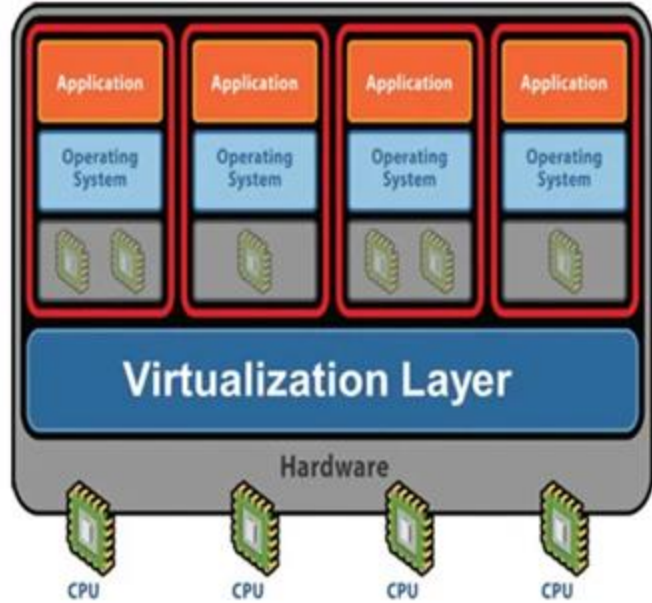# Virtualization in the ARF

Panel

Ken Feldman
Melissa Gonsalves
Julian Race (Moderator)
Chris Romsos
Erik Stevens

What is Virtualization

Virtualization software allows applications that previously ran on separate computers to run on one server machine.

- Virtualization is a technology that enables the creation of multiple simulated environments or dedicated resources from a single physical hardware system.

- Essentially, a software layer (often called a hypervisor) sits above the hardware and lets you split one machine into separate, isolated virtual machines (VMs)

- Each VM behaves like a full machine — own CPU, memory, storage, OS — but shares the underlying physical host

Why Use Virtualization

Efficient hardware use – Run many systems on one host or cluster, saving space, power, and hardware.

Flexibility & isolation – Each VM is independent; deploy or adjust quickly as mission needs change.

Reliable operations – Clustered hosts provide redundancy and fault tolerance for critical shipboard services.

Network segmentation & security – Connect VMs to VLANs for secure separation of science, admin, and public systems.

Simplified management – Use snapshots, live migration, and dynamic resource tools for smooth maintenance.
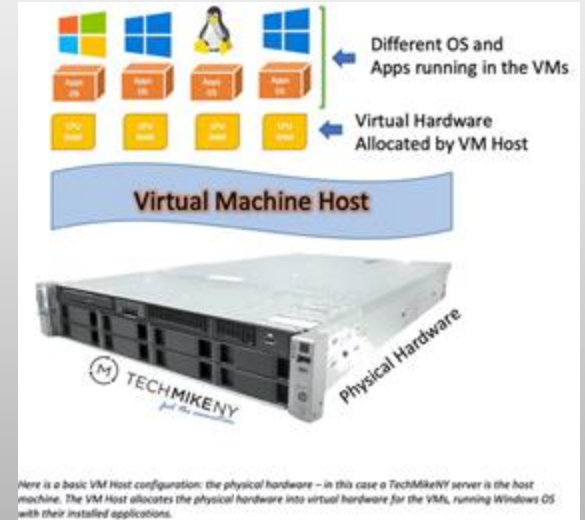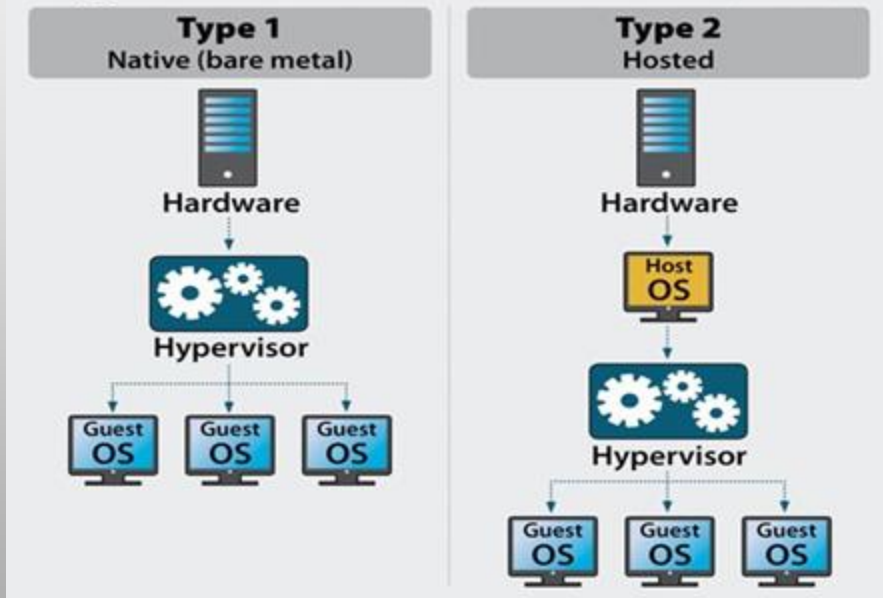

