



Ignite IT Performance™

Best Practices for Monitoring Databases on VMware

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Who Am I?

- 20+ Years in Oracle & SQL Server
 - DBA and Developer
 - Worked for Oracle Consulting
 - Specialize in Performance Tuning
 - Oracle, SQL Server, Sybase, DB2 on VMware
- Product Architect and DBA for Confio Software
 - DeanRichards@confio.com
 - Makers of Ignite8 Response Time Analysis Tools
 - IgniteVM for Oracle/SQL/Sybase/DB2 on VMware

- Virtualization at Confio
- Terms and Concepts
- Best Practices for Monitoring:
 - Memory
 - CPU
 - Storage
 - Network
- Summary

Why Virtualize?

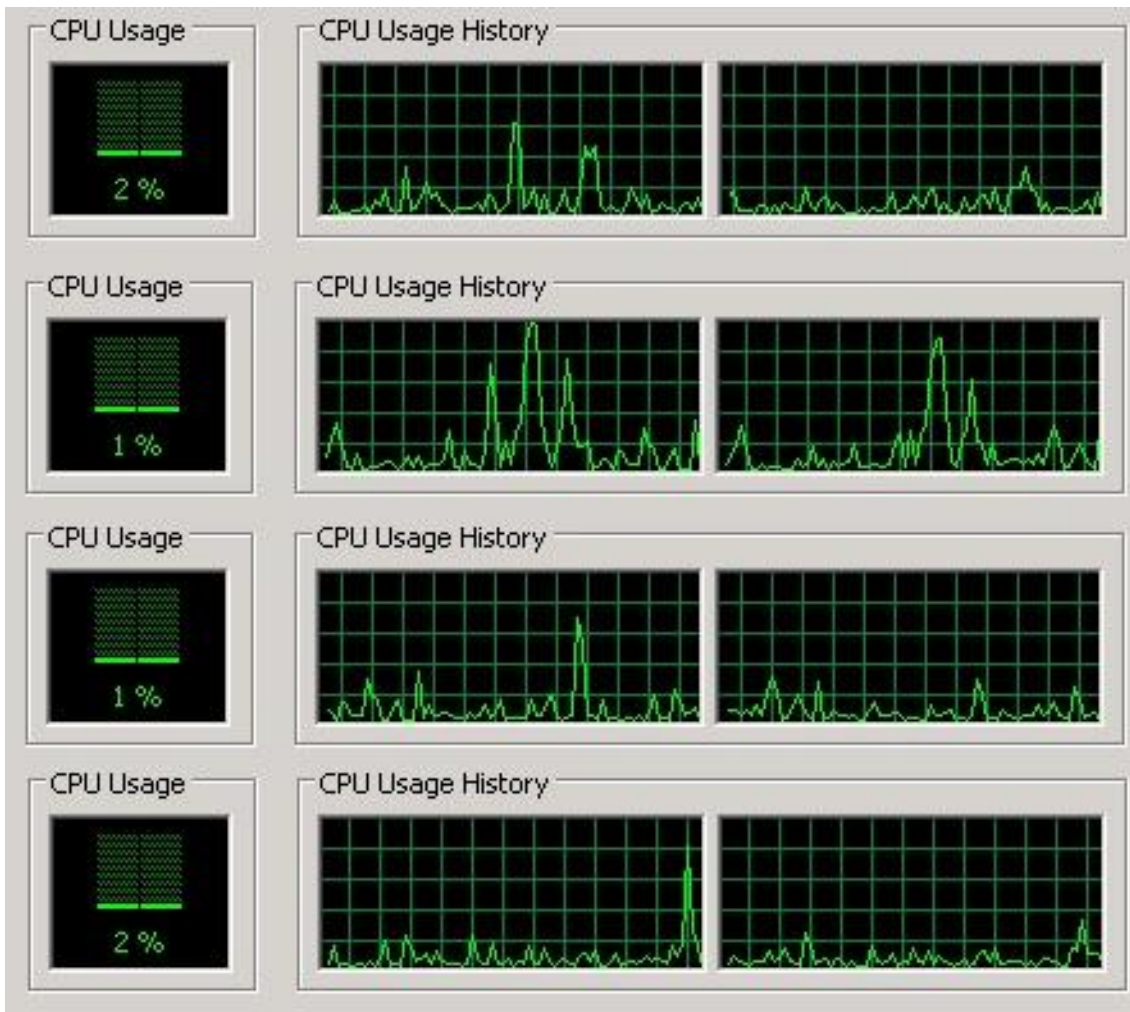
- Too much physical horsepower
 - Most are drastically underutilized
 - Many are running at <10% CPU
 - Confio Before Virtualization - Pictures
 - Confio After Virtualization - Pictures

Confio "Datacenter"

- 50+ Small Machines



Server Utilization



- All machines are severely underutilized
- Most machines running at 1-5% CPU

Confio New "DataCenter"



- Here is what we virtualized everything to.

New VMware Server Utilization

- New utilization of larger servers
 - We still have a lot of room

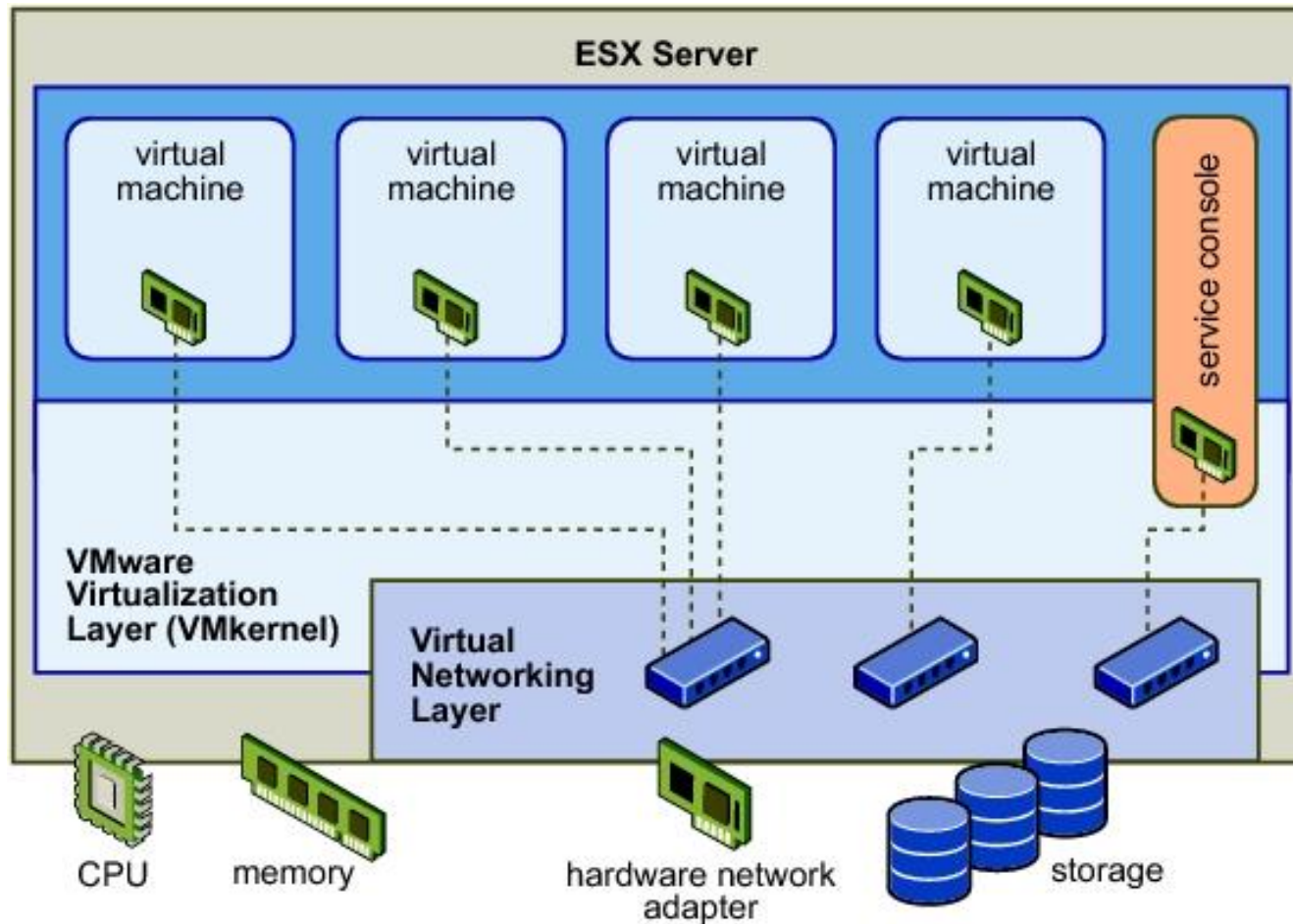


Why Virtualize?

- Easier to manage fewer physical boxes
 - Manage physical resources on 2, 4 or 8 physical machines vs. 50-100 small boxes
 - vMotion enables automatic resource balancing
- Cheaper
 - More bang for the buck with bigger machines
 - Increased power efficiency
 - Less floor space

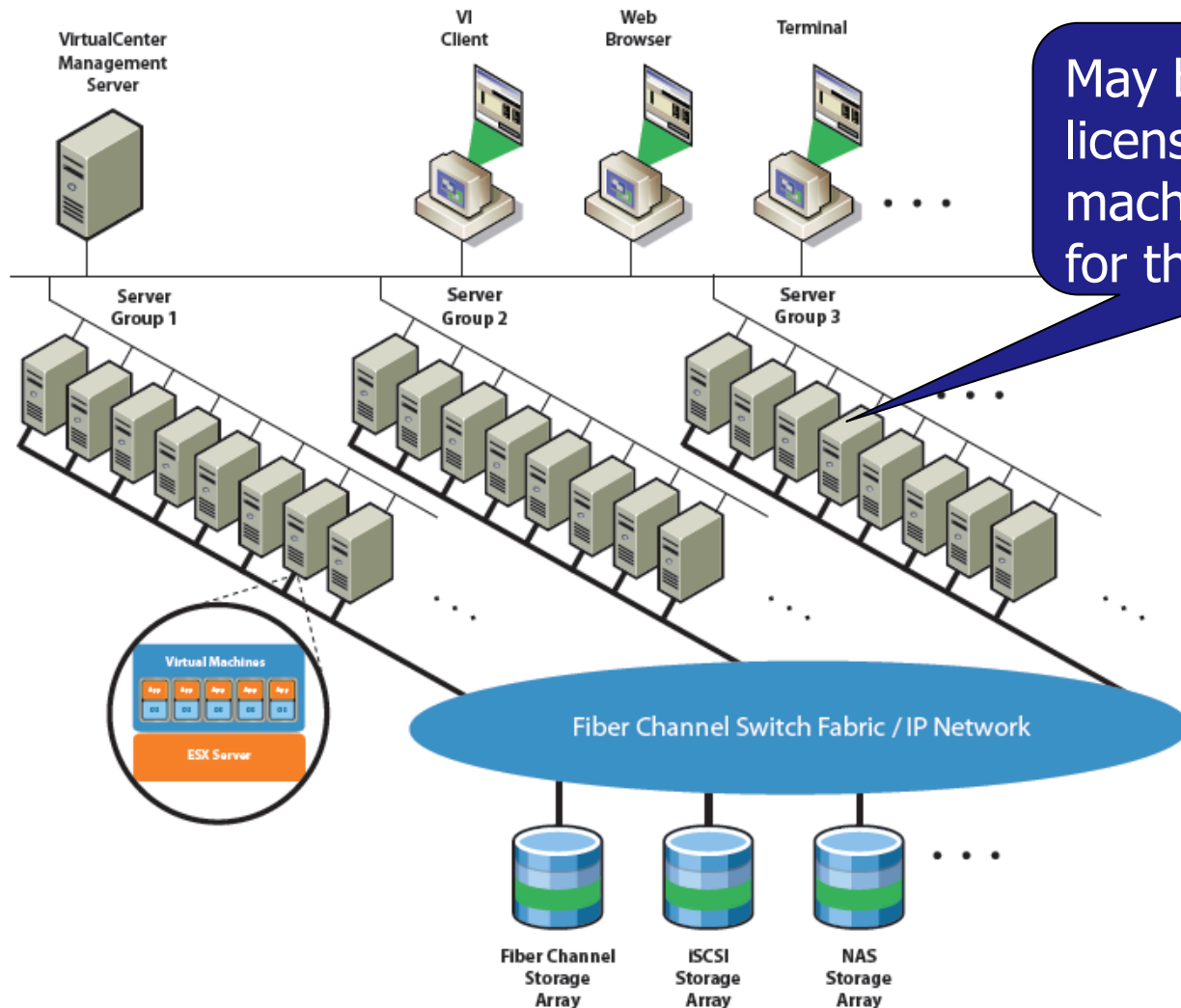
- Typically are supported by Database Vendor
 - If you have problems, vendor may ask you to reproduce on physical hardware
 - No bugs in any vendor support site related to VMware
- Most (95% says VMware) databases instances will be similar to native performance
 - <http://tinyurl.com/3e446rg> - TPC for Oracle
 - Fully saturated instances - 2-10% overhead
 - But, new hardware may be 10-30% faster
- Deploying databases on VMware is very similar to using physical servers
 - Monitoring the whole stack will take some change

