ESXi Resource Management

Focus on Resource Distribution

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Sr. Staff TSE / GSS Premier Services

2020-01-09

Agenda

Distributed Resources

vCenter Level View

Host Resources

ESXi Level View

Consumers

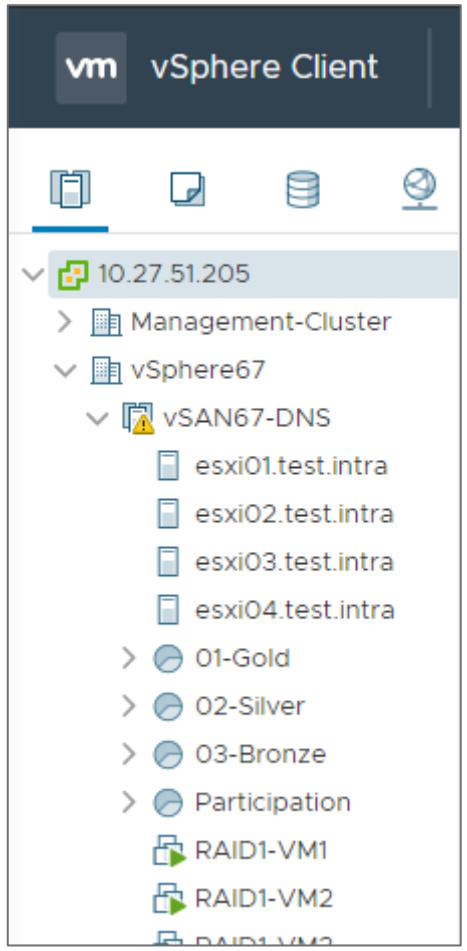
VMs

Consumers part 2

everything else

Resource Pools

Cluster Level



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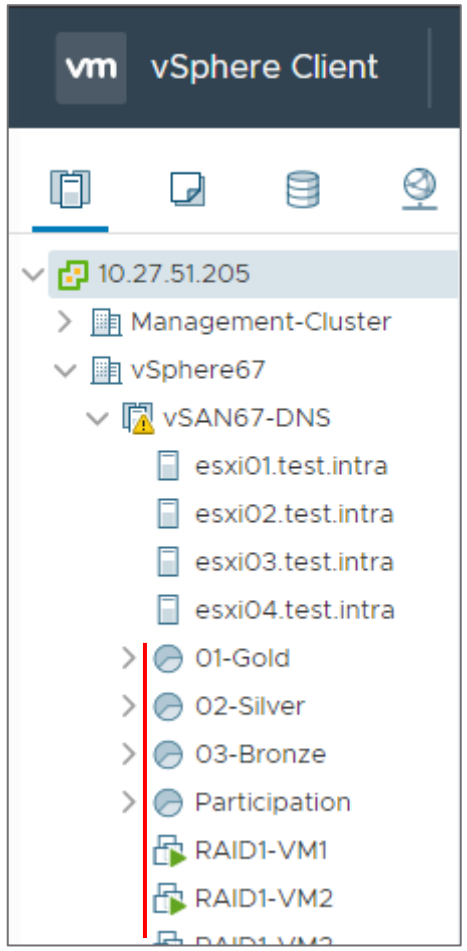
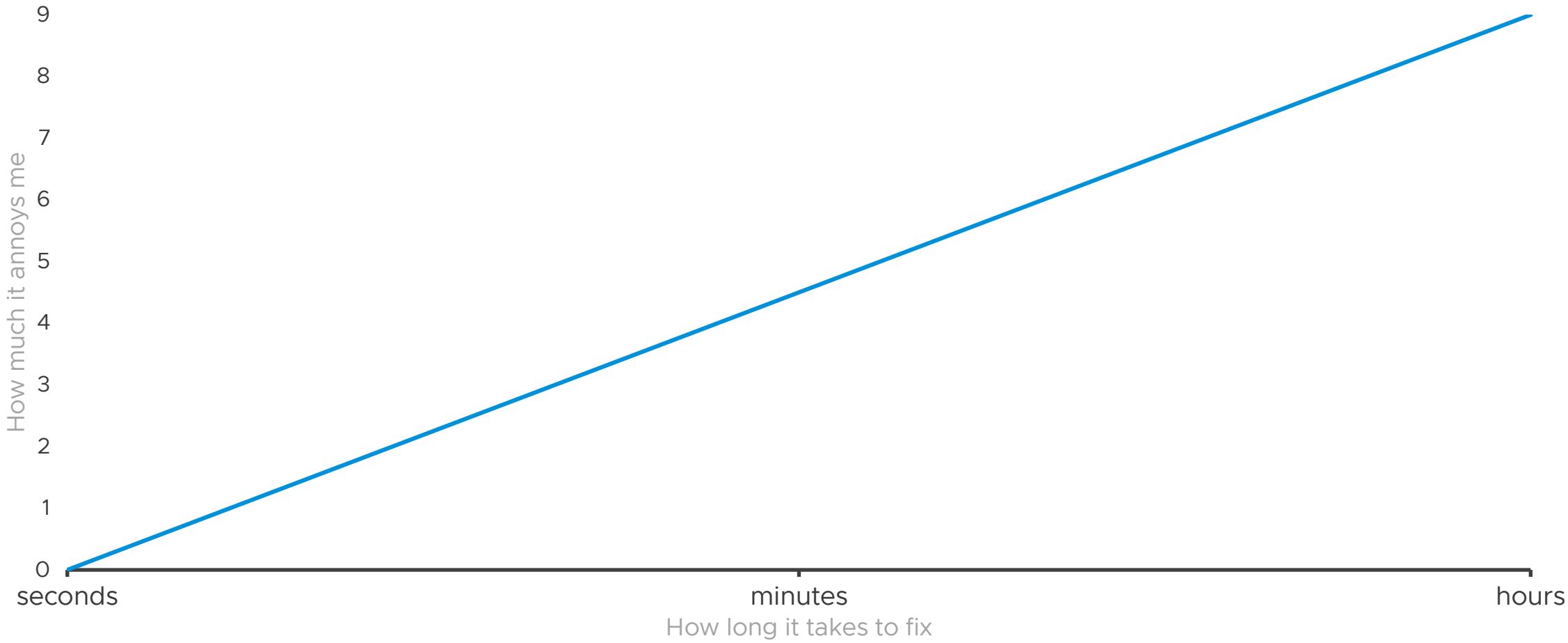


That warning triangle on the cluster …

Yes it annoys me too



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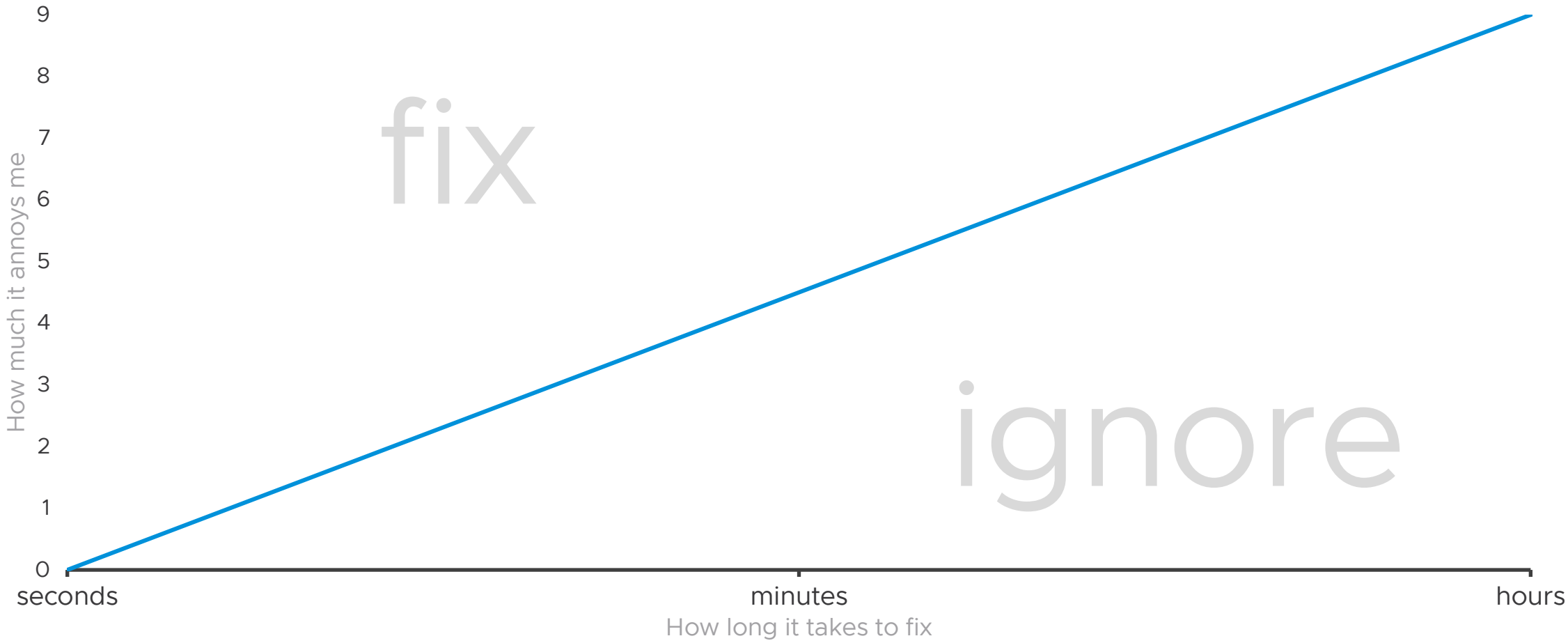

