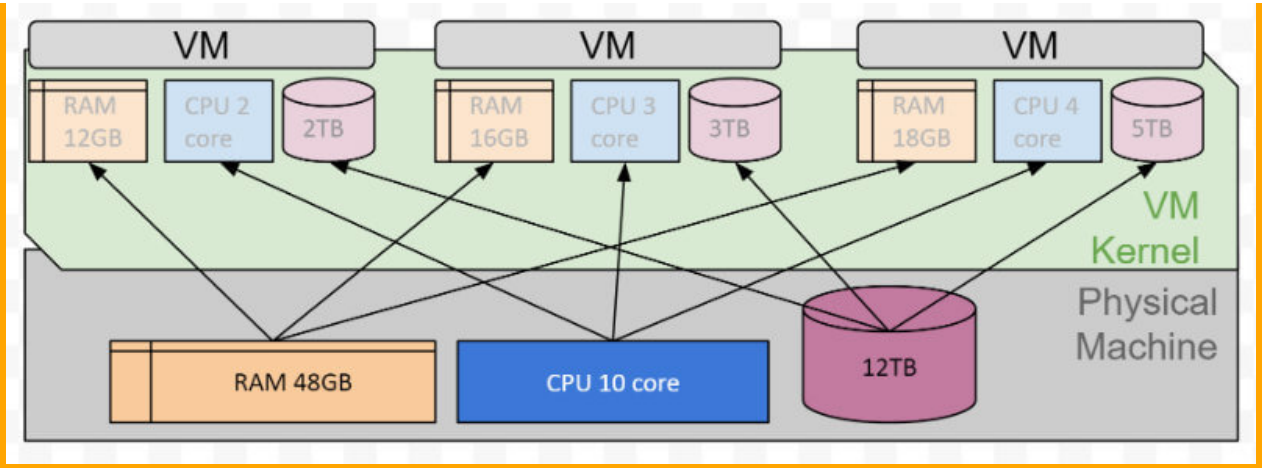
♦ Virtual Machines ARE:

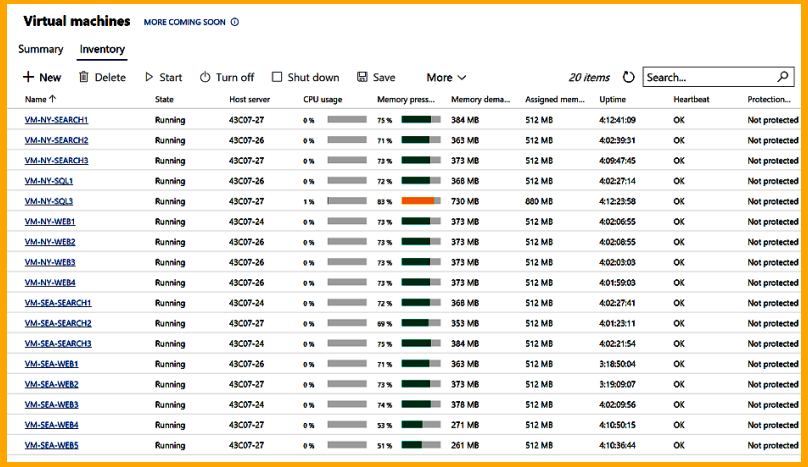
♣ Usually Hypervisor-based Emulations of GUEST OS's on a HOST OS or BARE METAL



♦ Virtual Machines ARE:

♣ Leading Type 1 Hypervisors: KVM, VMWARE ESXi, Xen, MSFT Hyper-V





Virtual machines MORE COMING SOON

Summary | Inventory

+ New | Delete | Start | Turn off | Shut down | Save | More | 20 items | Search...

