Olashile Agaba

Professor: Jeff Banham

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Tuning Practices for VM Memory - Capacity Planning Exercise

By Olashile, a Cloud Infrastructure Student (NOS 110 Complete, Currently in CTI 140)

Introduction

In virtualization, virtual machines (VMs) do not have direct access to the full physical memory of a host. Instead, the hypervisor manages memory allocation, assigning only what is provisioned for each VM. Efficient memory allocation balances performance, resource utilization, and cost-effectiveness in a virtualized environment. This exercise explores different capacity planning scenarios and memory optimization techniques to maximize VM density while maintaining system stability.

Physical Host's Memory Capacity

- Total physical memory: **128 GB RAM**
- Number of application servers: **32 VMs**
- Each application server requires **6 GB RAM**

Step 1: Without Memory Optimization

Each VM is allocated its full 6 GB memory requirement:

- **128 GB / 6 GB per VM = 21.33 VMs**
- Rounding down: **21 VMs** can be hosted.

Step 2: With 1.25:1 Memory Overcommitment

Memory overcommitment allows more VMs to run by allocating more virtual memory than the available physical memory.

- **128 GB × 1.25 = 160 GB virtual memory**
- **160 GB / 6 GB per VM = 26.67 VMs**
- Rounding down: **26 VMs** can be hosted.

Step 3: Using Actual 1 GB per VM Usage

If each VM only actively uses 1 GB of memory due to workload behavior, we can allocate based on actual usage:

- **160 GB / 1 GB per VM = 160 VMs**

Step 4: Applying a 90% Utilization Limit

To ensure stability and avoid overallocation issues, a 90% utilization limit is applied:

- **160 VMs × 0.9 = 144 VMs**

Final Results

Scenario	Number of VMs
Without memory optimizations	21
With 1.25:1 overcommit	26
With actual 1 GB usage & overcommit	160
With 90% utilization	144

Conclusion

Memory optimization techniques such as overcommitment, transparent page sharing, and memory ballooning enhance VM density while preserving performance. Although overcommitment allows more VMs to run on a host, administrators must carefully monitor resource usage and enforce limits to prevent contention. By balancing allocation strategies with real-time data, virtualization environments can maintain efficiency and reliability. In the optional weekly Q&A session, you mentioned that the expected number of VMs with a 1.25:1 overcommit ratio would be either 26 or 27. Thank you.