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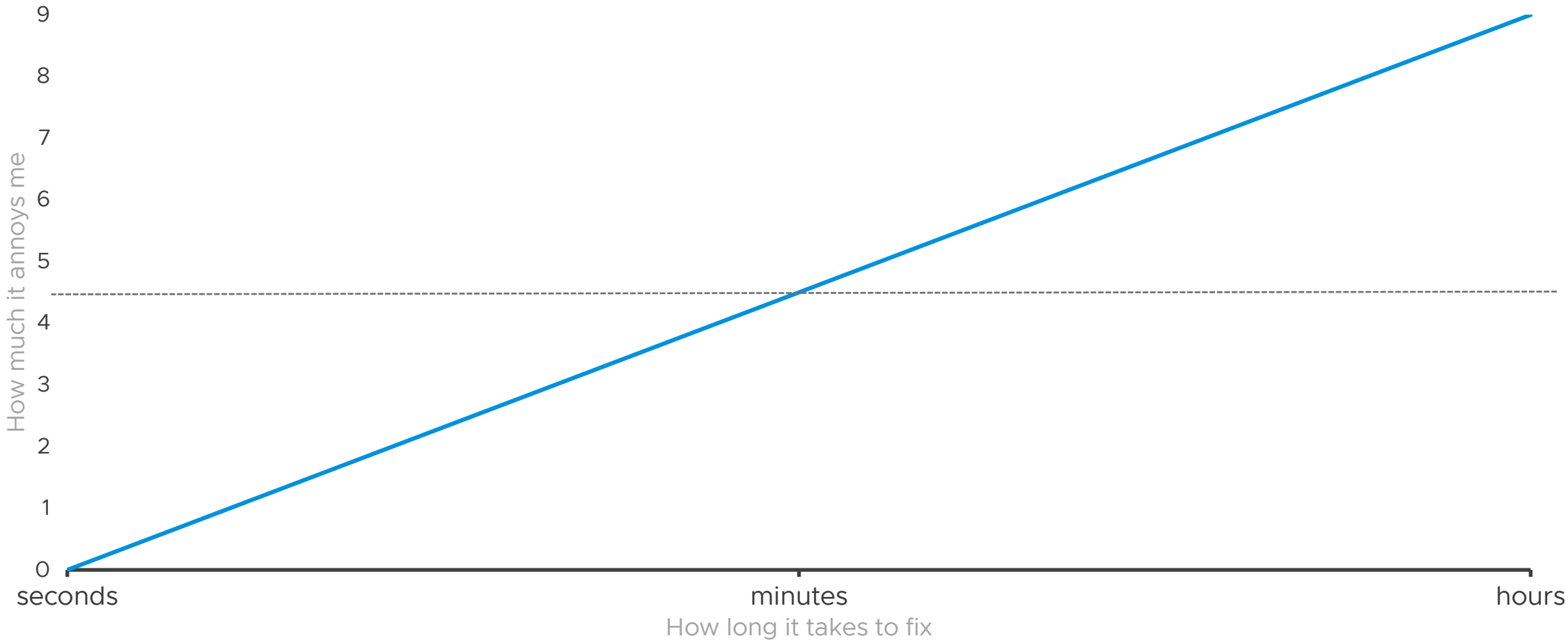

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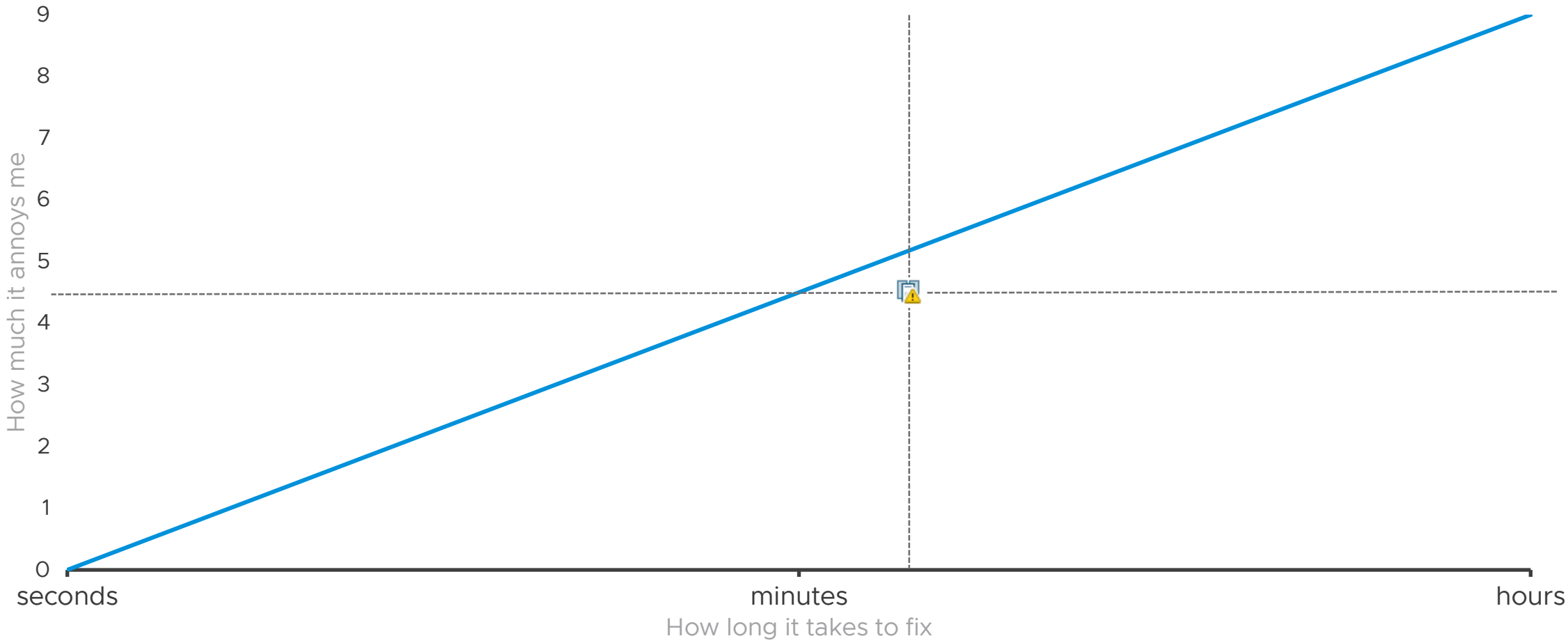