Name	State	Host server	CPU usage	Memory press...	Memory dema...	Assigned mem...	Uptime	Heartbeat	Protection...
VM-NY-SEARCH1	Running	43C07-27	0 %	75 %	384 MB	512 MB	4:12:41:09	OK	Not protected
VM-NY-SEARCH2	Running	43C07-26	0 %	71 %	363 MB	512 MB	4:02:39:31	OK	Not protected
VM-NY-SEARCH3	Running	43C07-27	0 %	73 %	373 MB	512 MB	4:09:47:45	OK	Not protected
VM-NY-SQL1	Running	43C07-26	0 %	72 %	368 MB	512 MB	4:02:27:14	OK	Not protected
VM-NY-SQL3	Running	43C07-27	1 %	83 %	730 MB	880 MB	4:12:23:58	OK	Not protected
VM-NY-WEB1	Running	43C07-24	0 %	73 %	373 MB	512 MB	4:02:06:55	OK	Not protected
VM-NY-WEB2	Running	43C07-26	0 %	73 %	373 MB	512 MB	4:02:08:55	OK	Not protected
VM-NY-WEB3	Running	43C07-26	0 %	73 %	373 MB	512 MB	4:02:03:03	OK	Not protected
VM-NY-WEB4	Running	43C07-26	0 %	73 %	373 MB	512 MB	4:01:59:03	OK	Not protected
VM-SEA-SEARCH1	Running	43C07-24	0 %	72 %	368 MB	512 MB	4:02:27:41	OK	Not protected
VM-SEA-SEARCH2	Running	43C07-27	0 %	69 %	353 MB	512 MB	4:01:23:11	OK	Not protected
VM-SEA-SEARCH3	Running	43C07-24	0 %	75 %	384 MB	512 MB	4:02:21:54	OK	Not protected
VM-SEA-WEB1	Running	43C07-26	0 %	71 %	363 MB	512 MB	3:18:50:04	OK	Not protected
VM-SEA-WEB2	Running	43C07-27	0 %	73 %	373 MB	512 MB	3:19:09:07	OK	Not protected
VM-SEA-WEB3	Running	43C07-24	0 %	74 %	378 MB	512 MB	4:02:09:56	OK	Not protected
VM-SEA-WEB4	Running	43C07-27	0 %	53 %	271 MB	512 MB	4:10:50:15	OK	Not protected
VM-SEA-WEB5	Running	43C07-27	0 %	51 %	261 MB	512 MB	4:10:36:44	OK	Not protected

https://actusdigital.com/virtual-machine-vs-physical-server/ https://docs.microsoft.com/en-us/windows-server/manage/windows-admin-center/use/manage-virtual-machines

♦ Virtual Machines ARE:

♣ Usually for Cloud Providers to Make Better Use of Big Servers

- *Esp. for single-threaded single-core apps on multi-core CPUs*
- *Esp. for bursty requirements per user*
- *Esp. when remote infrastructure ok or even required*

♣ Usually for Cloud Users to Have Scalability, Reliability, Shared Costs

- *Esp. when performance is not the only consideration*

- *Esp. when keeping machines patched and connected*

- *Esp. when lots of small-transaction, global customer traffic, MicroServices*

♦ Virtual Machines ARE:

♣ The Killer Solution for Malware? Open Everything in a New VM!

♣ The Modern Mainframe? The Shared SuperComputer? Global TimeSharing? Back to Batch?

♣ The New Professional Computing Environment, Like it or Not

QubesOS

Rutkowska

♣ Interesting from a Performance Pt of View

- *Was slow, no longer so*

- *5-10% slow-down for cpu, more for disk/net i/o*

VMWARE 2007 BARE METAL 2018 REDDIT 2019

- *Each VM uses 300-500MB of memory by itself*
- *More jobs per machine because of overlapping idle*
- *Memory/Disk mapped but not allocated (eager vs lazy/thick/thin provisioning/zeroed/compressed)*
- *A NEW WAY to maximize/manage resource utilization*