VMware Architecture



- Picture courtesy of VMware

VMware Clusters



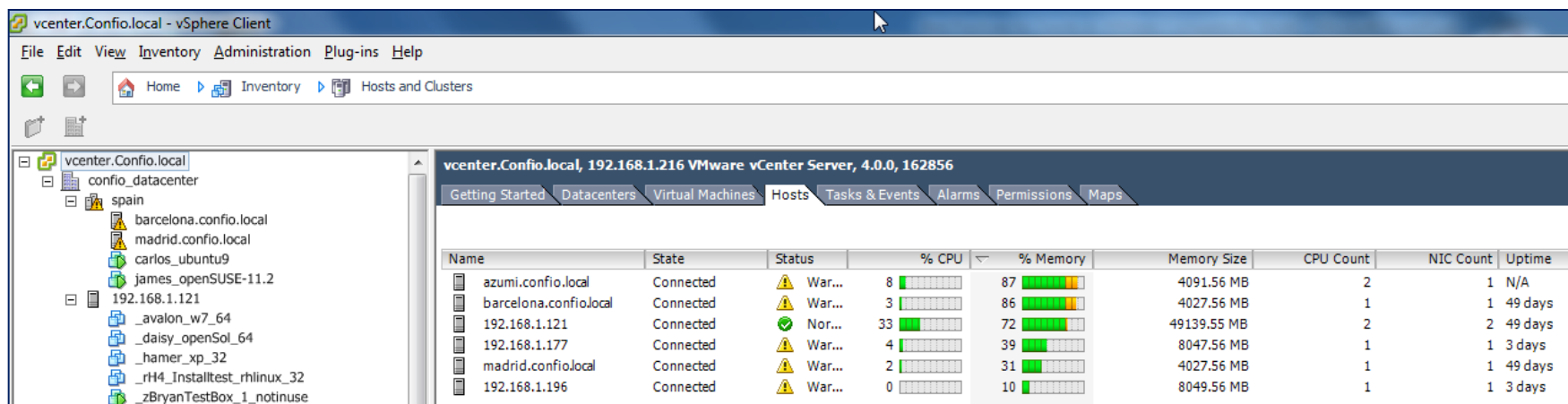
May be required to license all physical machines of cluster for the database

- ESX and ESXi – the hypervisor and foundation for VMware products
- Physical Host – underlying hardware where ESX is installed
- Virtual Machine (VM) – container inside host that looks like a physical machine
- vCenter Server – centralized management
- vSphere Client – Admin and Monitoring

- Cluster – several physical hosts linked together
- vMotion – live migration of VM from one host to another – no loss of connectivity
- Distributed Resource Scheduler (DRS) – can automatically make sure hosts in a cluster have a balanced workload – uses vMotion
- High Availability (HA) – automated restart of VMs after host failure – several minutes of downtime
- Fault Tolerance (FT) – a mirrored copy of a VM on another host – takes over with no downtime
- Consolidated Backup – (VCB) – integrates with several 3rd party tools to backup a snapshot of the VM

Monitoring - vSphere

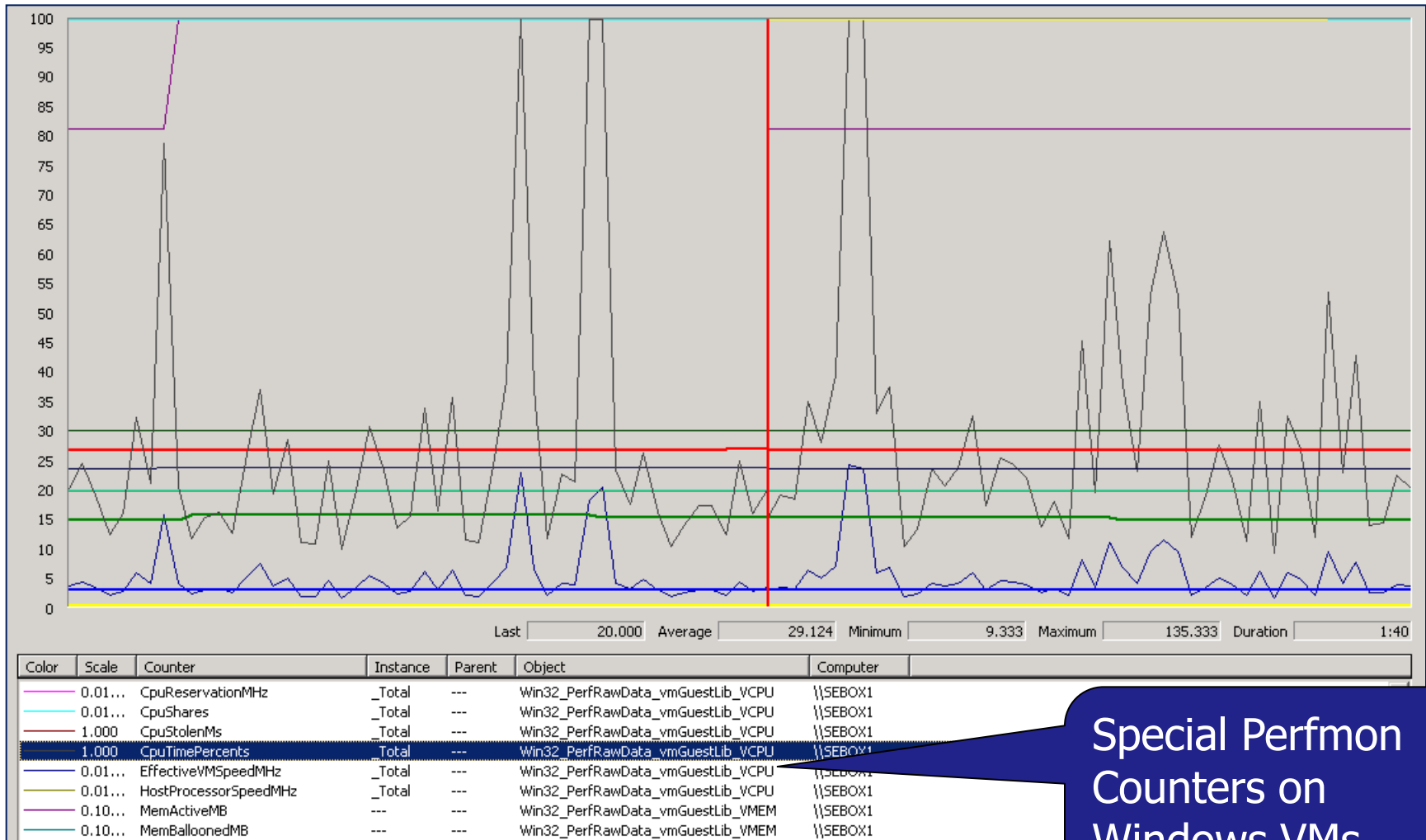
- Get access to vSphere client
 - Need a user account
 - <http://<machine>> - provides download link
- Why should I use vSphere?
 - Standard O/S Counters may be wrong!



The screenshot shows the vSphere Client interface for vcenter.Confio.local. The left pane displays a tree view of the inventory, including a datacenter, a host group (spain), and several hosts. The right pane shows the 'Hosts' tab with a table of host details.

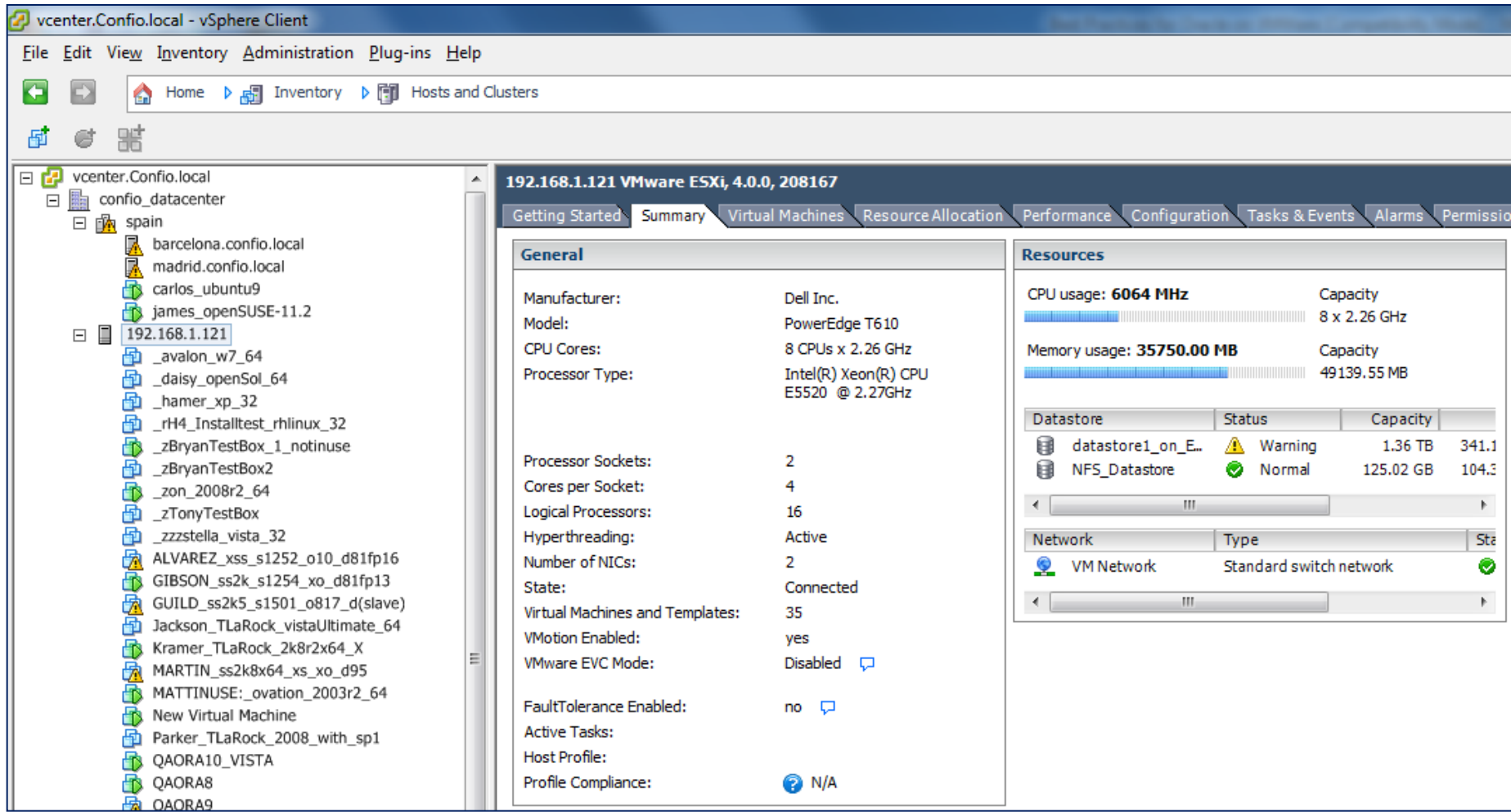
Name	State	Status	% CPU	% Memory	Memory Size	CPU Count	NIC Count	Uptime
azumi.confio.local	Connected	War...	8	87	4091.56 MB	2	1	N/A
barcelona.confio.local	Connected	War...	3	86	4027.56 MB	1	1	49 days
192.168.1.121	Connected	Nor...	33	72	49139.55 MB	2	2	49 days
192.168.1.177	Connected	War...	4	39	8047.56 MB	1	1	3 days
madrid.confio.local	Connected	War...	2	31	4027.56 MB	1	1	49 days
192.168.1.196	Connected	War...	0	10	8049.56 MB	1	1	3 days

VMware Perfmon Counters



Special Perfmon Counters on Windows VMs

vSphere – Host Summary



The screenshot displays the vSphere Client interface for a host named '192.168.1.121 VMware ESXi, 4.0.0, 208167'. The interface is divided into several sections:

- Left Panel:** A tree view showing the inventory structure. The host '192.168.1.121' is selected, and its contents are listed, including various test boxes and virtual machines.
- Top Panel:** A navigation bar with tabs for 'Getting Started', 'Summary', 'Virtual Machines', 'Resource Allocation', 'Performance', 'Configuration', 'Tasks & Events', 'Alarms', and 'Permissions'. The 'Summary' tab is currently active.
- General Section:** Provides key hardware and configuration details:
 - Manufacturer: Dell Inc.
 - Model: PowerEdge T6 10
 - CPU Cores: 8 CPUs x 2.26 GHz
 - Processor Type: Intel(R) Xeon(R) CPU E5520 @ 2.27GHz
 - Processor Sockets: 2
 - Cores per Socket: 4
 - Logical Processors: 16
 - Hyperthreading: Active
 - Number of NICs: 2
 - State: Connected
 - Virtual Machines and Templates: 35
 - VMotion Enabled: yes
 - VMware EVC Mode: Disabled
 - FaultTolerance Enabled: no
 - Active Tasks: (empty)
 - Host Profile: (empty)
 - Profile Compliance: N/A
- Resources Section:** Displays resource usage and capacity:
 - CPU usage: 6064 MHz (Capacity: 8 x 2.26 GHz)
 - Memory usage: 35750.00 MB (Capacity: 49139.55 MB)
 - Datstore Table:**

Datstore	Status	Capacity	Used
datastore1_on_E...	Warning	1.36 TB	341.1
NFS_Datstore	Normal	125.02 GB	104.3
 - Network Table:**

Network	Type	Status
VM Network	Standard switch network	Connected

vSphere – Host Performance

vcenter.Confio.local

- confio_datacenter
 - spain
 - barcelona.confio.local
 - madrid.confio.local
 - carlos_ubuntu9
 - james_openSUSE-11.2
 - 192.168.1.121
 - _avalon_w7_64
 - _daisy_openSol_64
 - _hamer_xp_32
 - _rH4_Installtest_rhlinux_32
 - _zBryanTestBox_1_notinuse
 - _zBryanTestBox2
 - _zon_2008r2_64
 - _zTonyTestBox
 - _zzzstella_vista_32
 - ALVAREZ_xss_s1252_o10_d81fp16
 - GIBSON_ss2k_s1254_xo_d81fp13
 - GUILD_ss2k5_s1501_o817_d(slave)
 - Jackson_TLaRock_vistaUltimate_64
 - Kramer_TLaRock_2k8r2x64_X
 - MARTIN_ss2k8x64_xs_xo_d95
 - MATTINUSE:_ovation_2003r2_64
 - New Virtual Machine
 - Parker_TLaRock_2008_with_sp1
 - QAORA10_VISTA
 - QAORA8
 - QAORA9
 - QASQL2K_WIN
 - QASQL2K5-CSWIN
 - QASQL2K8-CS
 - RobTest2
 - u oracle enterprise linux_y
 - ubuntu - ignite8 - too big
 - Ubuntu 8.04 JeOS does not work
 - Ubuntu JeOS - Ignite8
 - ubuntu jeos - krista1
 - VirtualKernel_CA_4.3_Release4_SE
 - VMRH4-DB2_xss_xs_xo_d91
 - VMware Capacity IQ
 - YAMAHA_xss_xs_xo_d95
 - z_vCenter Demo
 - azumi.confio.local
 - _bond_suse11.2_32
 - _crescent_2008sp2_32
 - _hondo_2003r2sp2_32
 - _ibanez_xp32_x
 - _levin_openSolaris2009.06_32