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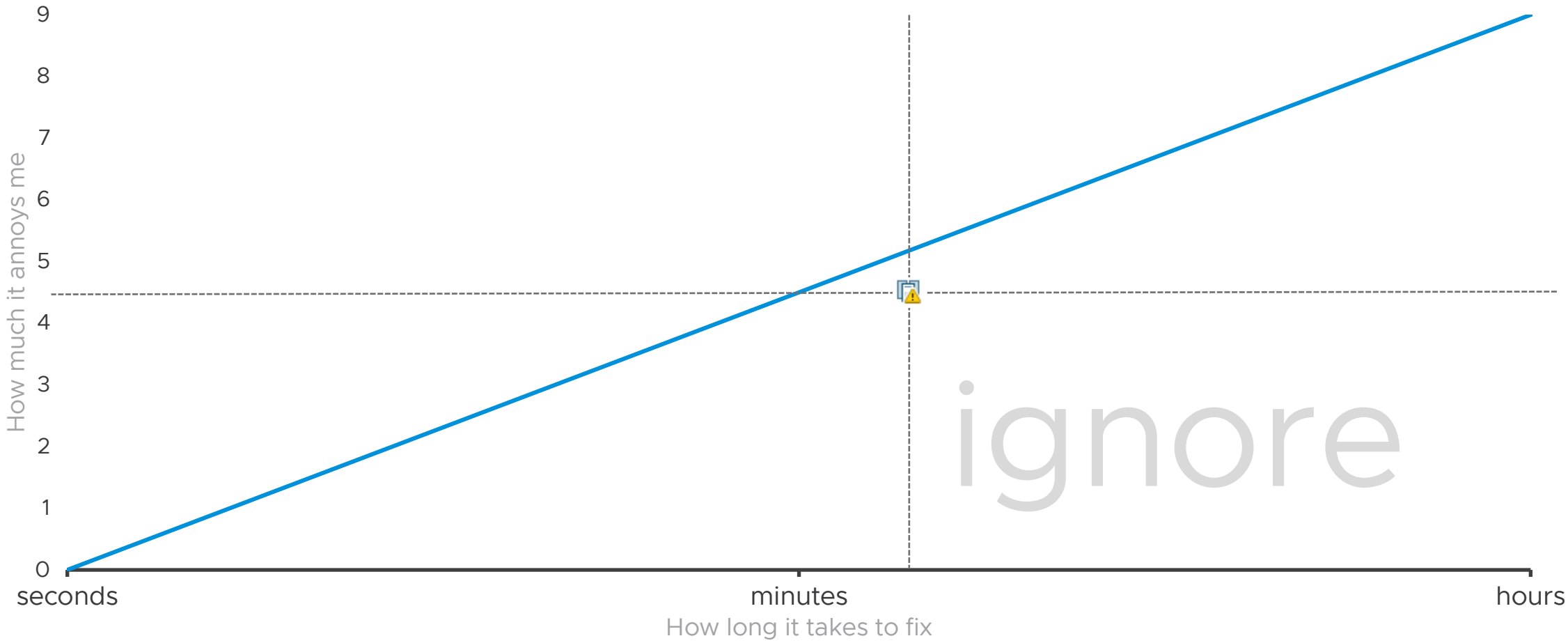

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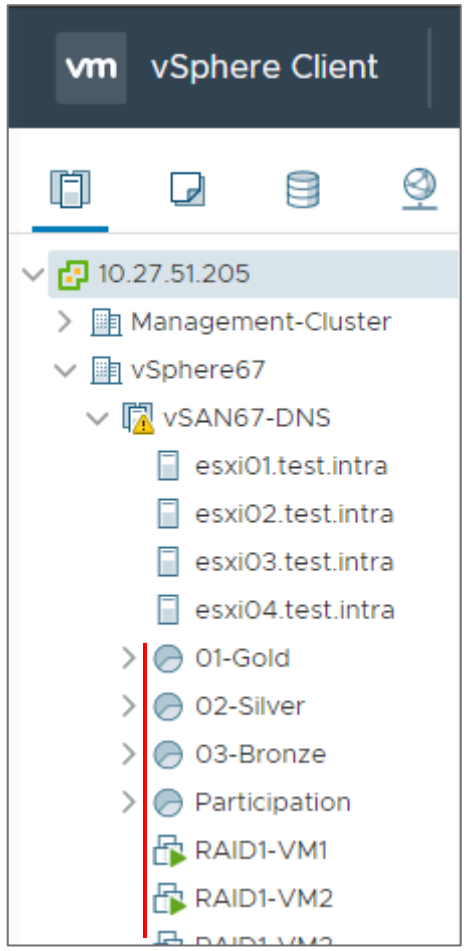

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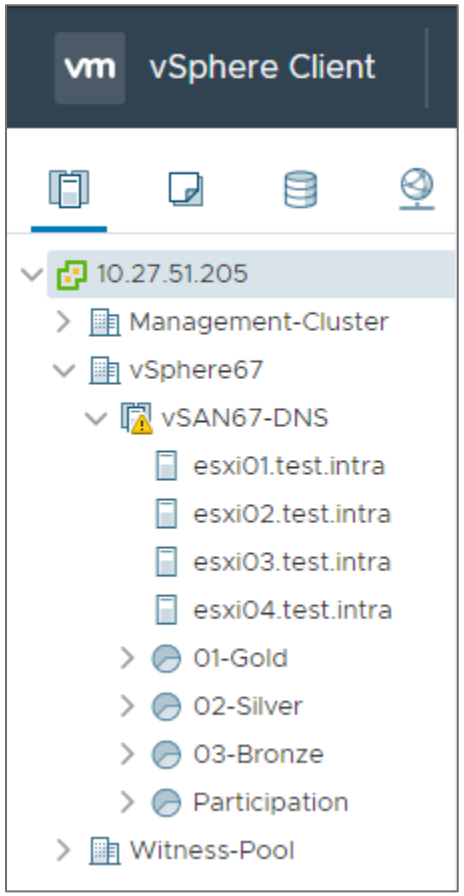

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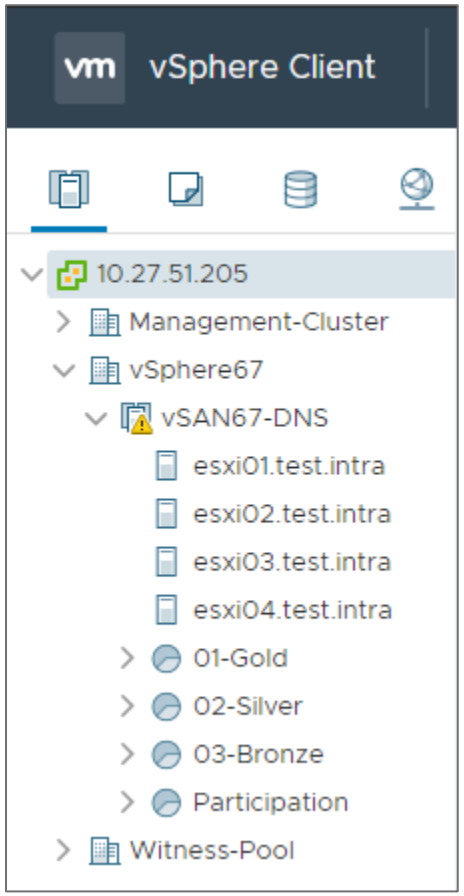