♦ Virtual Machines ARE NOT BAD PERFORMERS OVERALL

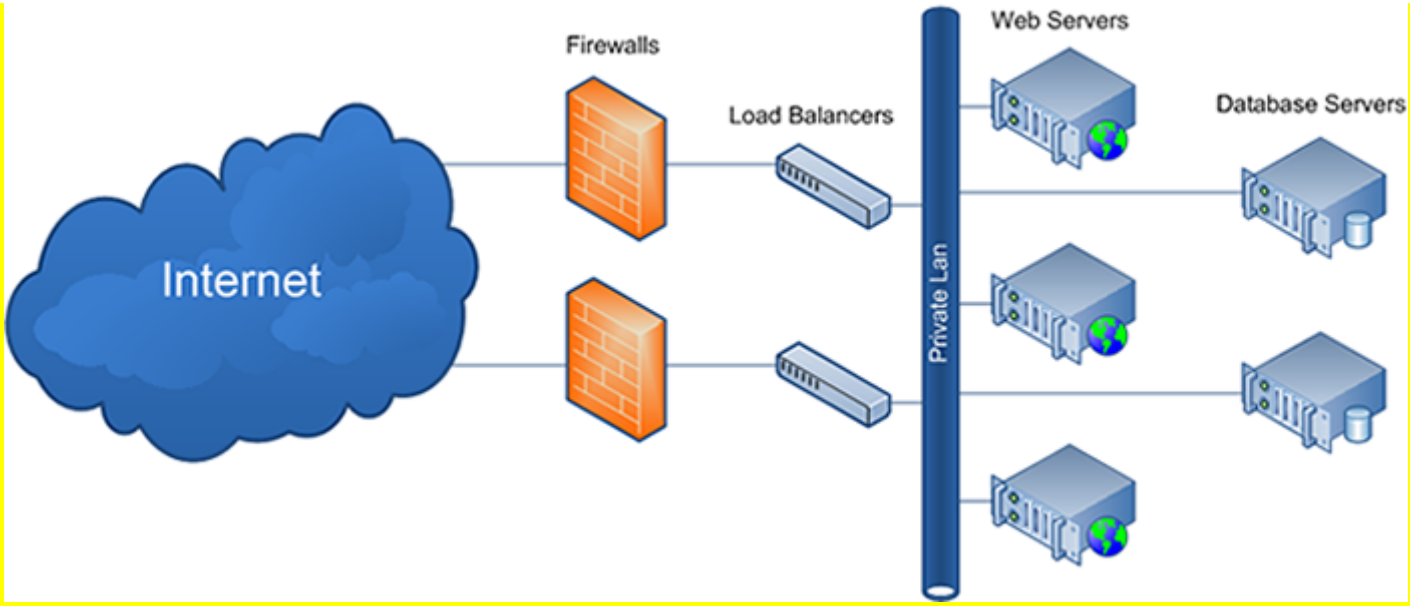
♣ REDDIT 2019

Type	CPU test	Memory test	Disk test	Cinebench
Bare Metal	-0%	-0%	-0%	-0%

Bhyve	-19%	-63%	-25%	-8%
ESXi	-1%	-4%	-30%	+1%
HyperV	-6%	-18%	-1%	-2%
KVM/KVMCPU/IDE	-10%	-1%	-50%	-2%
KVM/HostCPU/VirtIO	-1%	-4%	-1%	-2%

♦ Load Balancing (5m)

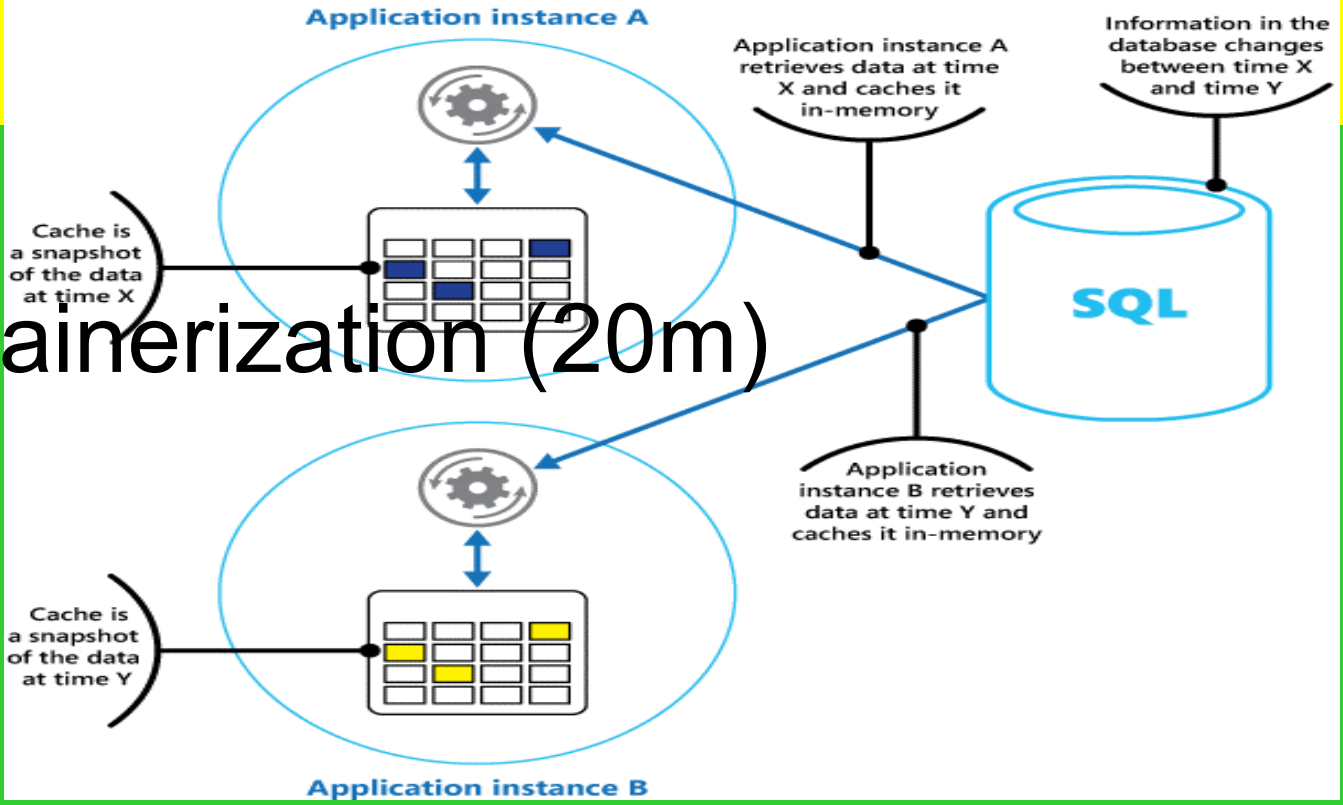
♣ Server Load Balancing IS:



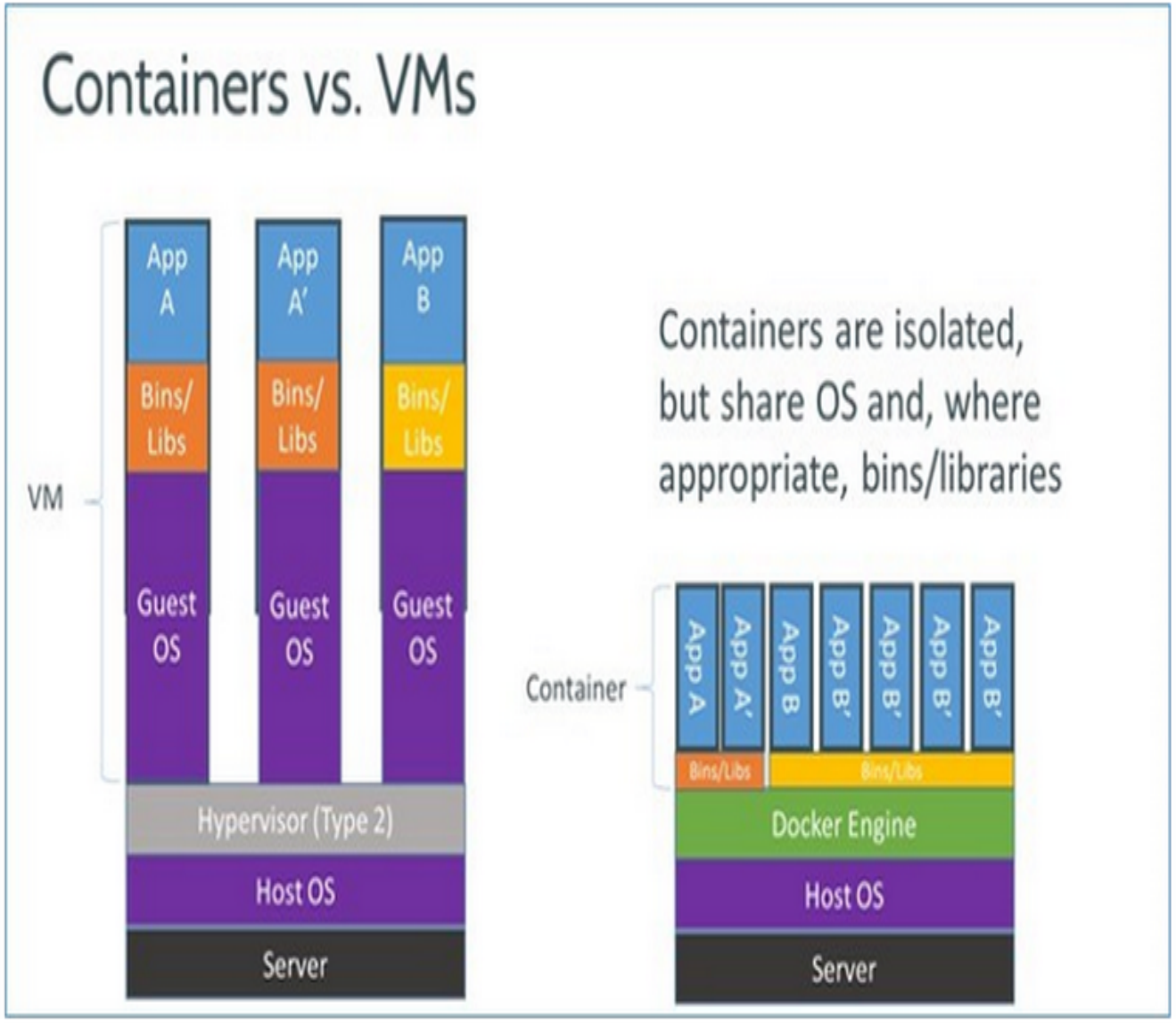
♣ Traditionally, for multiple web/sql servers w/millions of users