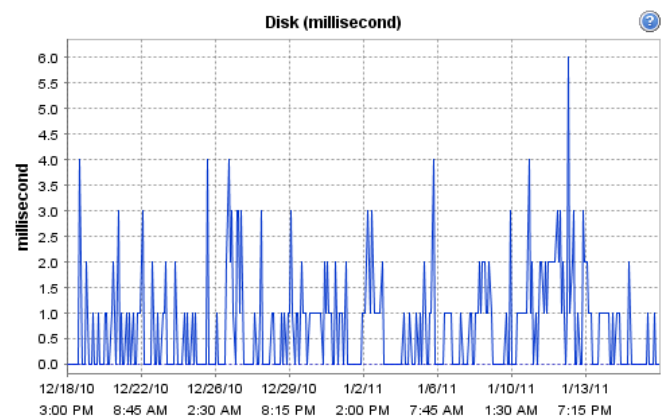
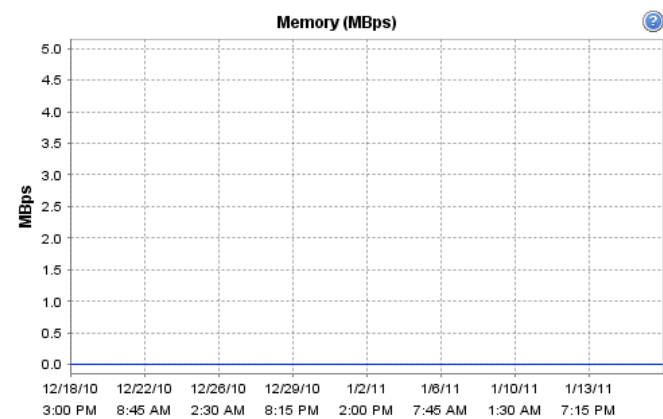
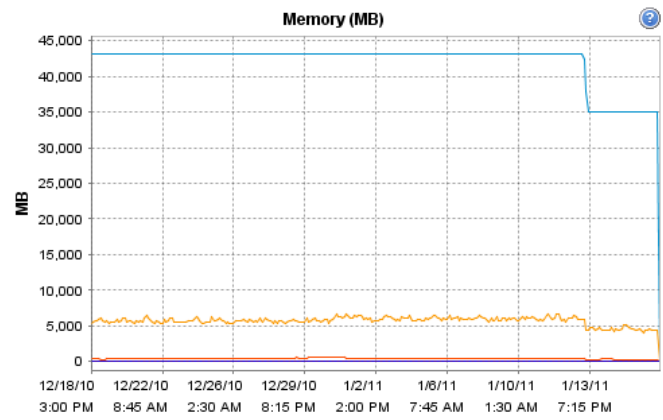
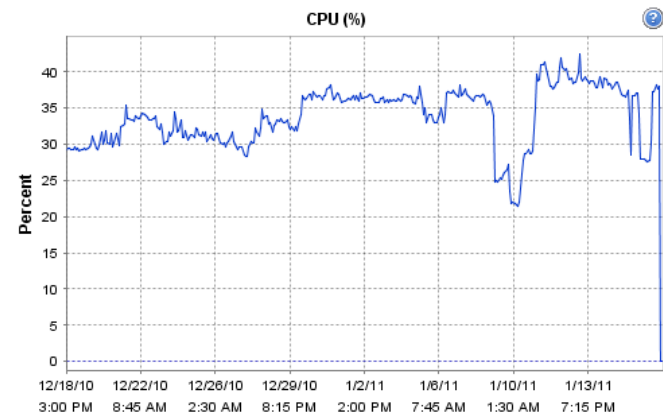
192.168.1.121 VMware ESXi, 4.0.0, 208167

Getting Started Summary Virtual Machines Resource Allocation Performance Configuration Tasks & Events Alarms Permissions Maps Hardware Status

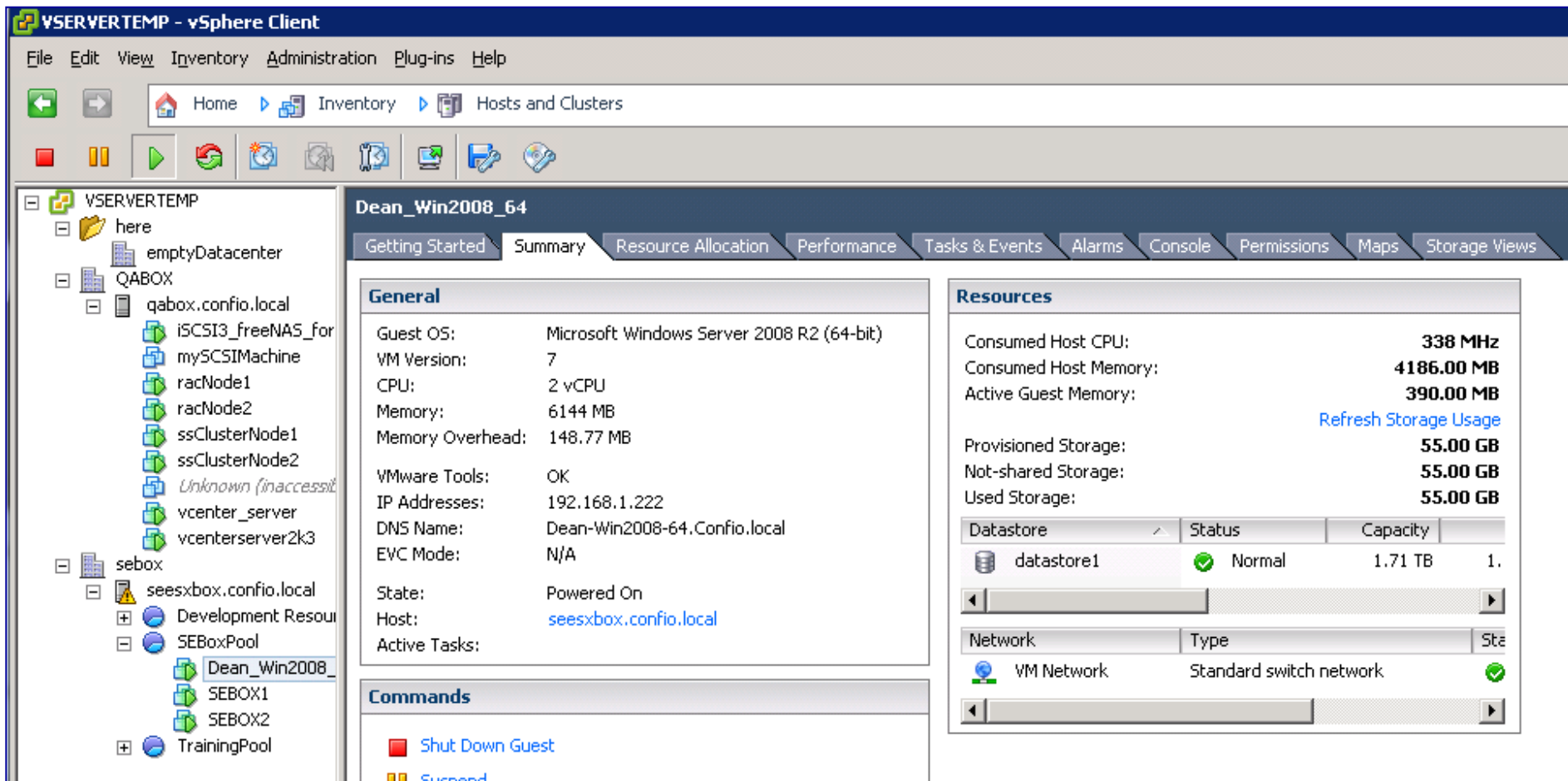
Overview Advanced

View: Home Time Range: 1 Month

1 Month Summary for 192.168.1.121



vSphere – VM Summary



VSERVERTEMP - vSphere Client

File Edit View Inventory Administration Plug-ins Help

Home > Inventory > Hosts and Clusters

VSERVERTEMP

- here
 - emptyDatacenter
- QABOX
 - qabox.confio.local
 - ISCSI3_freeNAS_for
 - mySCSIMachine
 - racNode1
 - racNode2
 - ssClusterNode1
 - ssClusterNode2
 - Unknown (inaccessib
 - vcenter_server
 - vcenterserver2k3
- sebox
 - seesxbox.confio.local
 - Development Resou
 - SEBoxPool
 - Dean_Win2008_64**
 - SEBOX1
 - SEBOX2
 - TrainingPool

Dean_Win2008_64

Getting Started Summary Resource Allocation Performance Tasks & Events Alarms Console Permissions Maps Storage Views

General

Guest OS: Microsoft Windows Server 2008 R2 (64-bit)
VM Version: 7
CPU: 2 vCPU
Memory: 6144 MB
Memory Overhead: 148.77 MB
VMware Tools: OK
IP Addresses: 192.168.1.222
DNS Name: Dean-Win2008-64.Confio.local
EVC Mode: N/A
State: Powered On
Host: seesxbox.confio.local
Active Tasks:

Resources

Consumed Host CPU: **338 MHz**
Consumed Host Memory: **4186.00 MB**
Active Guest Memory: **390.00 MB**
[Refresh Storage Usage](#)

Provisioned Storage: **55.00 GB**
Not-shared Storage: **55.00 GB**
Used Storage: **55.00 GB**

Datastore	Status	Capacity	Free Space
datastore1	Normal	1.71 TB	1.71 TB

Network

Network	Type	Status
VM Network	Standard switch network	Connected

Commands

- Shut Down Guest
- Suspend

vSphere – VM Performance

vcenter.Confio.local

- confio_datacenter
 - spain
 - barcelona.confio.local
 - madrid.confio.local
 - carlos_ubuntu9
 - james_openSUSE-11.2
 - 192.168.1.121
 - _avalon_w7_64
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 - _hamer_xp_32
 - _rH4_InstallTest_rhlinux_32
 - _zBryanTestBox_1_notinuse
 - _zBryanTestBox2
 - _zon_2008r2_64
 - _zTonyTestBox
 - zzzstella_vista_32
 - ALVAREZ_xss_s1252_o10_d81fp16**
 - GIBSON_ss2k_s1254_xo_d81fp13
 - GUILD_ss2k5_s1501_o817_d(slave)
 - Jackson_TLaRock_vistaUltimate_64
 - Kramer_TLaRock_2k8r2x64_X
 - MARTIN_ss2k8x64_xs_xo_d95
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 - QAORA8
 - QAORA9
 - QASQL2K_WIN
 - QASQL2K5-CSWIN
 - QASQL2K8-CS
 - RobTest2
 - u oracle enterprise linux_y
 - ubuntu - ignite8 - too big
 - Ubuntu 8.04 JeOS does not work
 - Ubuntu JeOS - Ignite8
 - ubuntu jeos - krista1
 - VirtualKernel_CA_4.3_Release4_SE
 - VMRH4-DB2_xss_xs_xo_d91
 - VMware Capacity IQ
 - YAMAHA_xss_xs_xo_d95
 - z_vCenter Demo
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 - _bond_suse11.2_32
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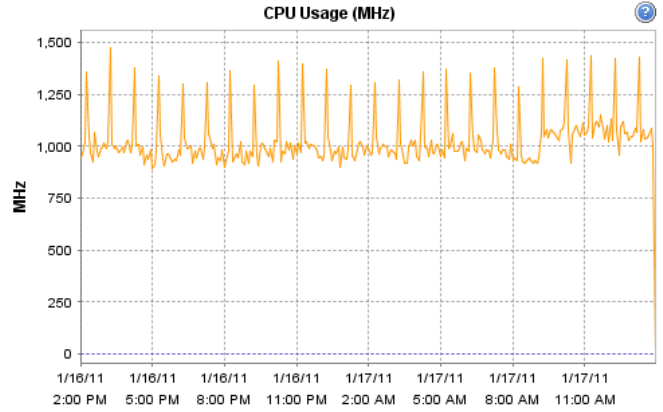
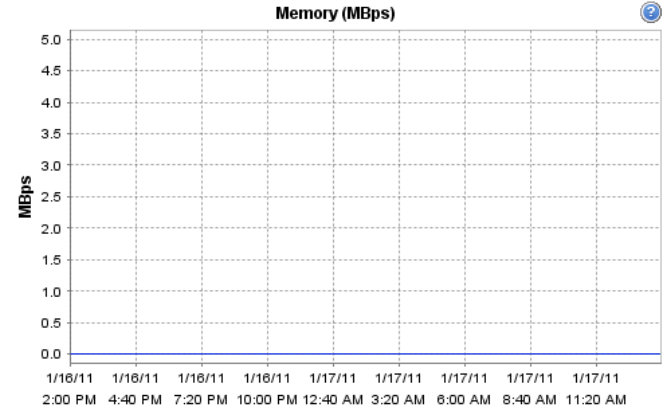
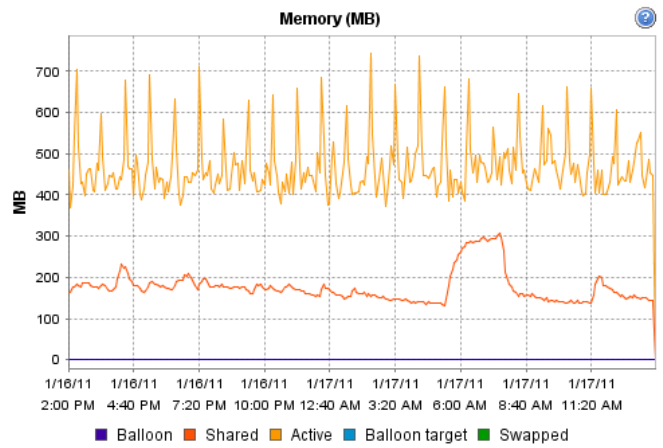
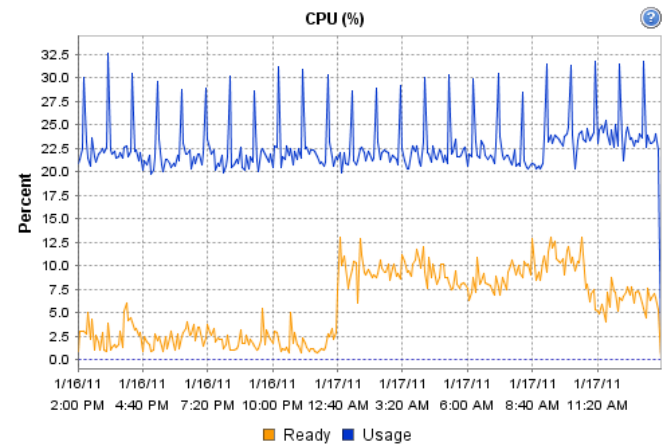
ALVAREZ_xss_s1252_o10_d81fp16