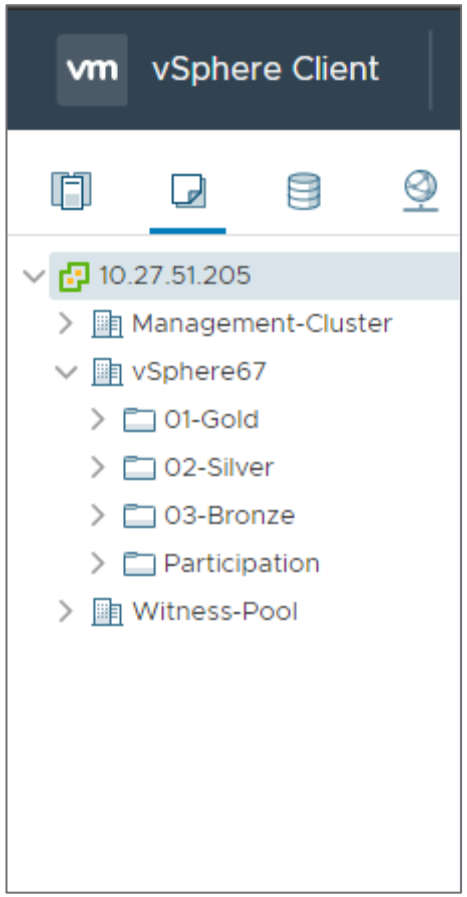

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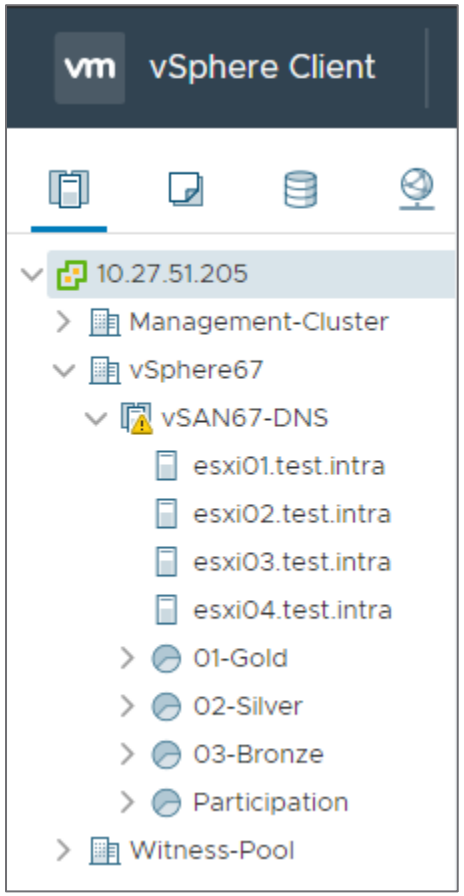
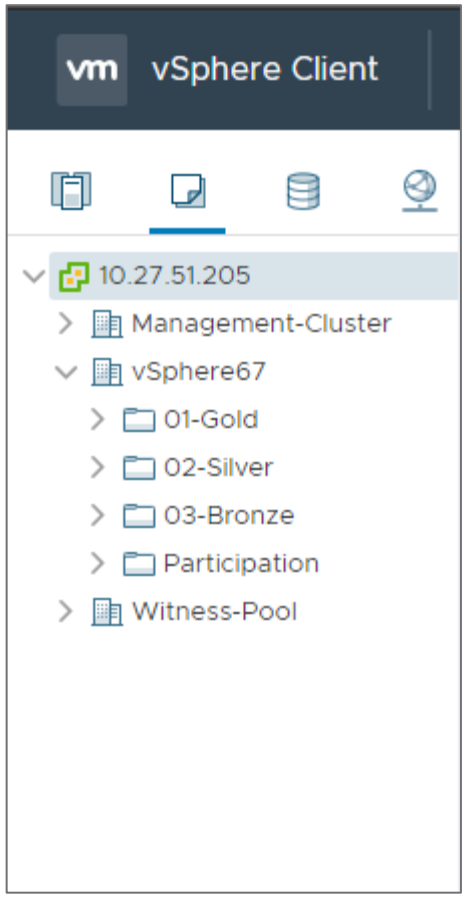


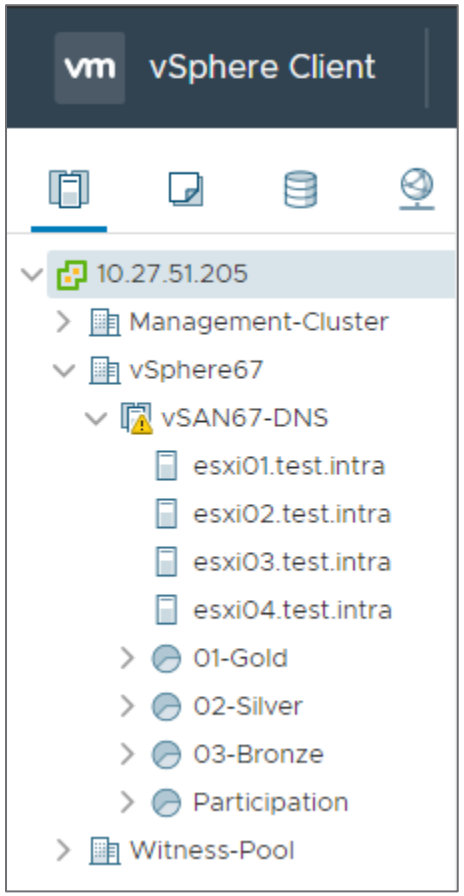


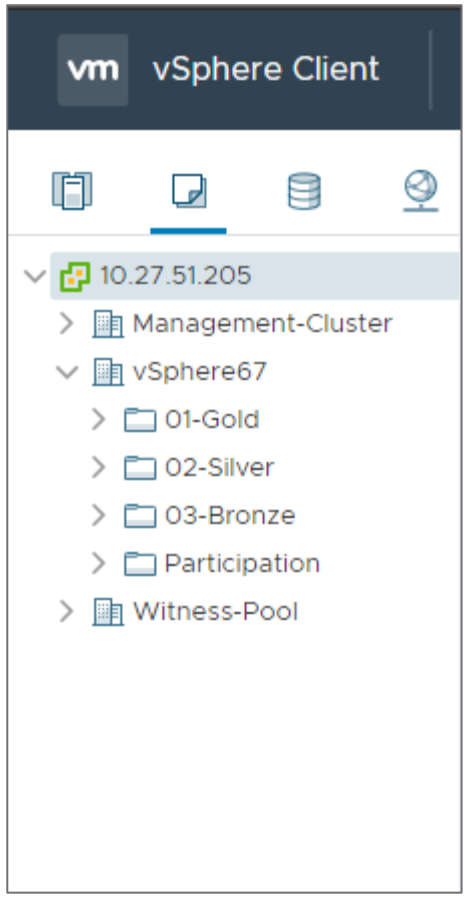
Resource Pools

Cluster Level*

Resource Pools

- Distribute
- Prioritize
- Guarantee
- Limit





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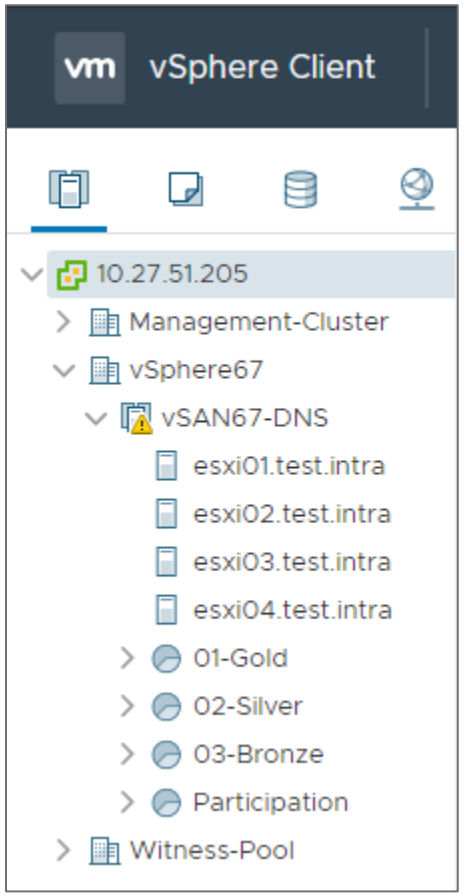
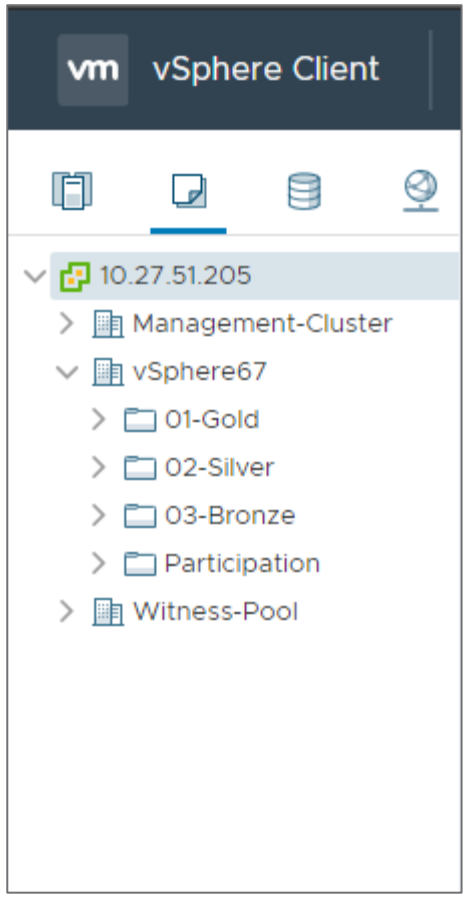


Folders

- Structure



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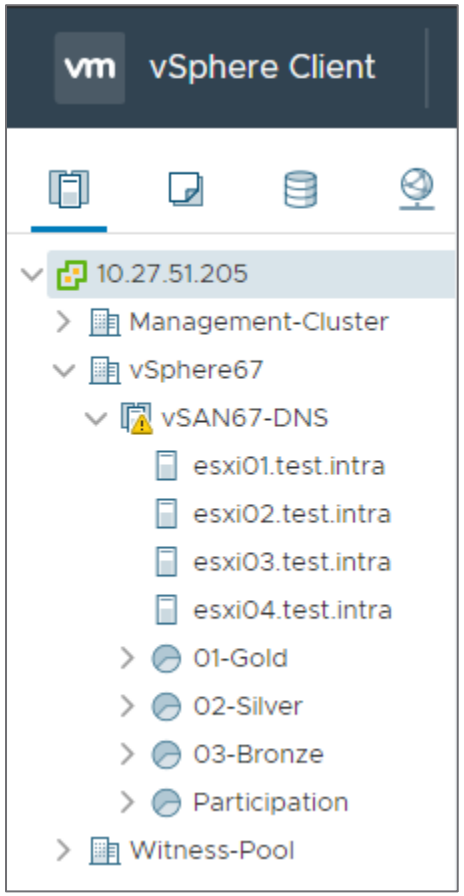

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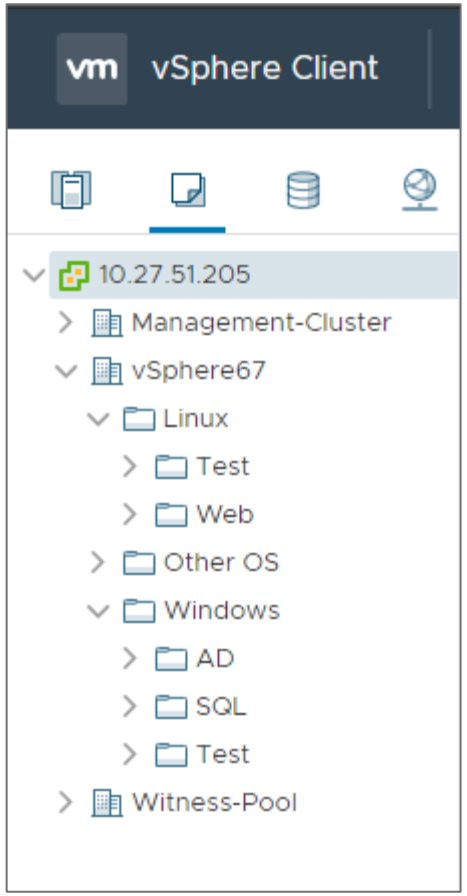

Resource Pools

So what if I don’t care about resources and just want some structure?