Image retrieved from https://techmikeny.com/

Understanding Hypervisors

Hypervisor or Virtual Machine Monitor (VMM)

Type 1 — Native (bare metal): Hardware → Hypervisor → Guest OS, Guest OS, Guest OS

Type 2 — Hosted: Hardware → Host OS → Hypervisor → Guest OS, Guest OS, Guest OS

Type 1 – Bare Metal Hypervisors

Run directly on the physical hardware, managing VMs without a host operating system.

- High performance and reliability — ideal for production or clustered environments.
- VMware ESXi, Proxmox VE, KVM, Microsoft Hyper-V (Server and Windows 11 Pro), Citrix
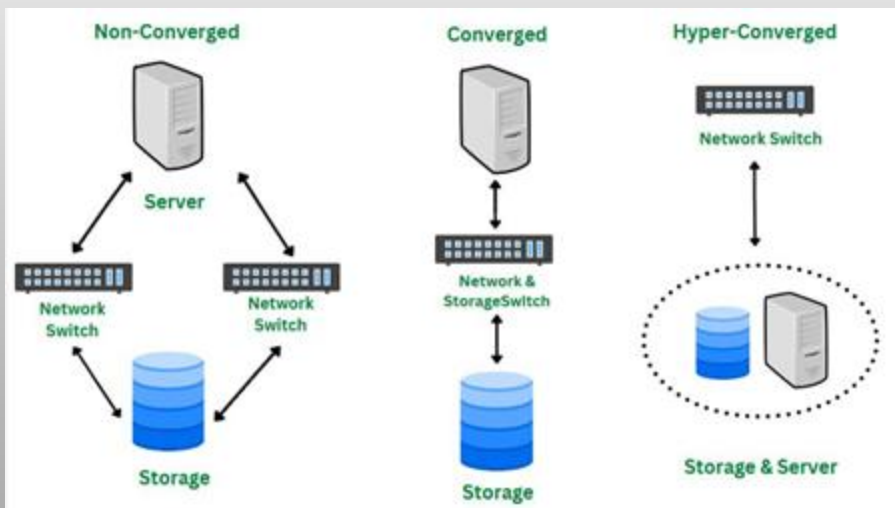
Type 2 – Hosted Hypervisors

Run on top of an existing operating system like Windows or macOS.

- Easier to set up — good for labs, testing, or personal use.
- Examples: VirtualBox, VMware Workstation, Parallels Desktop (macOS)

Hypervisor Architecture

Traditional Host+Storage

Server, Networking and Storage all separate

Converged

Single package, but still discrete components

Hyperconverged

Server + Storage combined

Virtualization Landscape

VMWare (ESXi, Workstation, Fusion)
Proxmox PVE
MS Hyper-V
Nutanix
KVM
Docker (Containerization)

Virtualization in the ARF

Sikuliaq - VMWare ESXi/vCenter 8 onboard, Proxmox ashore
Endeavor - Proxmox onboard
Thompson - VMWare ESXi/vCenter 8 (prod), Proxmox (dev)
Carson - VMWare ESXi
Sproul - Proxmox onboard
Ride - VMWare ESXi/vCenter 8 to Proxmox
Revelle - VMWare ESXi/vCenter 8 to Proxmox
RCRVs - VMWare*
Kilo Moana - KVM / LXC (containers)

Panel Discussion

Implementation & Challenges

- What are the primary technical challenges of implementing virtualization on a ship? (e.g., power consumption, space, network stability, and environmental factors like vibration and temperature)

- How do current IT infrastructure and staffing on research vessels need to adapt?

- Discuss the role of standardization and interoperability across different vessels and institutions.

Panel Discussion

Future Outlook

- What are the next-generation technologies (beyond VMware) that the fleet should consider?

- Hyper Converged Infra vs traditional Host+Storage model

- How can industry and academia collaborate?

- What steps should the community take to move forward on a shared virtualization strategy / standardization.

- In the age of subscription and cloud-based everything, where do we go from here?