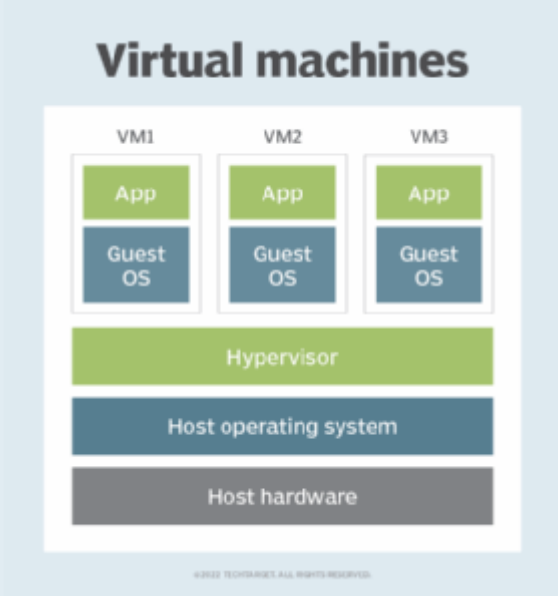
Virtual Machines (VMs)

A virtual machine, or VM, is a digitized version of a physical computer. Virtual machines can run programs and operating systems, store data, connect to networks, and do other computing functions. However, a VM uses entirely virtual resources instead of physical components.

A Virtual Machine (VM) is a software-based emulation of a physical computer that runs an operating system (OS) and applications just like a physical machine. VMs operate on top of a hypervisor, which manages and allocates hardware resources.



How VMs Work

1. **Hypervisor (Virtual Machine Monitor - VMM)**:
    - Type 1 (Bare-metal): Runs directly on hardware (e.g., VMware ESXi, Microsoft Hyper-V).
    - Type 2 (Hosted): Runs on an existing OS (e.g., Oracle VirtualBox, VMware Workstation).
2. **Virtualization**: Divides physical resources (CPU, RAM, storage) into multiple isolated virtual environments.
3. **Guest OS**: Each VM runs its own OS (Windows, Linux, etc.) independent of the host system.

Key Benefits

- **Cost Efficiency**: Reduces hardware expenses by running multiple VMs on a single server.
- **Isolation**: One VM crashing doesn't affect others.
- **Portability**: VMs can be migrated between hosts without downtime.
- **Legacy Software Support**: Run older OS versions safely.

Types of Virtual Machines & Use Cases

1. System Virtual Machines (Full Virtualization)

- Emulates an entire physical computer.
- Runs multiple OS instances simultaneously.
- **Examples**: VMware vSphere, Microsoft Hyper-V.
- **Use Cases**:
    - Server consolidation (cloud computing).
    - Software testing across different OS environments.

2. Process Virtual Machines (Application Virtualization)

- Runs a single application in an isolated environment.
- **Examples**: Java Virtual Machine (JVM), Docker (containerization).
- **Use Cases**:
    - Cross-platform app execution (e.g., Java apps).
    - Secure sandboxing for untrusted software.

3. Cloud-Based VMs

- Hosted on cloud platforms (IaaS).
- **Examples**: AWS EC2, Azure Virtual Machines, Google Compute Engine.
- **Use Cases**:
    - Scalable web hosting.
    - Disaster recovery solutions.