Resource Pools

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- Other OS
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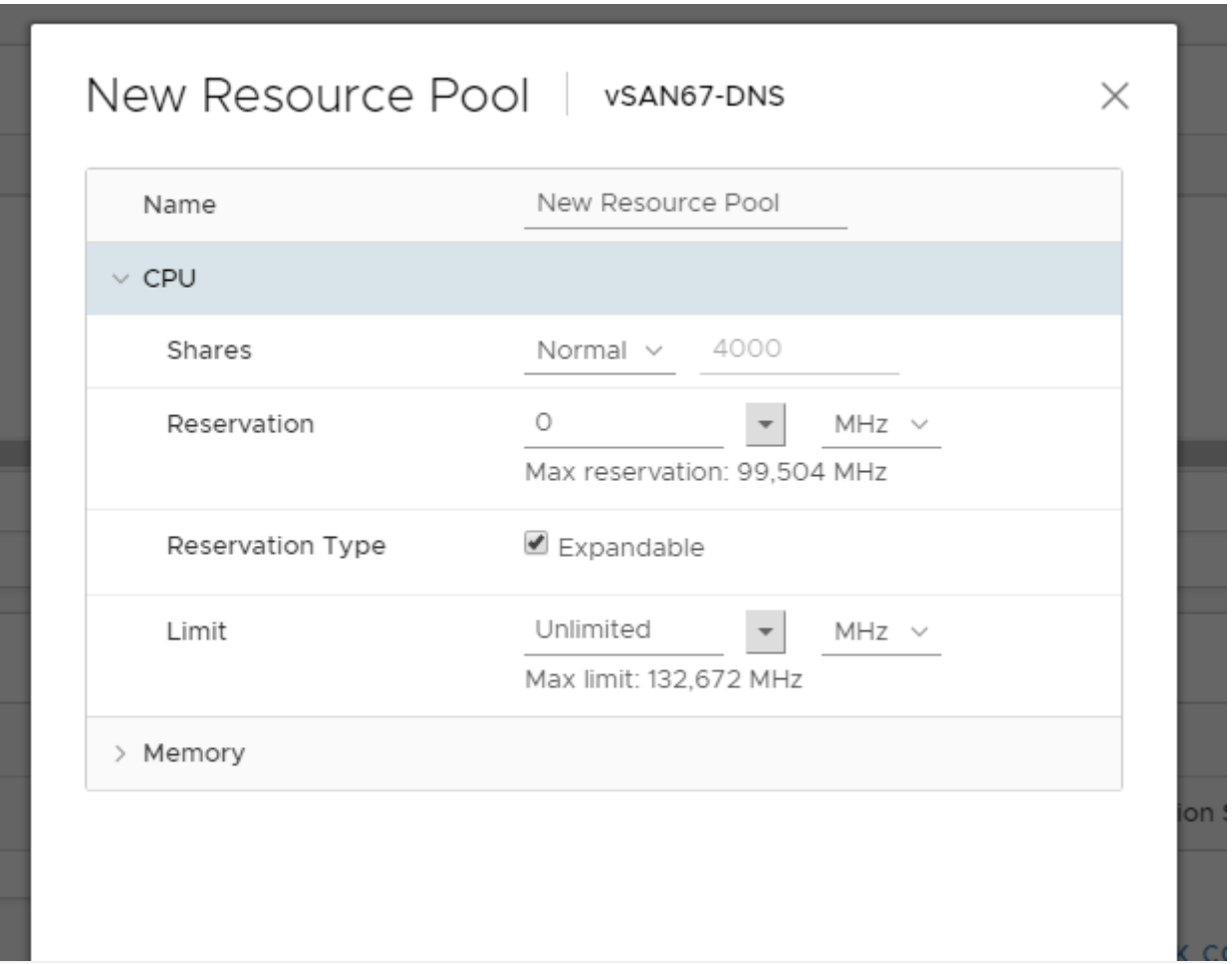
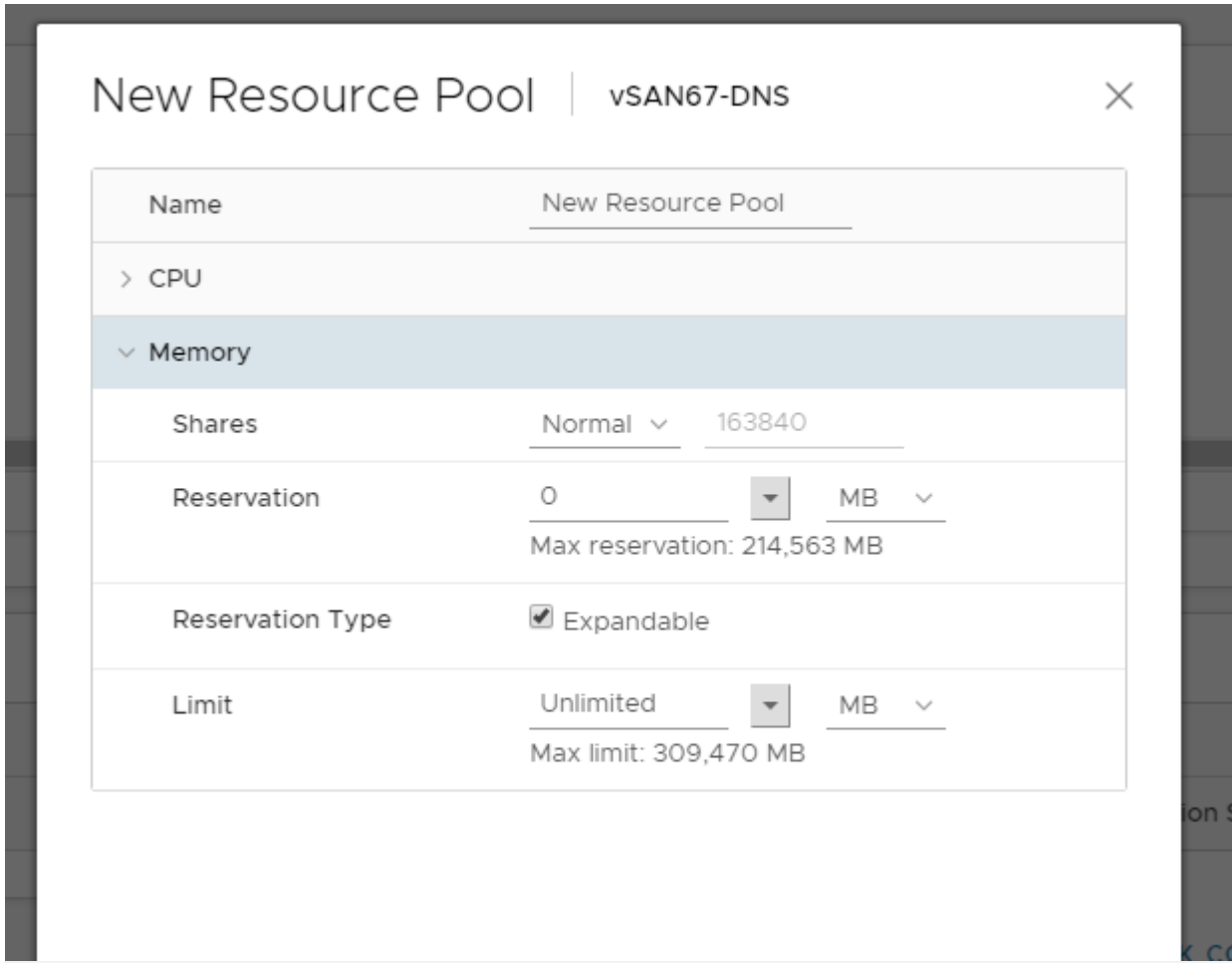
* don’t forget about tags