Getting Started Summary Resource Allocation Performance Tasks & Events Alarms Console Permissions Maps

Overview Advanced

View: Home | Time Range: 1 Day

1 Day Summary for ALVAREZ_xss_s1252_o10_d81fp16

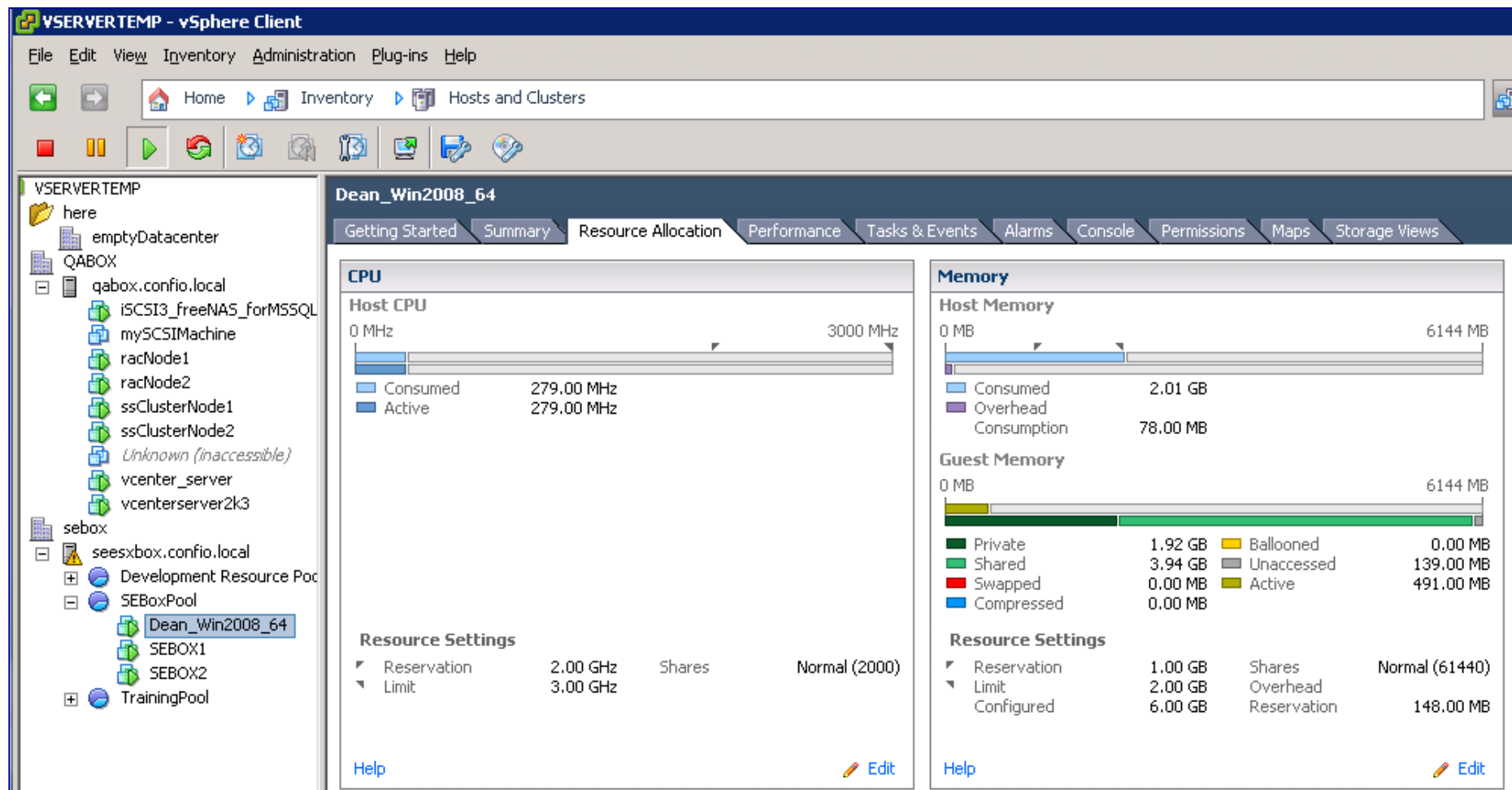


Memory Concepts

- Configured – amount of RAM given to VM
- Reservation – guarantees amount of RAM (default 0)
 - A reservation of 2GB means 2GB of physical memory must be available to power on the VM
- Limit – limits amount of RAM (default unlimited)
- Shares – priority of getting RAM
- Ballooning – unused memory that was given back for use on other VMs
- Swapping – memory (could be active) given back forcibly for use on other VMs
- Shared Memory – identical memory pages are shared among VMs

VM Memory Utilization

- How does memory allocation work



The screenshot displays the vSphere Client interface for a VM named 'Dean_Win2008_64'. The 'Resource Allocation' tab is active, showing CPU and Memory details.

CPU

Host CPU: 0 MHz to 3000 MHz

Consumed	279.00 MHz
Active	279.00 MHz

Resource Settings

Reservation	2.00 GHz	Shares	Normal (2000)
Limit	3.00 GHz		

Memory

Host Memory: 0 MB to 6144 MB

Consumed	2.01 GB
Overhead Consumption	78.00 MB

Guest Memory

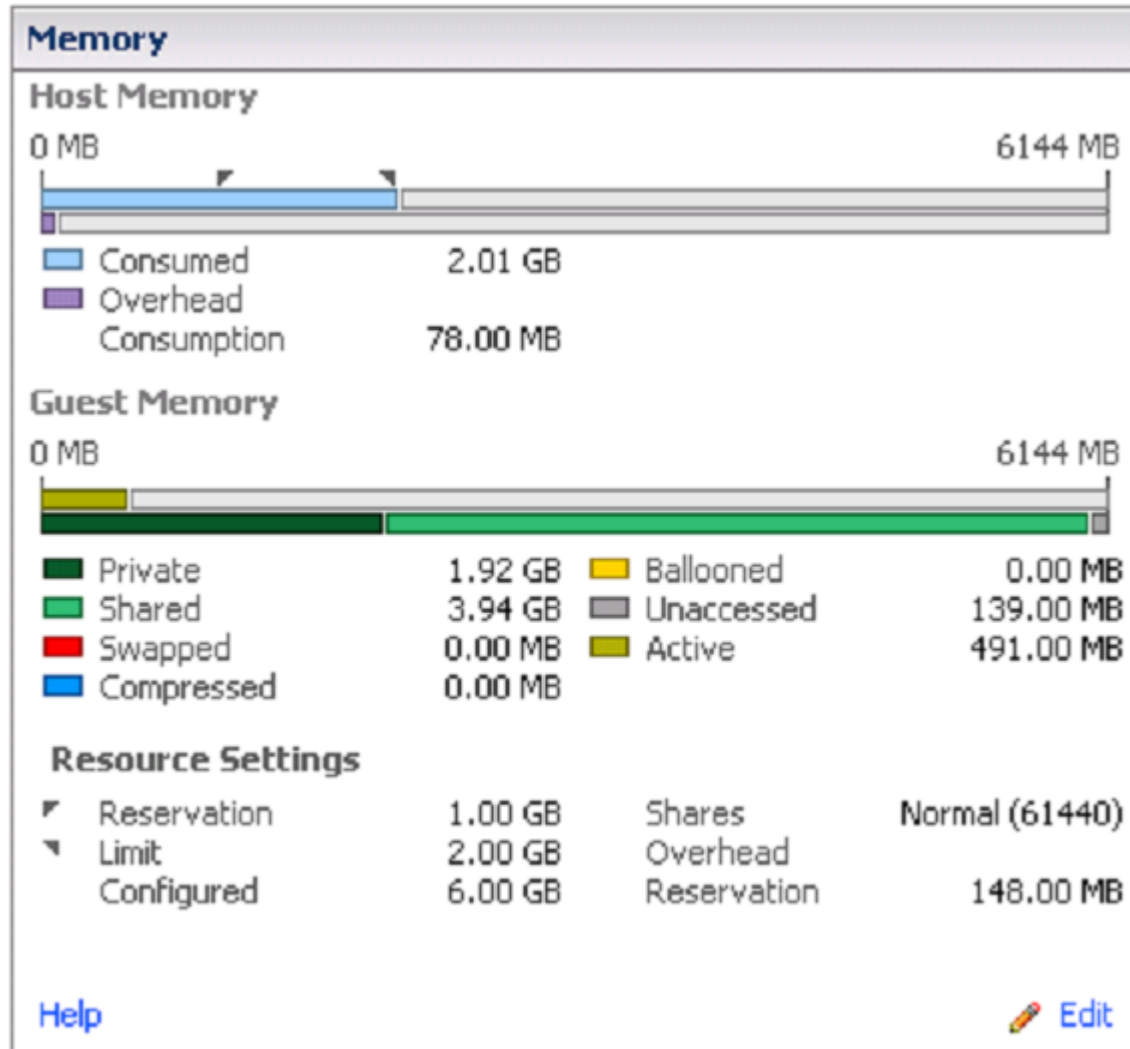
0 MB to 6144 MB

Private	1.92 GB	Ballooned	0.00 MB
Shared	3.94 GB	Unaccessed	139.00 MB
Swapped	0.00 MB	Active	491.00 MB
Compressed	0.00 MB		

Resource Settings

Reservation	1.00 GB	Shares	Normal (61440)
Limit	2.00 GB	Overhead	
Configured	6.00 GB	Reservation	148.00 MB

VM Memory Details



Host Memory Utilization

VSERVERTEMP - vSphere Client

File Edit View Inventory Administration Plug-ins Help

Home Inventory Hosts and Clusters

VSERVERTEMP

- here
 - emptyDatacenter
- QABOX
 - qabox.confio.local
 - bobserverCLONED
 - iSCSI3_freeNAS_for
 - mySCSIIMachine (ina
 - New Virtual Machine
 - racNode1
 - racNode2
 - SimplifiedChinese_W
 - ssClusterNode1
 - ssClusterNode2
 - Unknown (inaccessit
 - vcenter_server
 - vcenterserver2k3
- sebox
 - seesxbox.confio.local
 - Development Resou
 - SEBoxPool
 - Dean_Win2008_
 - SEBOX1
 - SEBOX2

SEBoxPool

Getting Started Summary Virtual Machines **Resource Allocation** Performance Tasks & Events Alarms Permissions Maps Storage Views

CPU

Configured Reservation:	0 MHz
Reservation Type:	Expandable
Used Reservation:	2000 MHz
Available Reservation:	11858 MHz

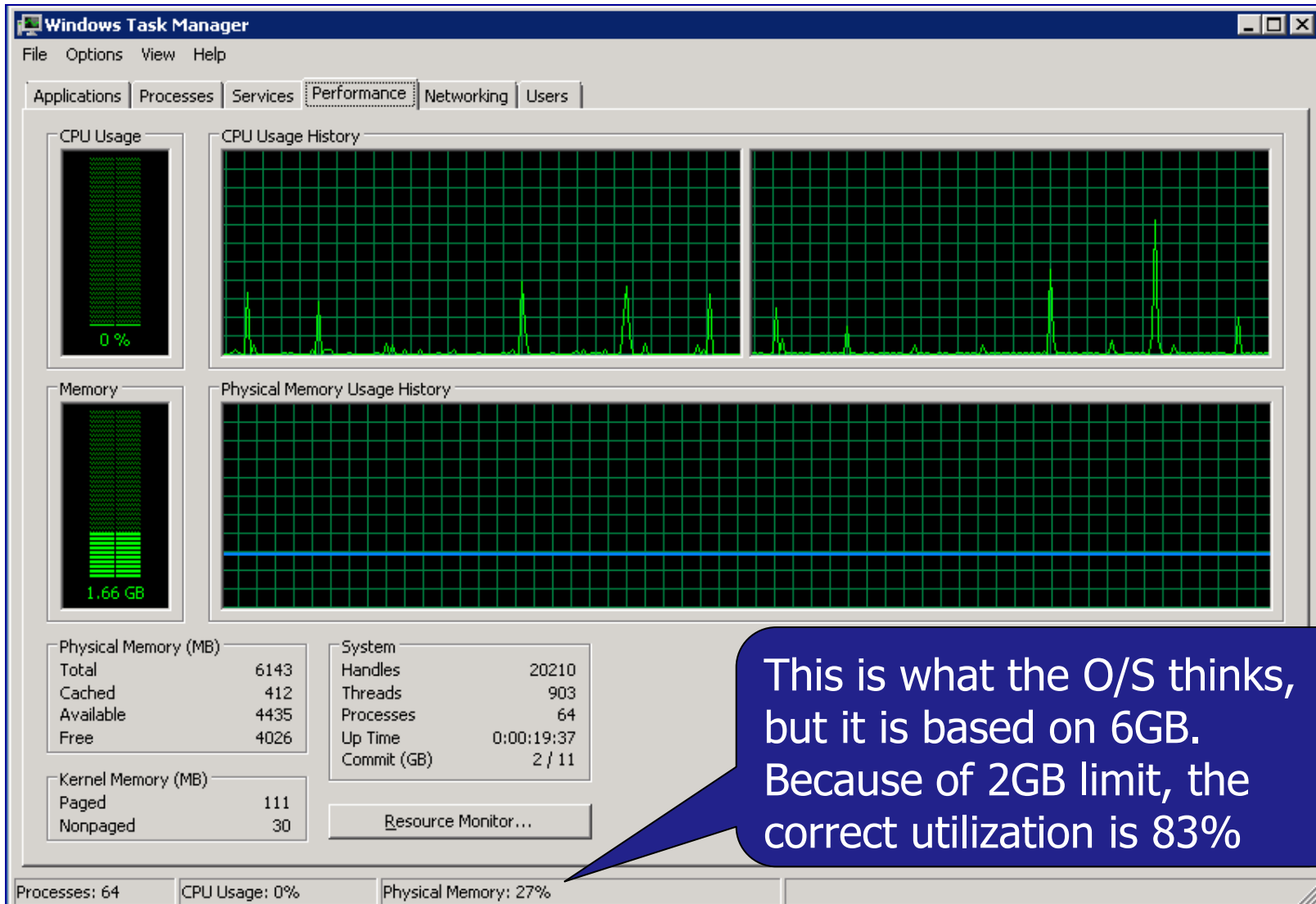
Memory

Configured Reservation:	0 MB
Reservation Type:	Expandable
Used Reservation:	1620.98 MB
Available Reservation:	25666.62 MB