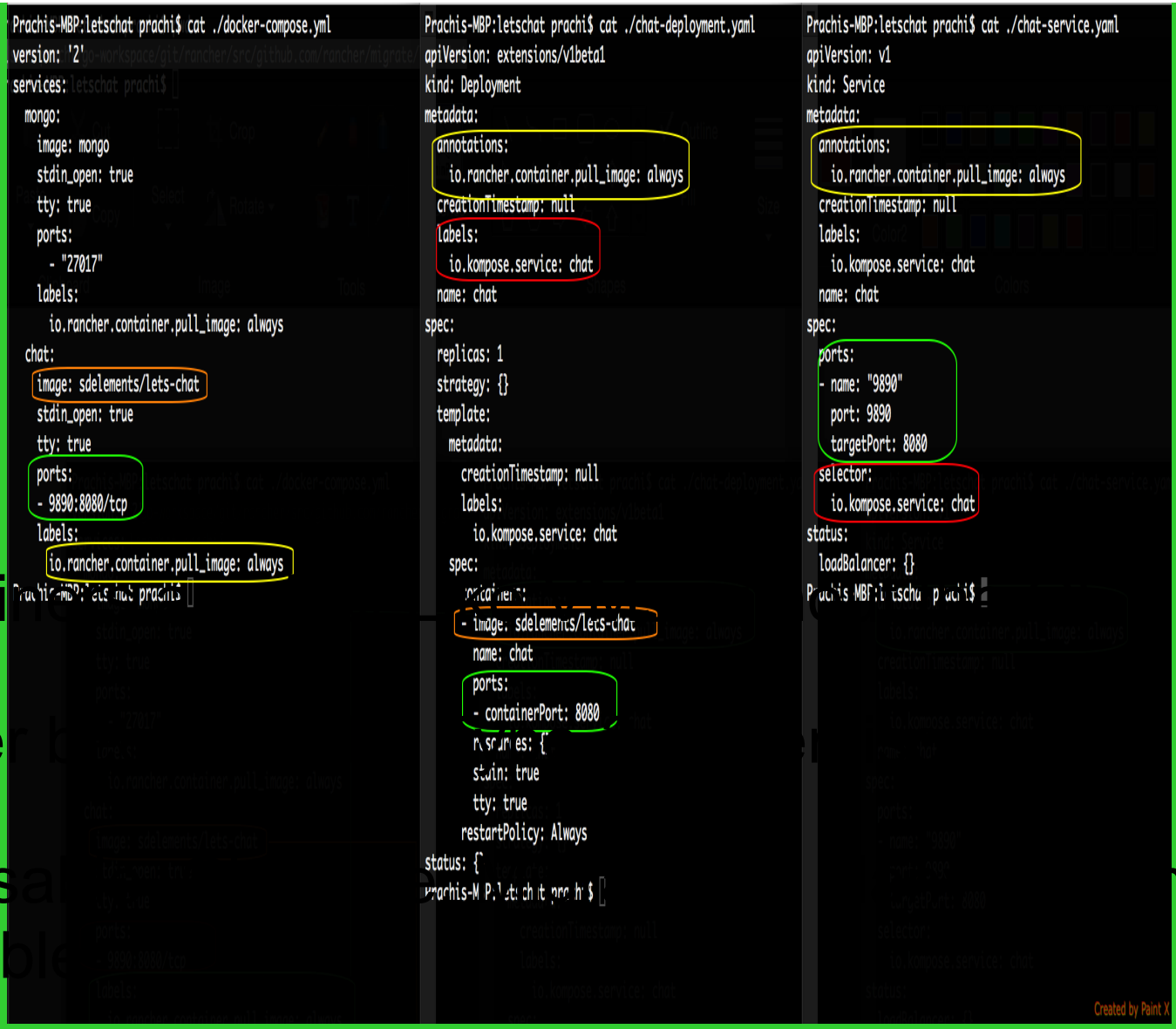
♣ Round robin, random, fewest connx, least load, hashed, sticky