Resource Pools

Creation and Maximums





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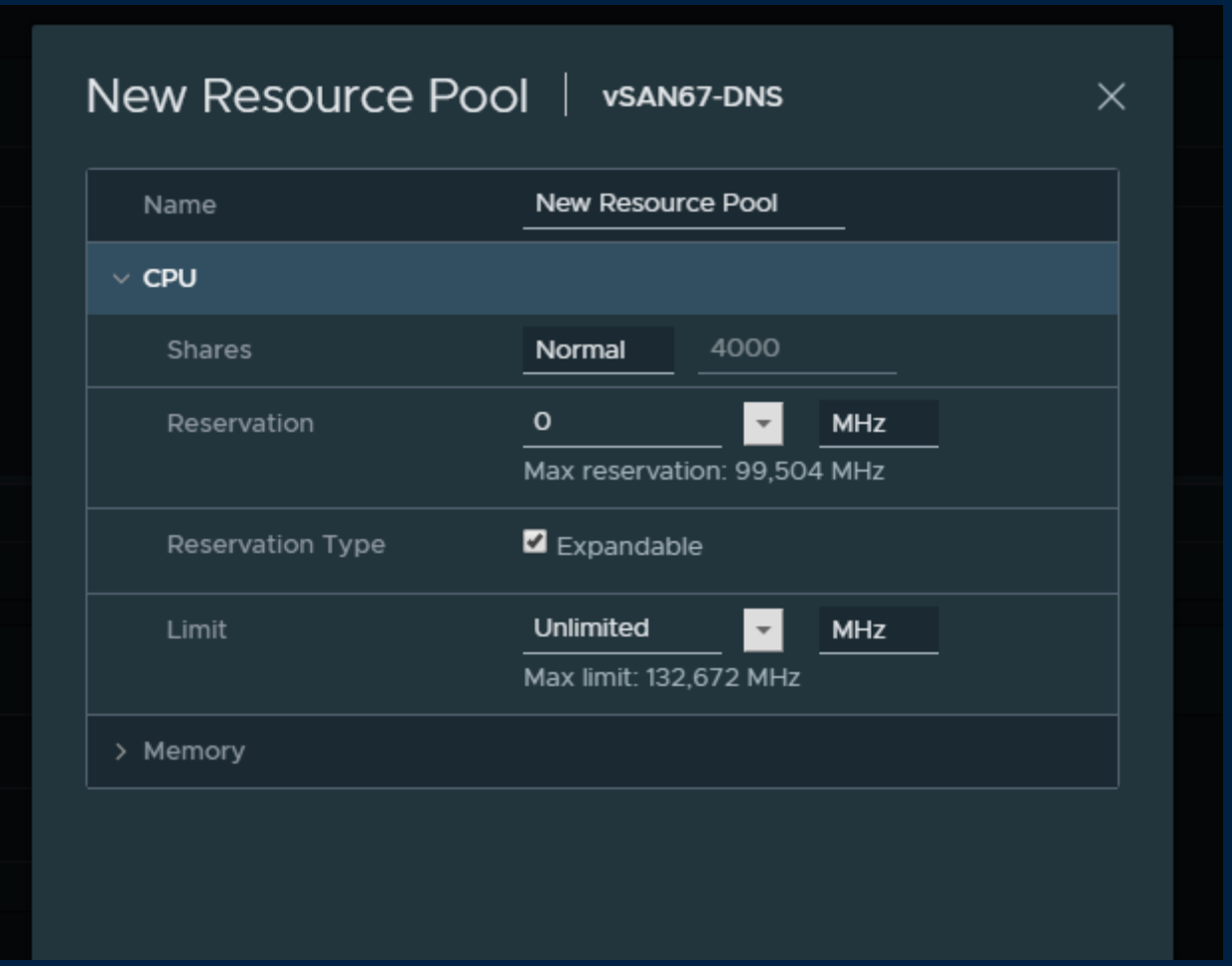
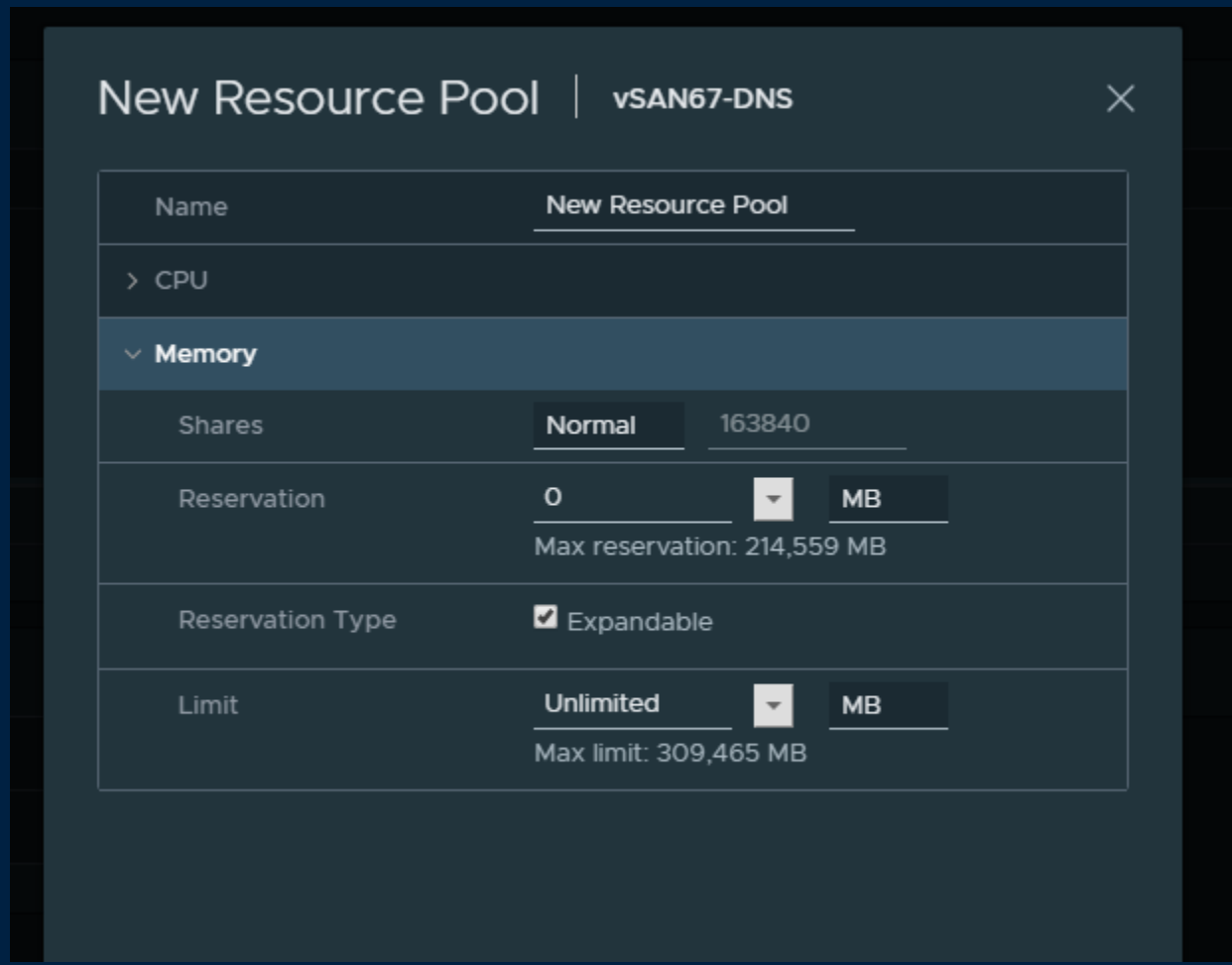
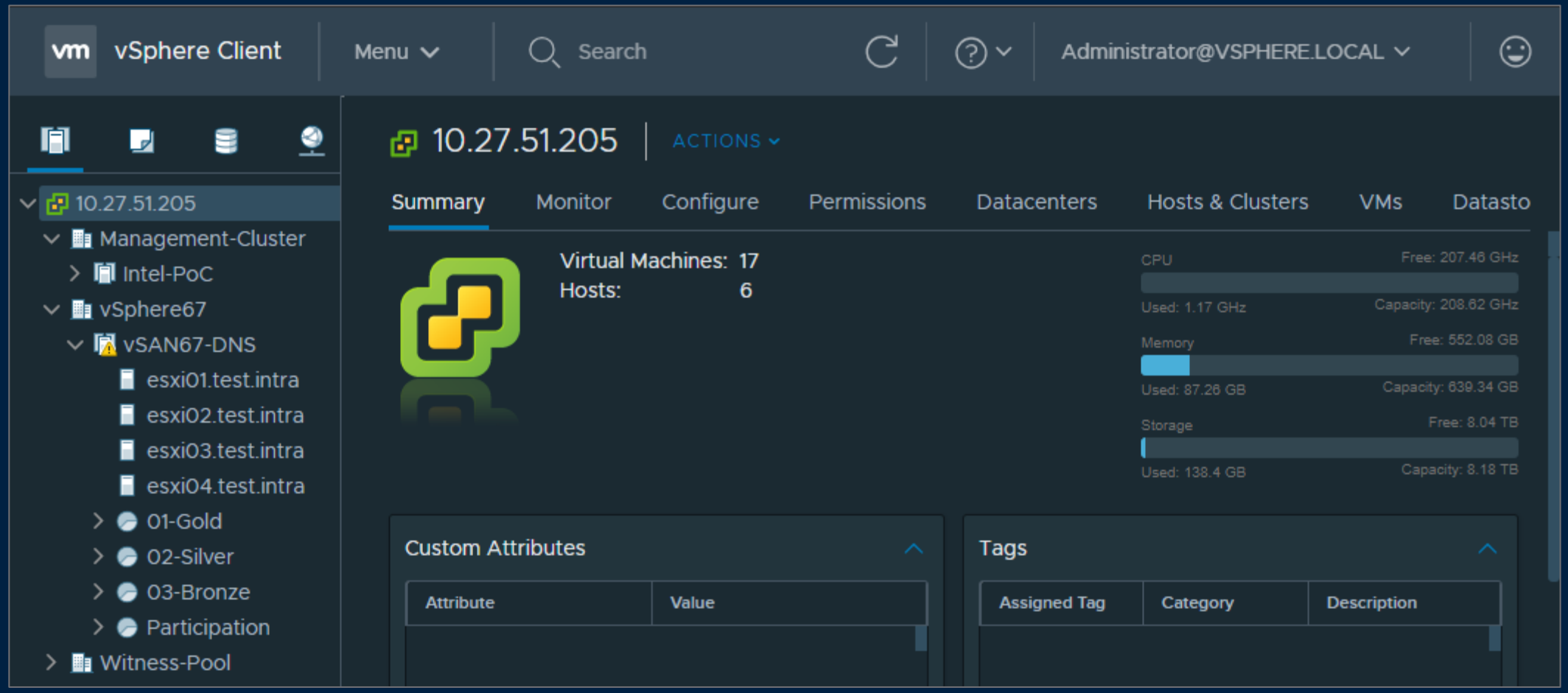