View: CPU Memory **Storage**

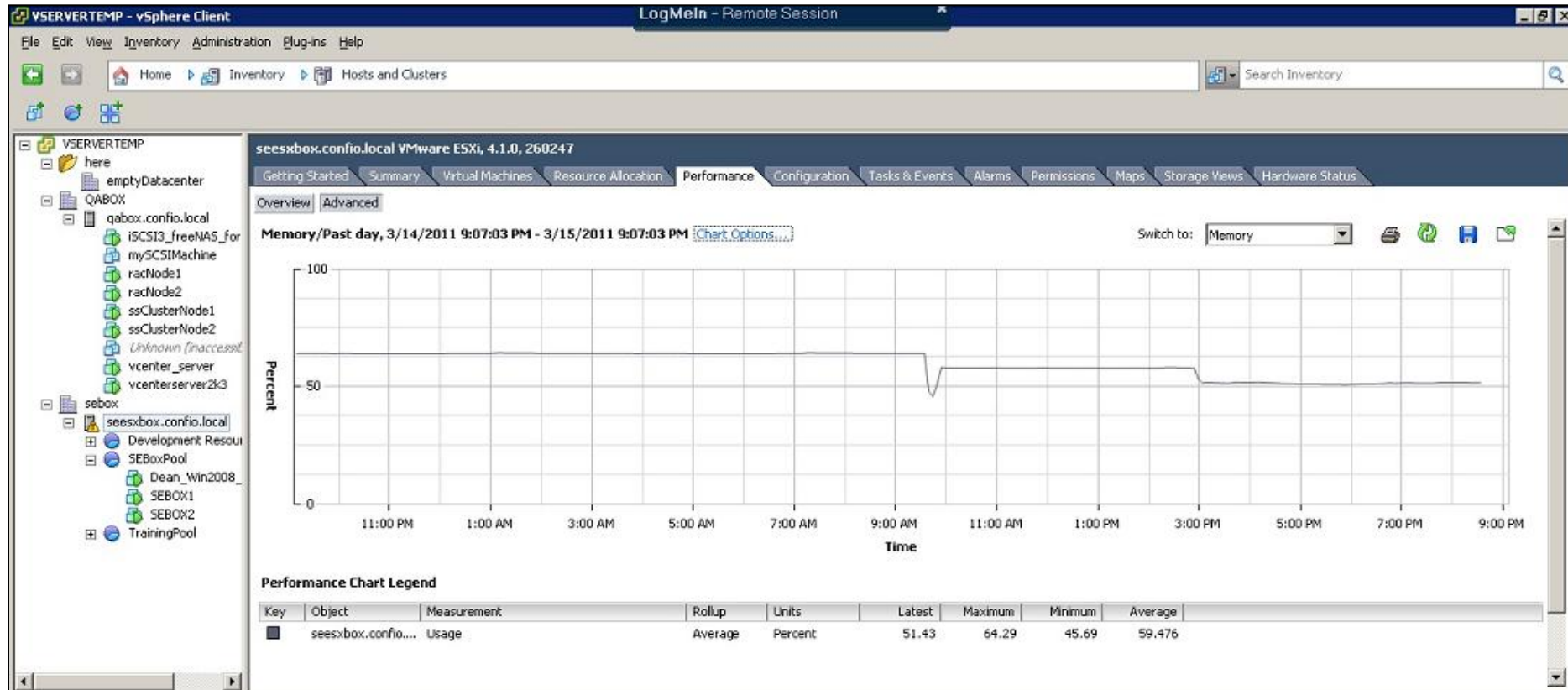
Name	Reservation - MB	Limit - MB	Shares	Shares Value	% Shares	Type
SEBOX2	0	Unlimited	Normal	30200	24	N/A
SEBOX1	0	Unlimited	Normal	30200	24	N/A
Dean_Win2008_64	1024	3072	Normal	61440	50	N/A

O/S Counter Problem



- Set Memory Reservation \geq Database Memory
 - If limits are used, do not exceed this amount for DB
 - Leave room for O/S and other things
- Be careful about overcommitting in production
 - Can be less careful in dev/test/stage
- Set CPU/MMU Virtualization to Automatic
 - Use hardware assisted memory management if you can
- Large Pages are Supported in VMware

Charts in vSphere



- Primary Metric – Swapping, Ballooning
- Secondary Metrics – VM & Host Memory Utilization, VM Memory Reservation, VM Memory Limit
- Rules
 - If Any Swapping is occurring
 - Host needs more memory because it cannot satisfy current demands
 - Lessen demands for memory – lower reservations where possible
 - Excessive Ballooning
 - May be ok for now, but could be a pending issue
 - VM Memory Utilization High
 - May not be a problem now unless Guest O/S swapping is occurring
 - If VM is limited, may want to increase memory this VM can get
 - If Host Memory Utilization High
 - May not be a problem now if no swapping or ballooning
 - Could be a problem soon for all VMs on this host


- Configured – Number of vCPU
 - Think in terms of clock speed ($\# \text{ vCPU} * \text{GHz}$)
- Reservation – amount of CPU guaranteed
- Limit – limits the amount of CPU
- Shares – sets priority for this VM
- Databases are not typically CPU bound
 - Use only the vCPUs required
 - If not known, start with 1 or 2 and increase later
 - vSphere attempts to co-schedule CPUs
 - If you have 4 vCPU, 4 physical cores need to be available to start processing
 - This is handled much better in ESX 4.x

VM CPU Utilization

CPU

Host CPU


0 MHz 3000 MHz



Consumed	338.00 MHz
Active	338.00 MHz

Resource Settings

Reservation	2.00 GHz	Shares	Normal (2000)
Limit	3.00 GHz		


[Help](#)  [Edit](#)

ts Alarms Console Permissions Maps Storage Views

Memory

Host Memory


6144 MB



Consumed	2.01 GB
Overhead Consumption	78.00 MB

Guest Memory

6144 MB



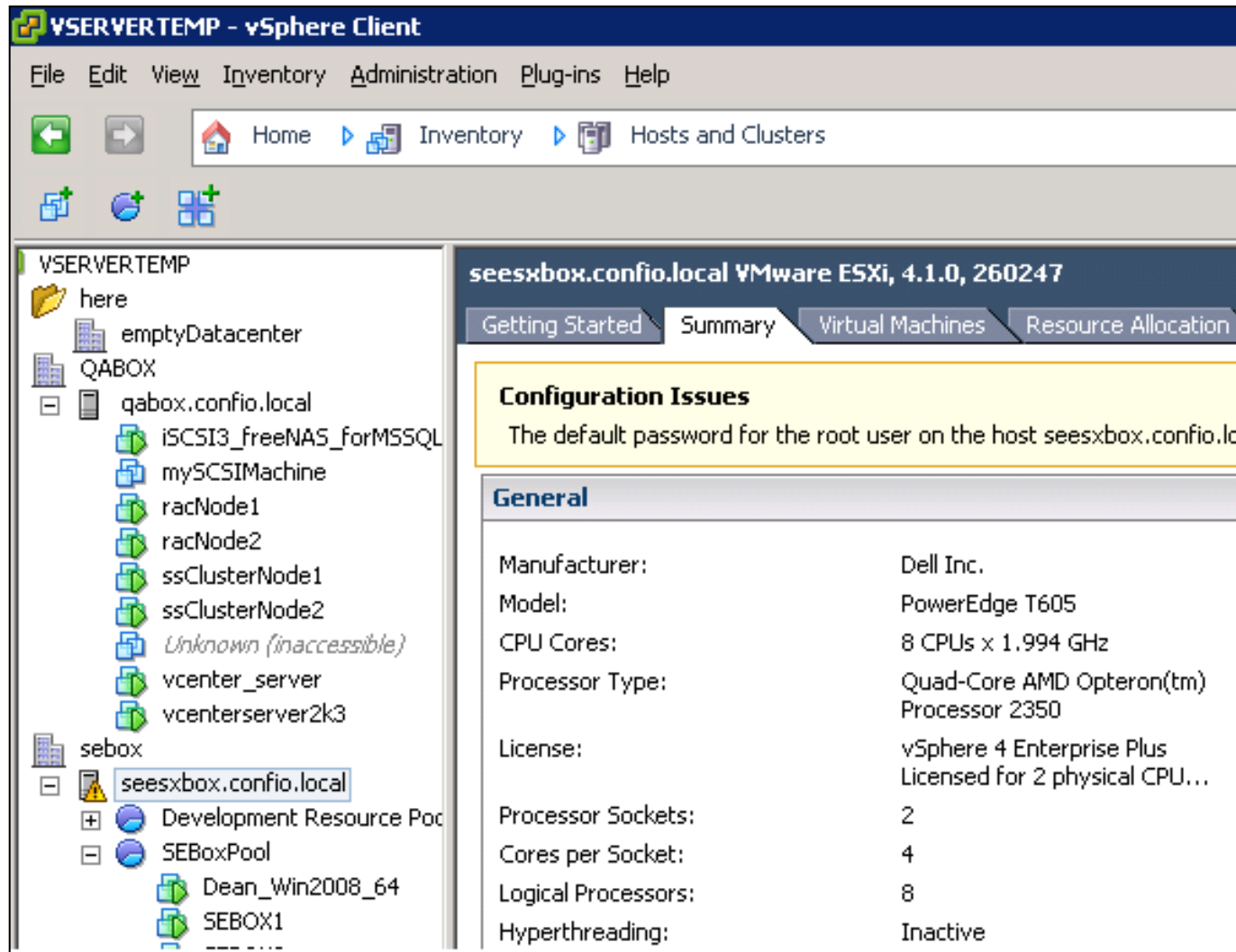
Private	1.92 GB	Ballooned	0.00 MB
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Resource Settings

Reservation	1.00 GB	Shares	Normal (61440)
Limit	2.00 GB	Overhead	
Configured	6.00 GB	Reservation	148.00 MB

[Edit](#)

VM CPU Details



The screenshot shows the vSphere Client interface. The left pane displays a tree view of the inventory, with the host `seesxbox.confio.local` selected. The right pane shows the host's configuration details, including a warning for configuration issues and a table of general hardware information.

Configuration Issues

The default password for the root user on the host `seesxbox.confio.lo`

General	
Manufacturer:	Dell Inc.
Model:	PowerEdge T605
CPU Cores:	8 CPUs x 1.994 GHz
Processor Type:	Quad-Core AMD Opteron(tm) Processor 2350
License:	vSphere 4 Enterprise Plus Licensed for 2 physical CPU...
Processor Sockets:	2
Cores per Socket:	4
Logical Processors:	8
Hyperthreading:	Inactive

- Primary Metric – VM Ready Time
- Secondary Metrics – VM CPU Utilization, Host CPU Utilization
- Rules
 - If VM Ready Time > 10-20%
 - If Host CPU Utilization is high => Need more CPU resources on Host
 - If Host CPU Utilization ok => VM is limited, give more CPU resources
 - If VM CPU Utilization high (sustained over 80%)
 - May not be a problem now if no ready time
 - could be a problem soon for this VM
 - If Host CPU Utilization high (sustained over 80%)
 - May not be a problem now if no ready time on any VM
 - Could be a problem soon for all VMs on this host
 - Balance VM resources better

- The VM is a set of files on shared storage
- All nodes of cluster will access the same storage
- VMFS - VMware File System
- Datastore – access point to storage
- Storage issues are usually related to configuration and not capabilities of ESX
- Follow best practices from storage vendor
- Create dedicated datastores for databases
 - More flexibility
 - Bad SAN planning cannot be fixed by datastores
 - Isolate data and log activity

- Primary Metrics – Host maxTotalLatency, Host Device Latency (by device), VM Disk Commands Aborted, VM Command Latency
- Secondary Metrics – Host Disk Read Rate, Host Disk Write Rate, VM Disk Usage Rate
- Rules
 - If Host Latency \geq 20-30 ms
 - Review Device Latencies to understand which one has latencies
 - Review Disk Read / Write rates
 - If Close to Storage Capacity - Overloaded Storage
 - Otherwise - Slow Storage
 - If VM Command Latency \geq 30ms only for your VM
 - Tune Disk I/O intensive processes on database
 - Are Memory / CPU issues causing I/O problems

- vSwitch – software switch inside Vmkernel
 - Can be tied to 1 or more NICs
- VMware can handle > 30GB / sec
- Databases are not typically network constrained
 - Typically well below 100 MB / sec
- If you need more bandwidth, consider VMXNET paravirtualized network adapter
 - Installed into guest O/S capable of 1Gbps
 - Minimizes overhead between VM and Host
 - Requires VMware Tools

- Primary Metric – Dropped Receive Packets, Dropped Transmit Packets
- Secondary Metrics – Network Rate
- Rules
 - If any packets are being dropped
 - Look for errors on the Host's NIC
 - See if one NIC is getting all traffic
 - Understand which VM is causing the most traffic and reduce it
 - If Network Rate is getting close to maximum for hardware
 - Understand which VM is causing load
 - May need to get better network hardware

