Understanding VMware Capacity

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Topics

- Why OS Monitoring Can be Misleading
- 5 Key VMWare Metrics for Understanding VMWare capacity
- How VMWare processor scheduling impacts CPU capacity measurements
- Measuring Memory Capacity
- Measuring Disk Storage Latency
- Calculating Headroom in VMs
Why OS Monitoring Can be Misleading: Determining CPU usage of a VM

CPU: 1 Second

VM1
OS: 50% CPU Busy
vmware: 25% CPU Busy
Dormant/Idle

VM2
OS: 50% CPU Busy
vmware: 50% CPU Busy
Why OS Monitoring Can be Misleading: OS vs. VM CPU Data Differences
Why OS Monitoring Can be Misleading: Time Slicing

- Cores are shared between vCPUs in time slices
  - 1 vCPU to 1 core at any point in time
- More vCPUs = More time slicing
- More time slicing = less accurate data from the OS
- Ignore OS metrics that involve time
  - (Disk Occupancy is probably OK)
5 Key VMWare Metrics

- CPU MHz
  - VM, Host, Cluster
- Ready Time
- Active Memory
  - VM, Cluster
- Ballooned Memory
- Host Disk Latency
  - Device, Kernel & Queue
5 Key VMWare Metrics: Ready Time

• **Ready Time**
  – VM wants to process, but can’t
  – Accumulated against VM
  – More of a stack than a queue
  – Contention for CPUs
  – Performance impact

• **How to avoid Ready Time**
  – Fewer vCPUs per VM
  – Monitor: CPU Threads vs vCPUs
    • & Ready Time
VMWare Processor Scheduling: Proportion of Time: 4 vCPU VM
VMWare Processor Scheduling:
Proportion of Time: 2 vCPU VM
VMWare Processor Scheduling: vCPU Co-Scheduling & Ready Time

Threads
1
2
3
4

Ready
VM
VM
VM
VM

Idle
VM
VM
VM
VM
VMWare Processor Scheduling: Ready Time - Recap

- Impacts on performance
- Monitor Ready Time as well as CPU %
- Avoid using high vCPU VMs - more VCPUs introduces the potential of higher ready time
Measuring Memory Capacity:
Not that simple

• Tightest headroom in most clusters
• Not just a question of % used
• Other VMWare memory management techniques
  – Reservations
  – Limits
  – Ballooning
  – Shared Pages
  – Active Memory
  – Memory Available for VMs
Measuring Memory Capacity: VM Memory Occupancy

VM Memory

- Average Memory overhead MB
- Average Memory used by the VM MB
- Average Memory shared MB
- Average Amount of host memory consumed by the VM MB
- Average Memory granted to the VM MB

14/Dec
Measuring Memory Capacity: VM Memory Performance

![VM Memory Performance Graph]

- **Average Memory reclaimed with vmmemctl MB**
- **Average Memory swapped MB**
- **Memory Limit MB**
- **Memory Reservation MB**
- **Average Amount of host memory consumed by the VM MB**

*Graph showing memory performance metrics over time.*
Measuring Memory Capacity: Cluster Memory

Cluster Memory Overview

- Avg Memory usage of total available memory %
- Average Amount of memory used by memory control MB
- Average Memory shared across VMs MB
- Average Swap space in use MB

Memory Used %

19/Dec

Memory MB
Measuring Disk Storage Latency: At the OS vs. within VMWare

- Why not KB/s or IO Time at the OS?
  - Time slicing
  - VMware has more detail

- 2 Levels of Interest
  - Device
  - Kernel
Measuring Disk Storage Latency: Kernel I/O Processing on processor 0

Host CPU time Utilization %

CPU time Utilization %

00:00:00 01:00:00 02:00:00 03:00:00 04:00:00 05:00:00 06:00:00 07:00:00 08:00:00 09:00:00 10:00:00 11:00:00 12:00:00 13:00:00 14:00:00 15:00:00 16:00:00 17:00:00 18:00:00 19:00:00 20:00:00 21:00:00 22:00:00 23:00:00

13/Dec
Measuring Disk Storage Latency
Total vs. Device Latency

Host Disk Latency

- Device Latency ms
- Kernel Latency ms
- Total Latency ms
Calculating Headroom in VMs

- Makes traditional Capacity Planners uncomfortable
- Easy number for the business to absorb
- Estimates are ok
  - Your Mileage May Vary
Headroom in Number of VMs

- (Size of the cluster – Used) / Average VM usage
- Do you have to cope with host failures (allow for failover capacity)?
  - Which is the largest host?
- What are you sizing on?
  - vCPUs to Core ratio?
  - MHz and MB
  - … Something else?
- Can you calculate your average VM?
- Prefer Small/Medium/Large?
Data Sources

• From your capacity management tool
  – Or collected manually from vCenter
• A good peak
  – Not when windows updates being applied and/or rebooted
• Future project requirements
Good Peak

![VMware Cluster, MHz graph]

- Average CPU usage MHz

Graph showing the average CPU usage MHz over a period from 7th Dec to 19th Dec, with peaks on the 10th Dec, 12th Dec, and a notable peak on the 13th Dec.
### Before Future Projects

<table>
<thead>
<tr>
<th>Number of VMs available</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bound By</td>
<td>Memory</td>
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- Existing VMs: 8
- Max VMs in Cluster: 14

Number of VMs based on existing average VM utilisation of the cluster. Cluster is 90% of n-1.
Including Known Plans

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Number of VMs based on existing average VM utilisation of the cluster. Cluster is 90% of n-1.
Trend

VMs available by CPU MHZ vs Average CPU per VM

- Least square fit
- 90% upper conf. limit
- 90% lower conf. limit
- VMs Available by CPU
Roundup

- Ready Time
  - Time slicing, vCPUs
- Memory
  - Active, Balloon, Swap
- Disk Latency

- Define the size of your cluster
- Average VM usage
  - Good peak
- Trend result
Thank you for attending

The End

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