Clarity Dark Theme

Official CSS / unsupported extension

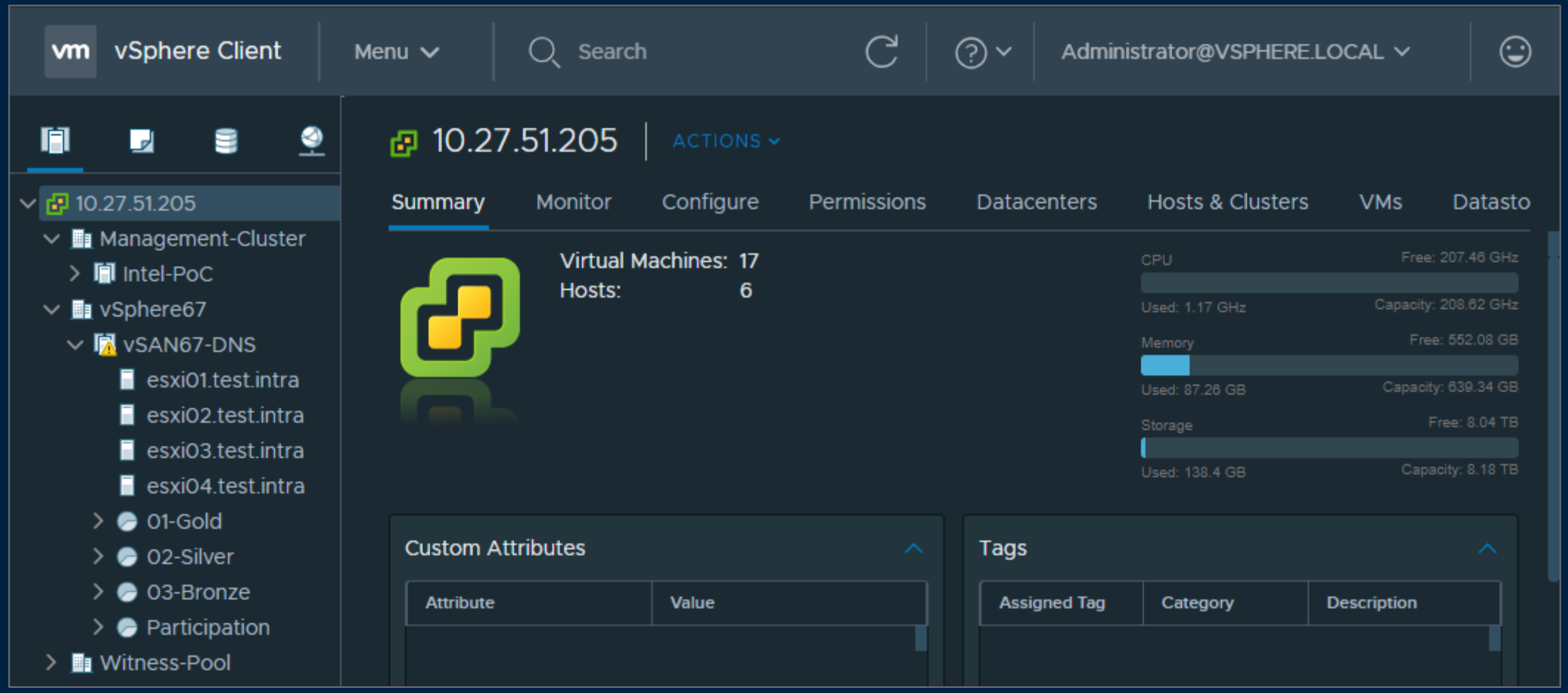


Use at your own risk: https://github.com/BeryJu/dark-vcenter

Clarity Dark Theme

Fully Supported in 6.7 U1

New in 6.7 U1



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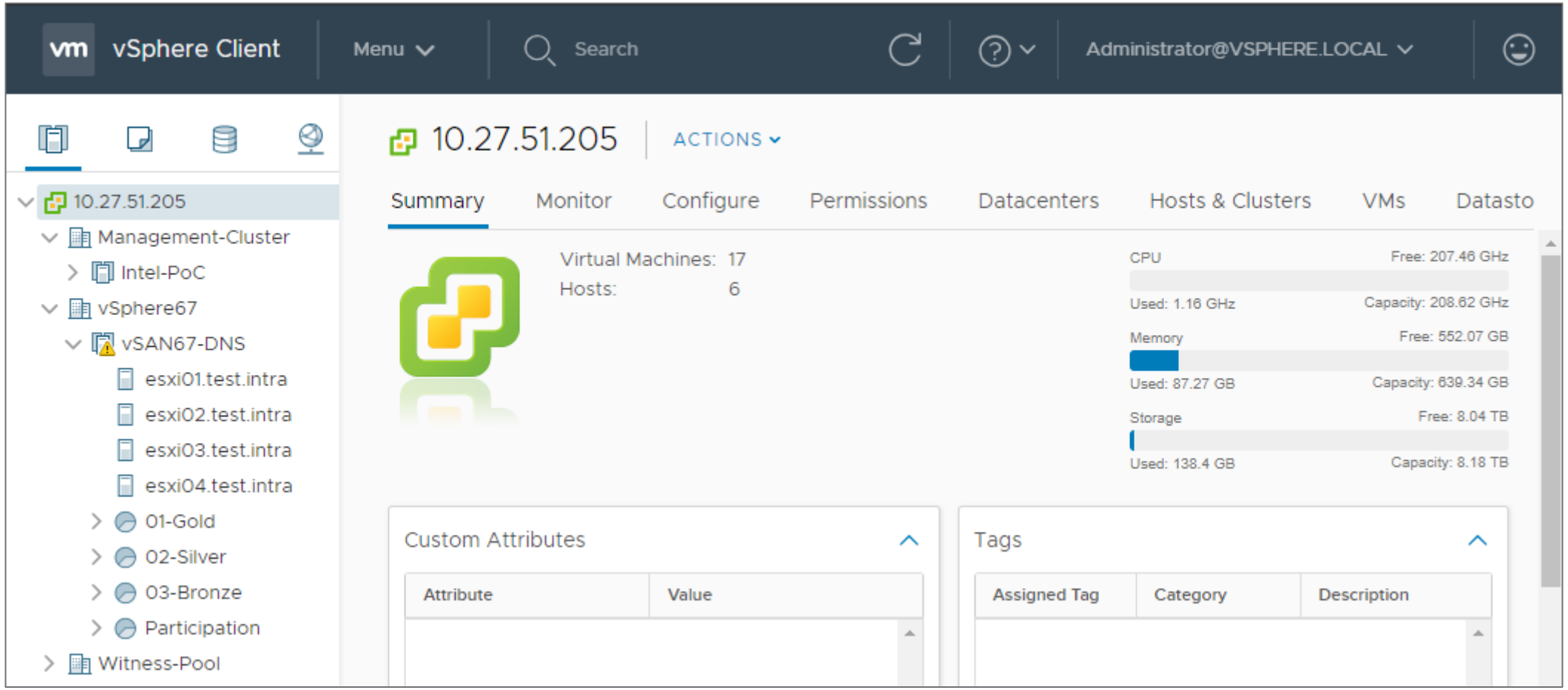