- Too much information
 - 100s of counters – no indication of importance
- Not enough detailed data
 - Keeps details only for a day by default – rolls to hourly
 - Expand this and GUI performance becomes issue
- GUI performance
 - vSphere is slow and frustrating at times
- Graphs are isolated
 - Can only see one type of chart at a time
 - Hard to mix Memory, CPU, Storage, etc

- <http://www.confio.com/demo>
 - Username / Password – demo/demo

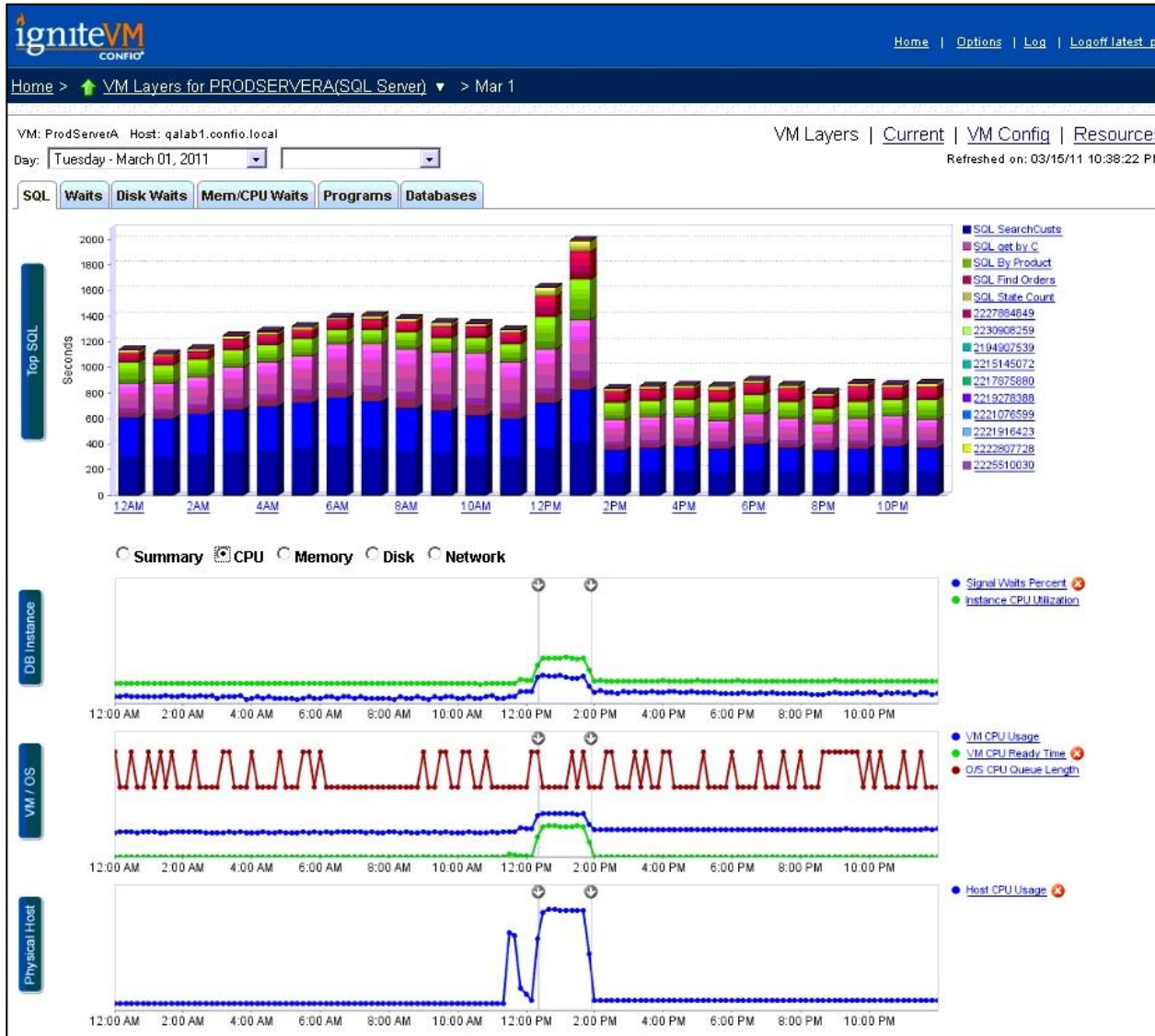
igniteVM CONFIO Options | Log | Logoff deanpi

Repository: DEANPI@SEBOX1

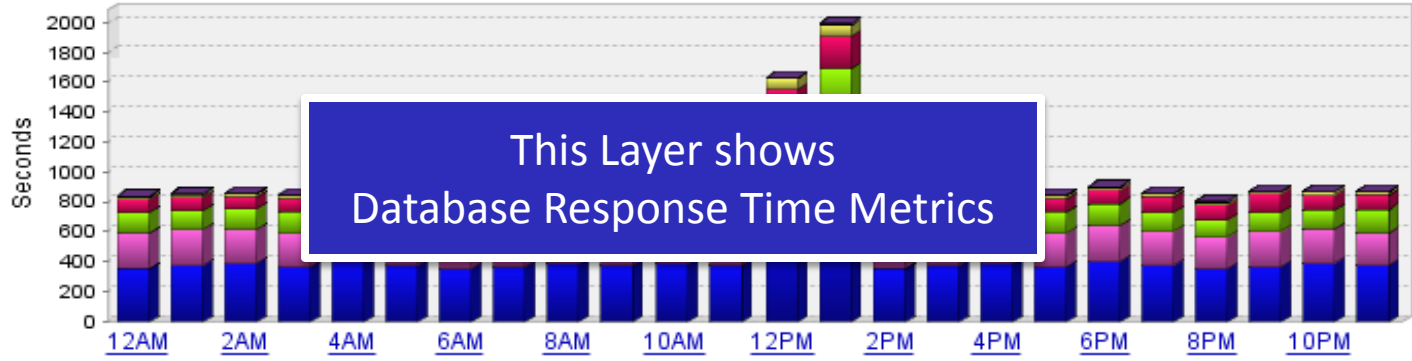
Register Database Instance for Monitoring Register VMware for Monitoring Product: **Virtualization** Start All Monitors Stop All Monitors License Management

Database Instance	Host	VM Utilization		Alarms				Type		
		CPU	Mem	Wait	CPU	Mem	Disk		Net	
Running in a VM										
↑ DEAN-WIN2008-64\OPSMGR	Action ▼	seESXbox.conf...	20%	6 GB		✓	⚠	✗	✓	SQL 2008 SP1
↑ DEVSQL2K5	Action ▼	seESXbox.conf...	17%	2 GB		✓	✓	✗	✓	SQL 2005 SP3
↑ GUILD:5000	Action ▼	eko.confio.lo...				✓	✓	✓	✓	Sybase 15.0.1
↑ ORCL_SEBOX1	Action ▼	seESXbox.conf...	11%	2.9 GB		✓	✓	✗	✓	Oracle 10g R2
↑ SEBOX1SE12000	Action ▼	seESXbox.conf...	11%	2.9 GB		✓	✓	✗	✓	SQL 2000 SP4
↓ SEBOX1SE12005	Action ▼	seESXbox.conf...				⊘	⊘	⊘	⊘	SQL 2005 SP2
↑ VCENTER\SQLXP VIM	Action ▼	eko.confio.lo...				✓	✓	✓	✓	SQL 2005 SP2
VM Not Detected										
↓ DAISY DAISY	Action ▼					⊘	⊘	⊘	⊘	Oracle 11g R2
↑ DEMO_CONFIODEMO	Action ▼					✓	✓	✓	✓	Oracle 11g R1
↓ ORCL11R2_CONFIODEMO	Action ▼					⊘	⊘	⊘	⊘	Oracle 11g R2
↓ RAC1_LINUX1.CONFIO.LOCAL	Action ▼					⊘	⊘	⊘	⊘	Oracle 10g R2
↑ TAYLOR:5000	Action ▼					✓	✓	✓	✓	Sybase 12.5.2
↓ VISION_TESTBOX	Action ▼					⊘	⊘	⊘	⊘	Oracle 9i R2
↑ VSERVERTEMP\SQLXP VIM	Action ▼					✓	✗	✓	✓	SQL 2005 SP2

Layers and Annotations

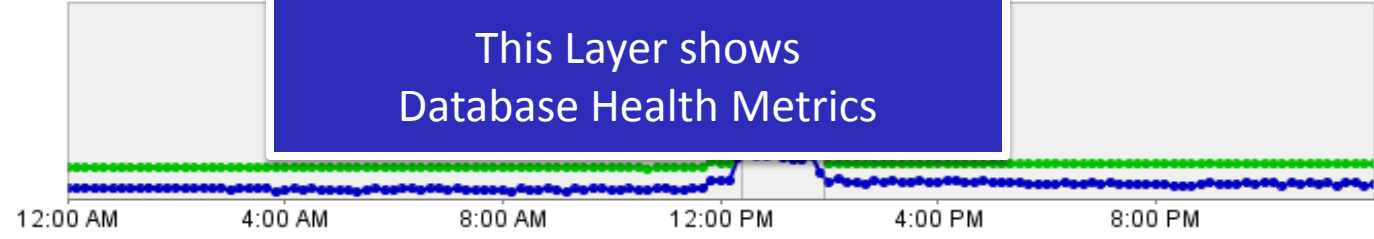


Top SQL



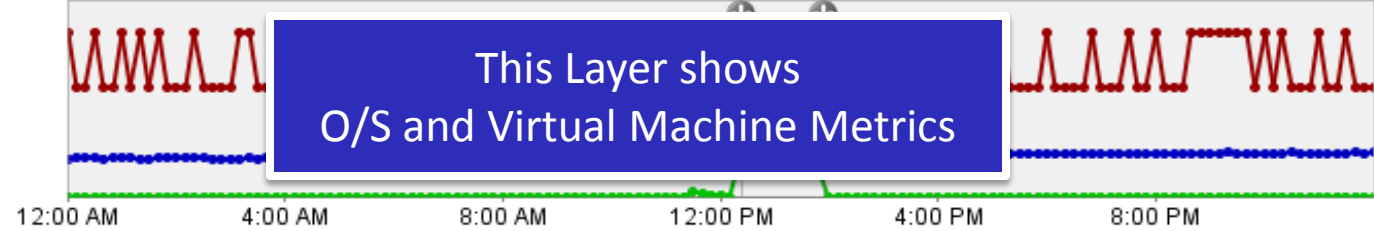
- SQL SearchCusts
- SQL get by C
- SQL By Product
- SQL Find Orders
- SQL State Count
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- 2194907539
- 2215145072
- 2217875880
- 2219278388

DB Instance



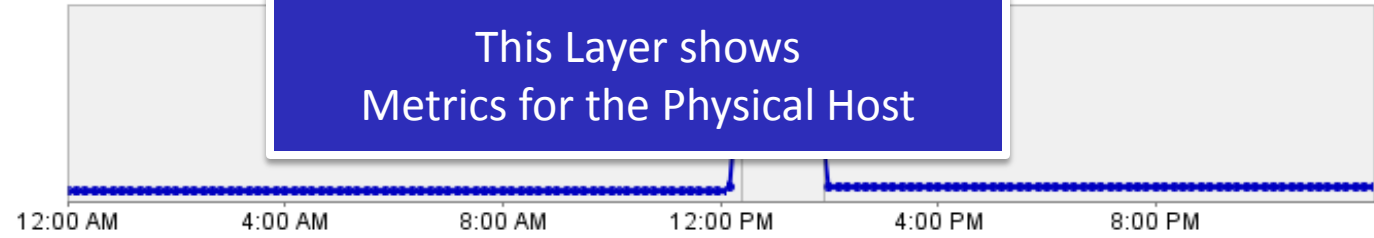
- Signal Waits Percent
- Instance CPU Utilization

VM / OS



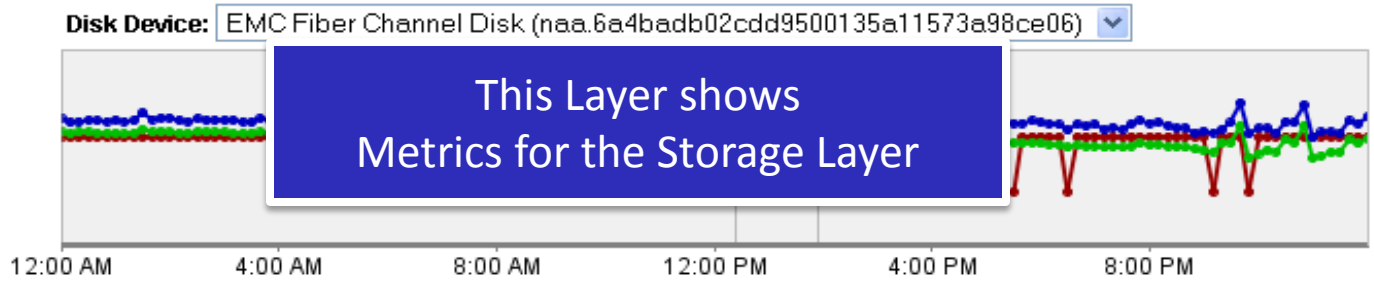
- VM CPU Usage
- VM CPU Ready Time
- O/S CPU Queue Length