♦ Containerization (20m)



https://www.idaq.com/info/load-balanced-dedicated-servers https://docs.microsoft.com/en-us/azure/architecture/best-practices/caching



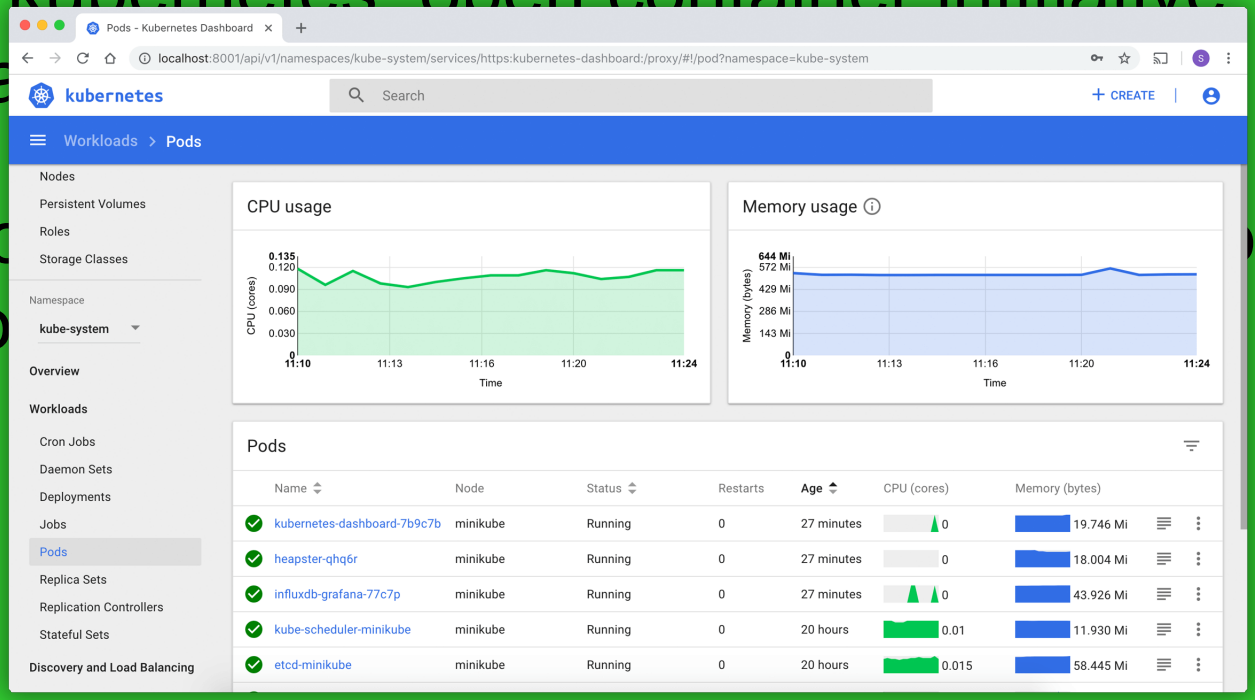


- ♣ Contai
- ♣ Docke
- ♣ Dispos me Deployable

https://www.zdnet.com/article/what-is-docker-and-why-is-it-so-darn-popular/ https://rancher.com/blog/2018/2018-08-02-journey-from-cattle-to-k8s/

♣ docker, kubernetes, open container intitiative, core os/rkt, apa

♣ cluster c od (an app), a po



https://kubernetes.io/docs/tasks/access-application-cluster/web-ui-dashboard/

♣ Spinning up or down a pod is 5-15sec

♣ Spinning up or down a vm is 1-10min

♣ Containers include libraries minimized for App, BUT NOT other OS parts

♣ Containers are [security--] while VMs are [security++]

https://stackoverflow.com/questions/30869185/kubernetes-pod-creation-speed