Physical Host



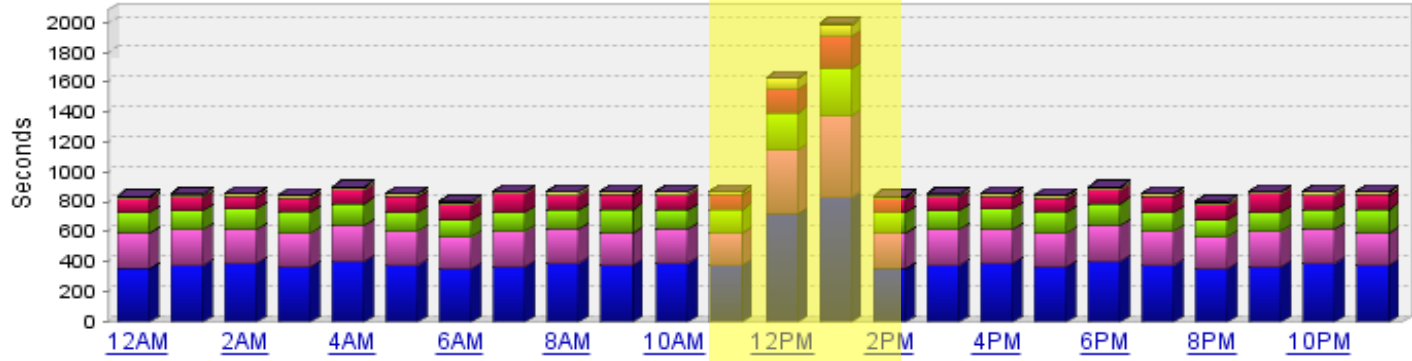
- Host CPU Usage

Storage



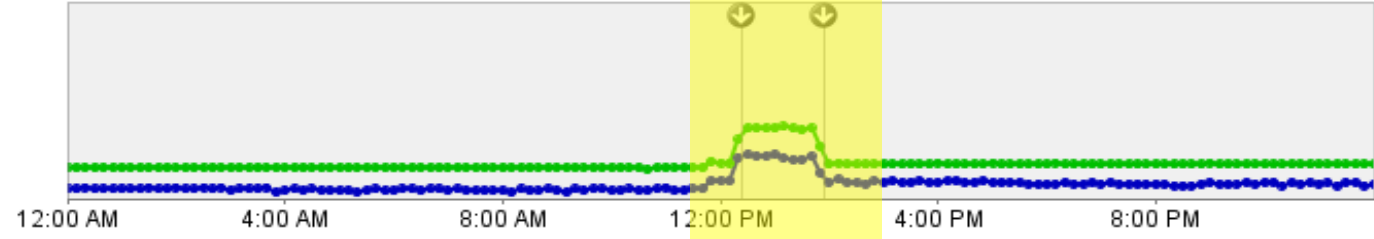
- Host Disk Device Read Rate (KB/s)
- Host Disk Device Write Rate (KB/s)
- Host Disk Device Read Latency (ms)
- Host Disk Device Write Latency (ms)

Top SQL



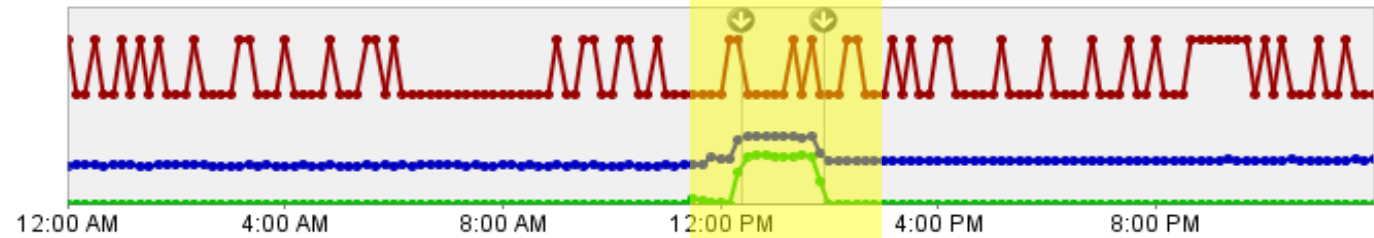
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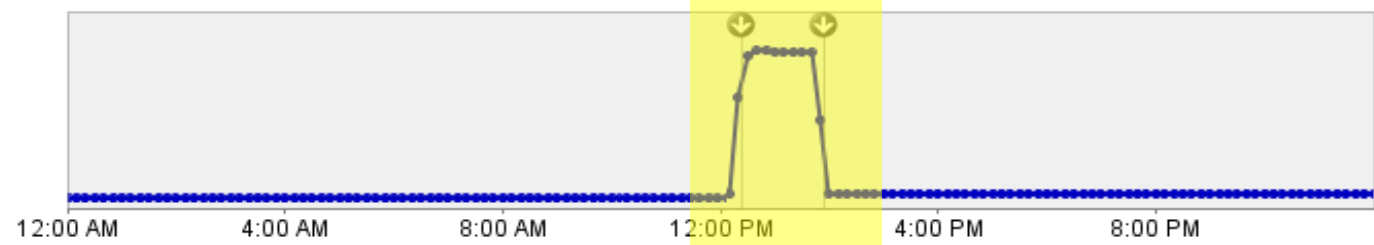
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VM / OS



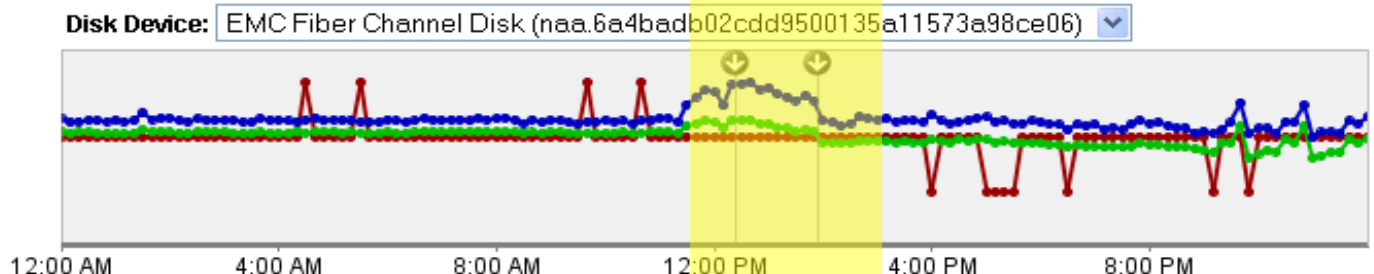
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Physical Host



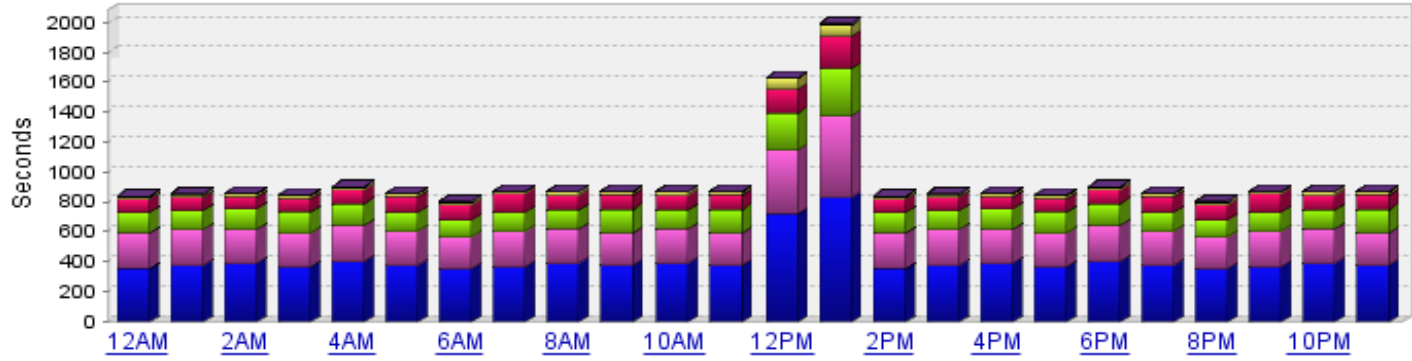
- Host CPU Usage

Storage

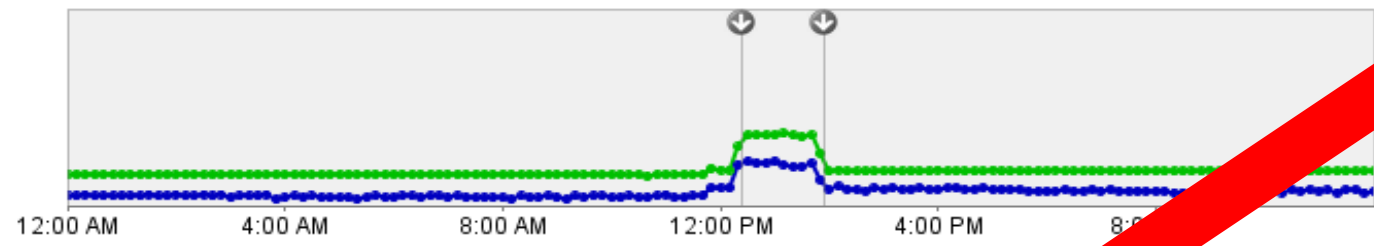


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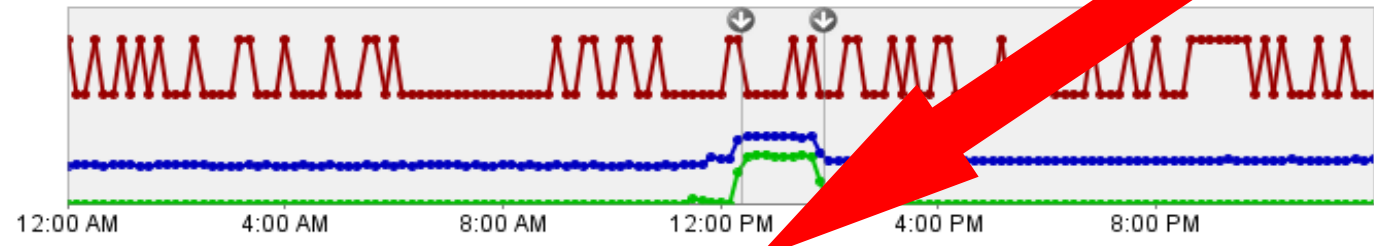
Top SQL



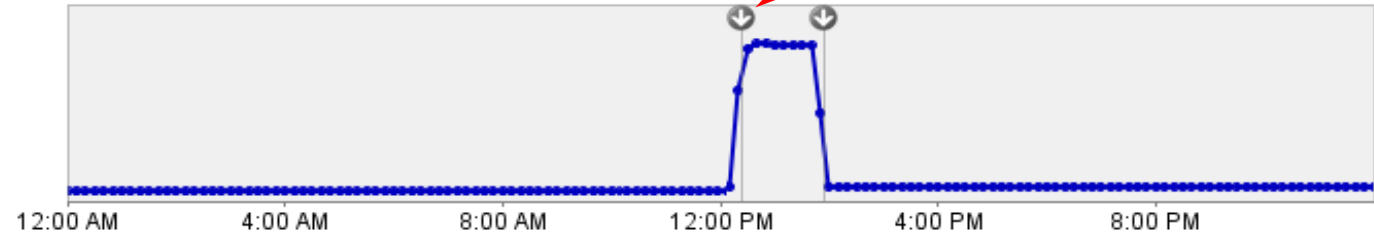
DB Instance



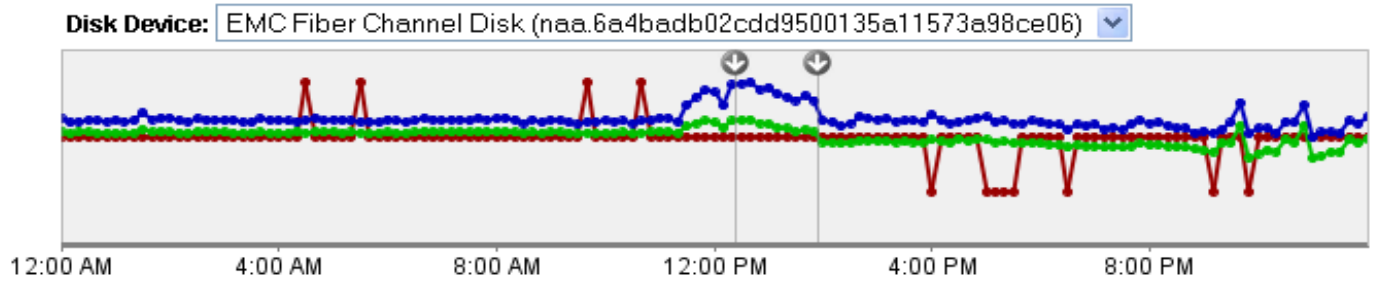
VM / OS



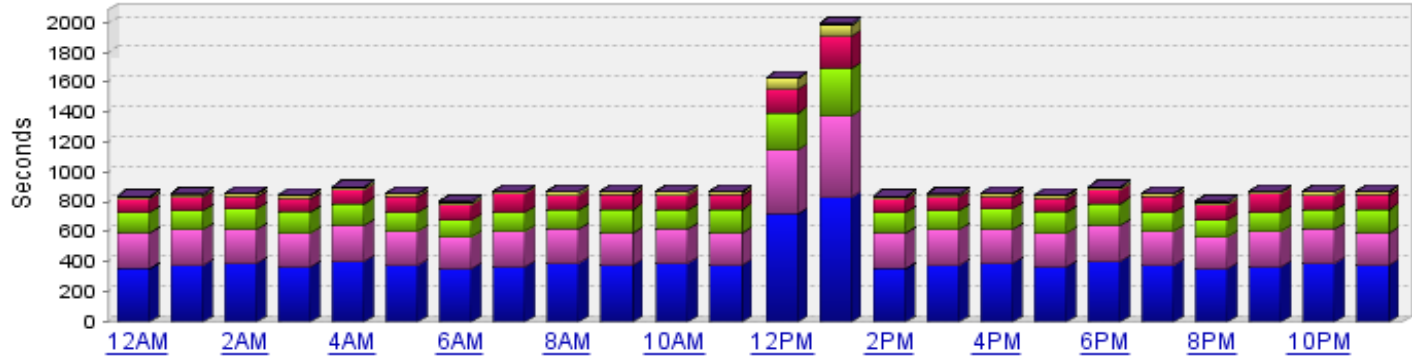
Physical Host



Storage

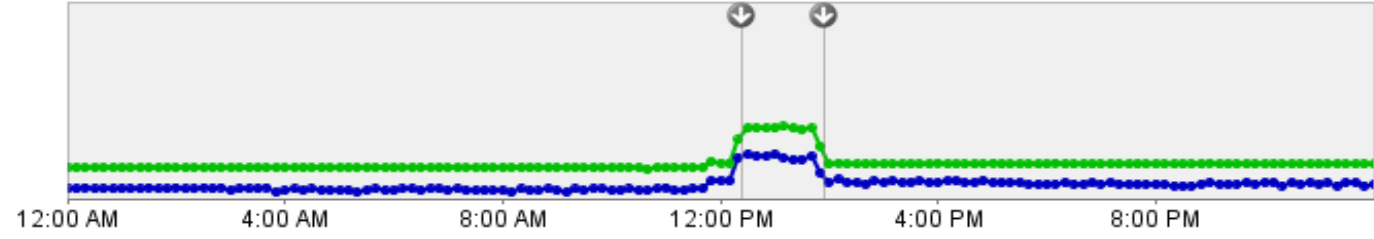


Top SQL



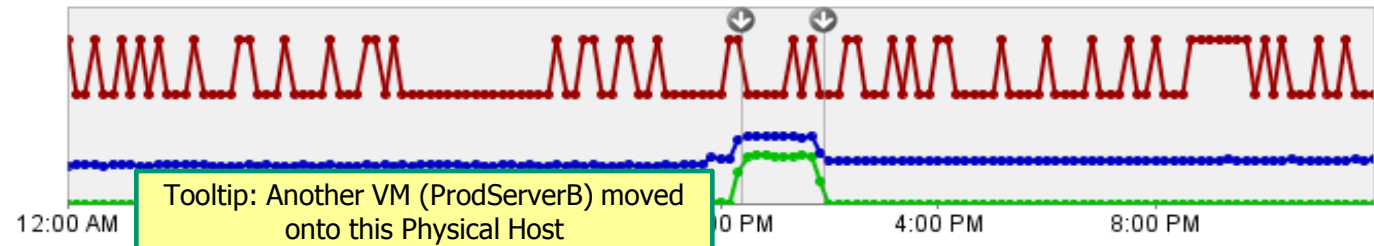
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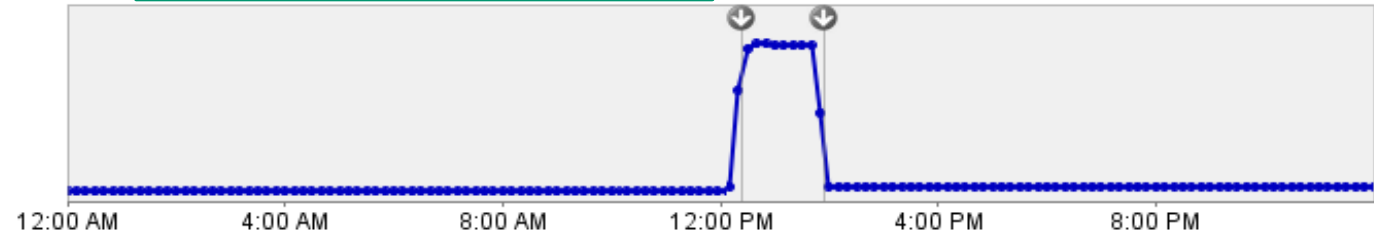
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- Instance CPU Utilization

VM / OS



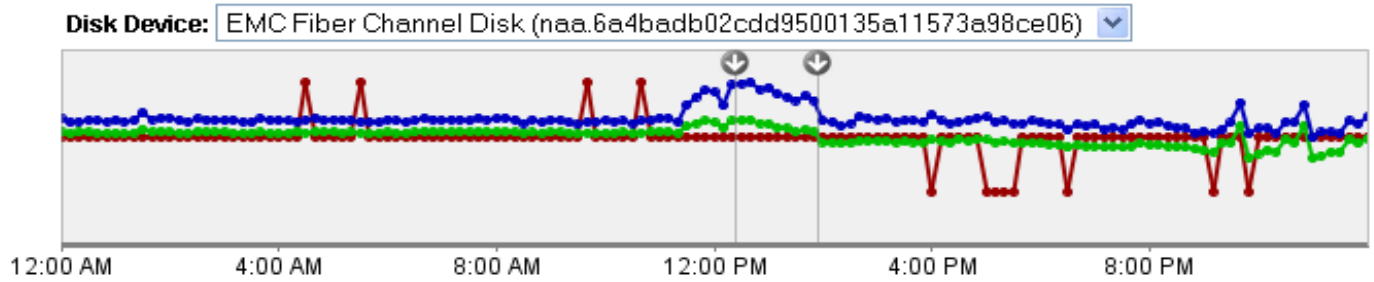
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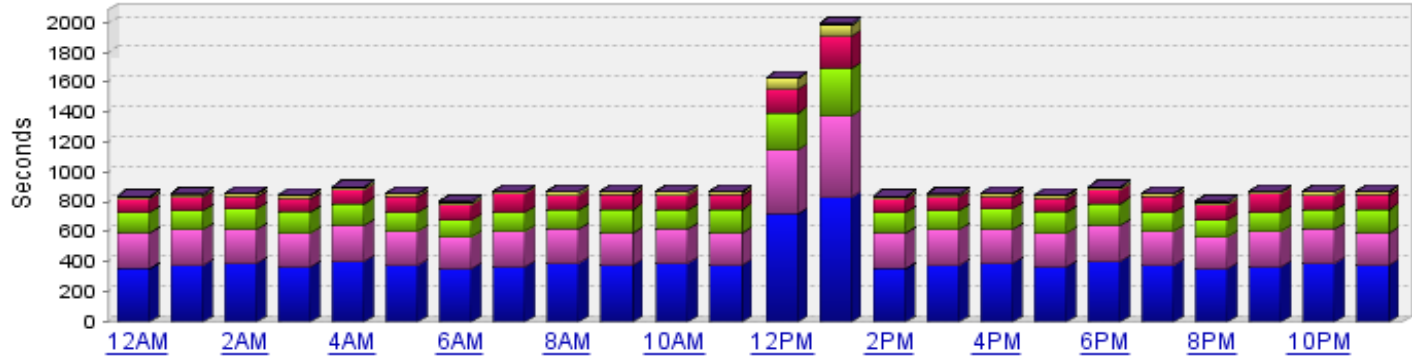
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Storage



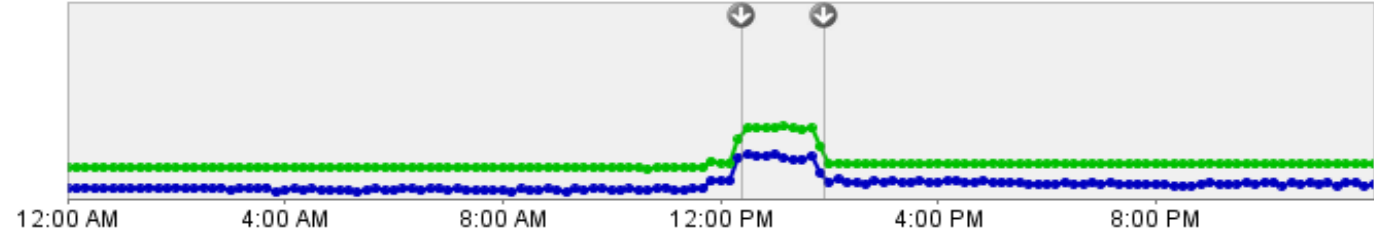
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Top SQL



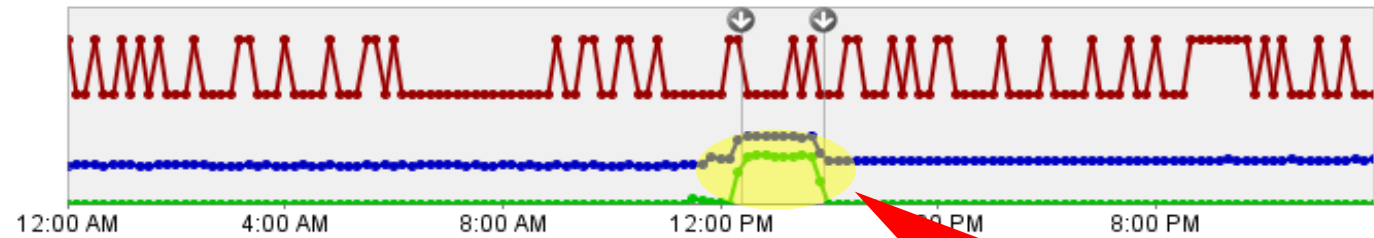
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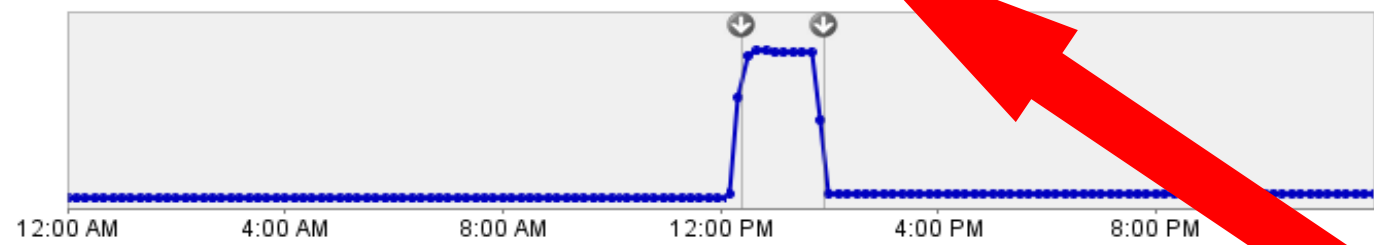
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VM / OS



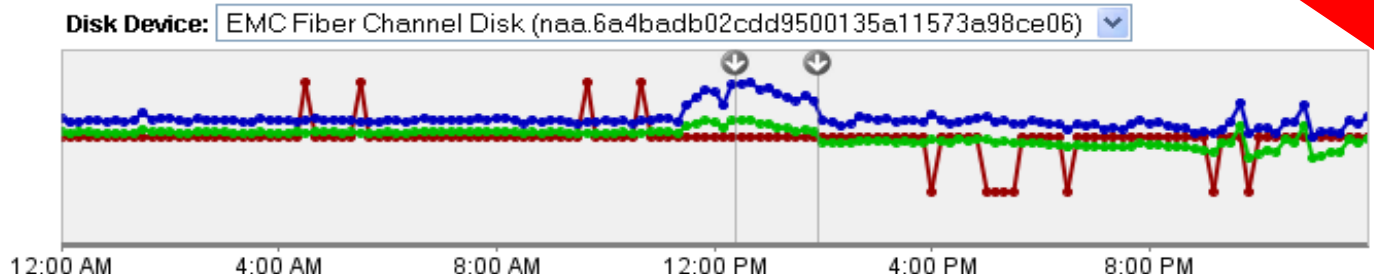
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- O/S CPU Queue Length

Physical Host



- Host CPU Usage

Storage



- Host Disk Device Read Rate (KB/s)
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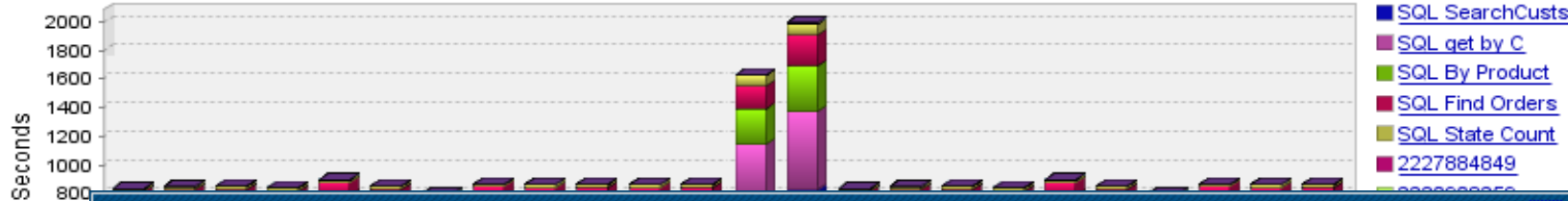
Top SQL

DB Instance

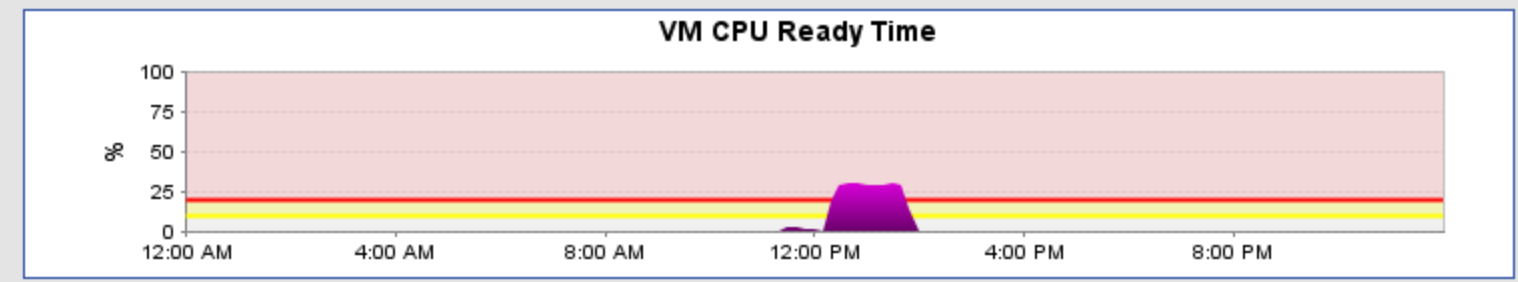
VM / OS

Physical Host

Storage



Information [X]



VM CPU Ready Time

Percentage of time that the virtual machine was ready to use CPU resources, but could not get scheduled to run on the physical CPU.

Solutions

If VM Ready Time is high, check Host CPU Usage:

- **Host CPU Usage is Normal:** This implies that the VM has *under-allocated CPU* resources.

1. Check to see if the VM has been configured with a CPU Limit. Consider raising or removing the limit.

You can use the ESXTOP VMware utility to check the %MLMTD metric which shows how much

Close

12:00 AM 4:00 AM 8:00 AM 12:00 PM 4:00 PM 8:00 PM

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ead Rate (KB/s)
rite Rate (KB/s)
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