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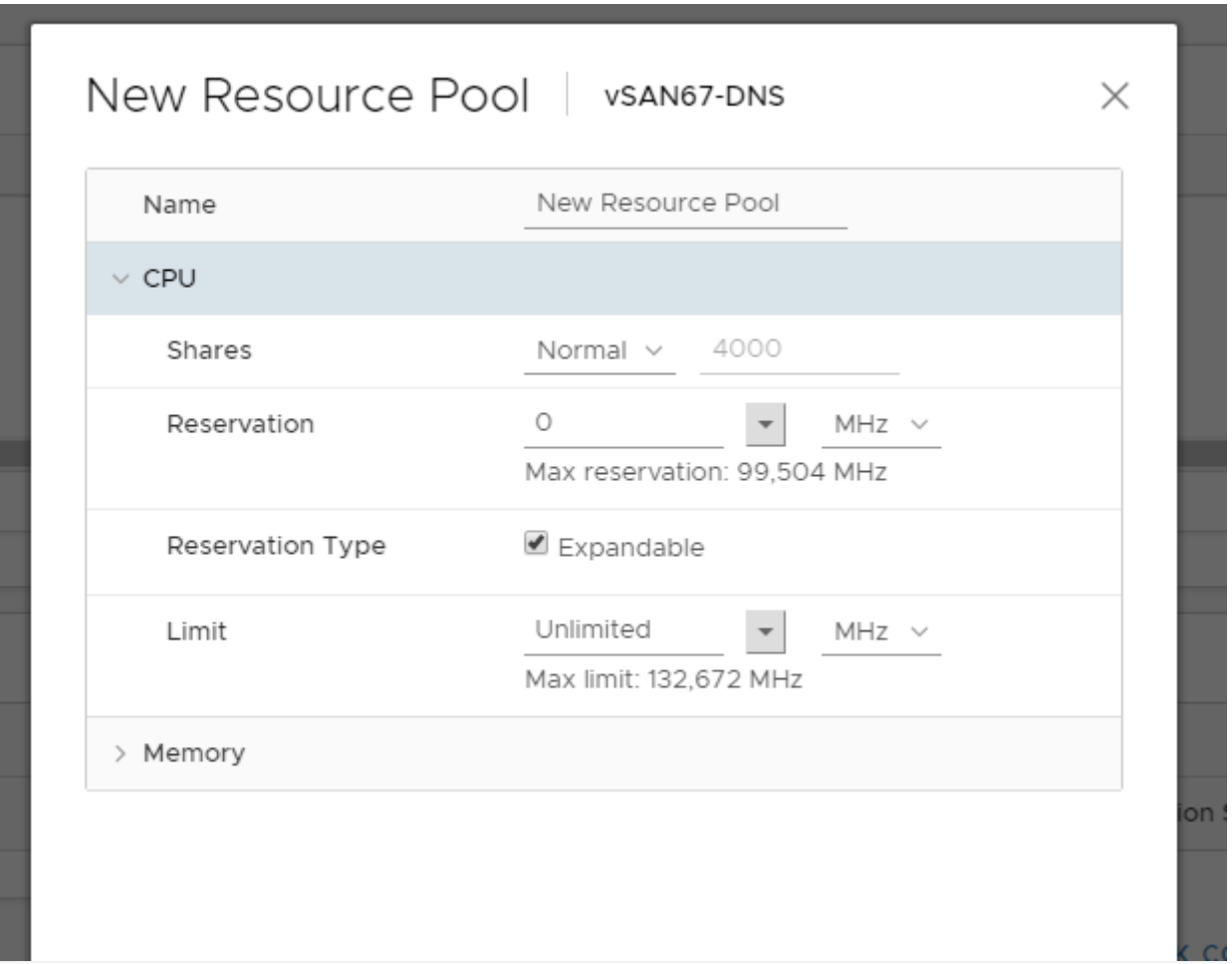

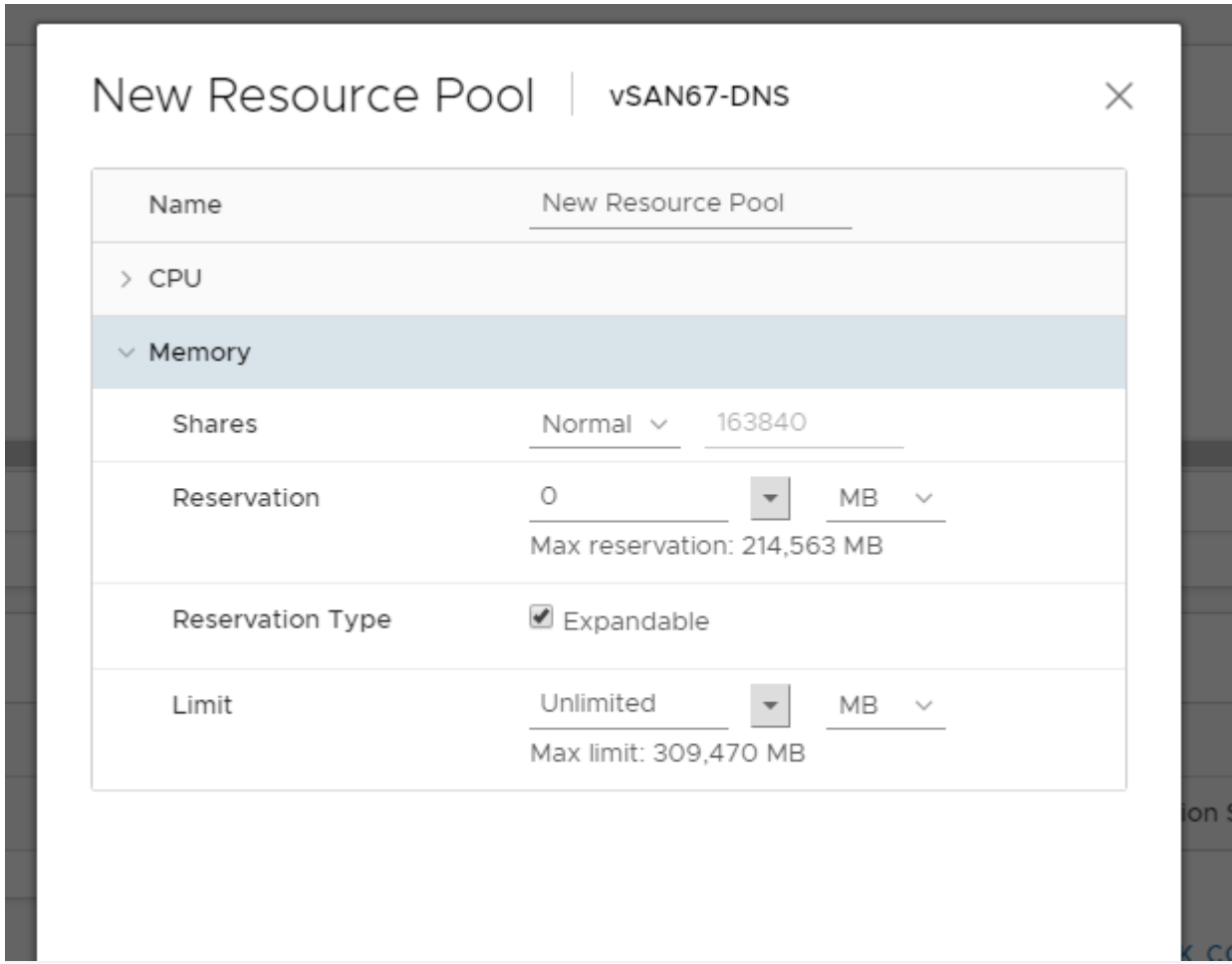

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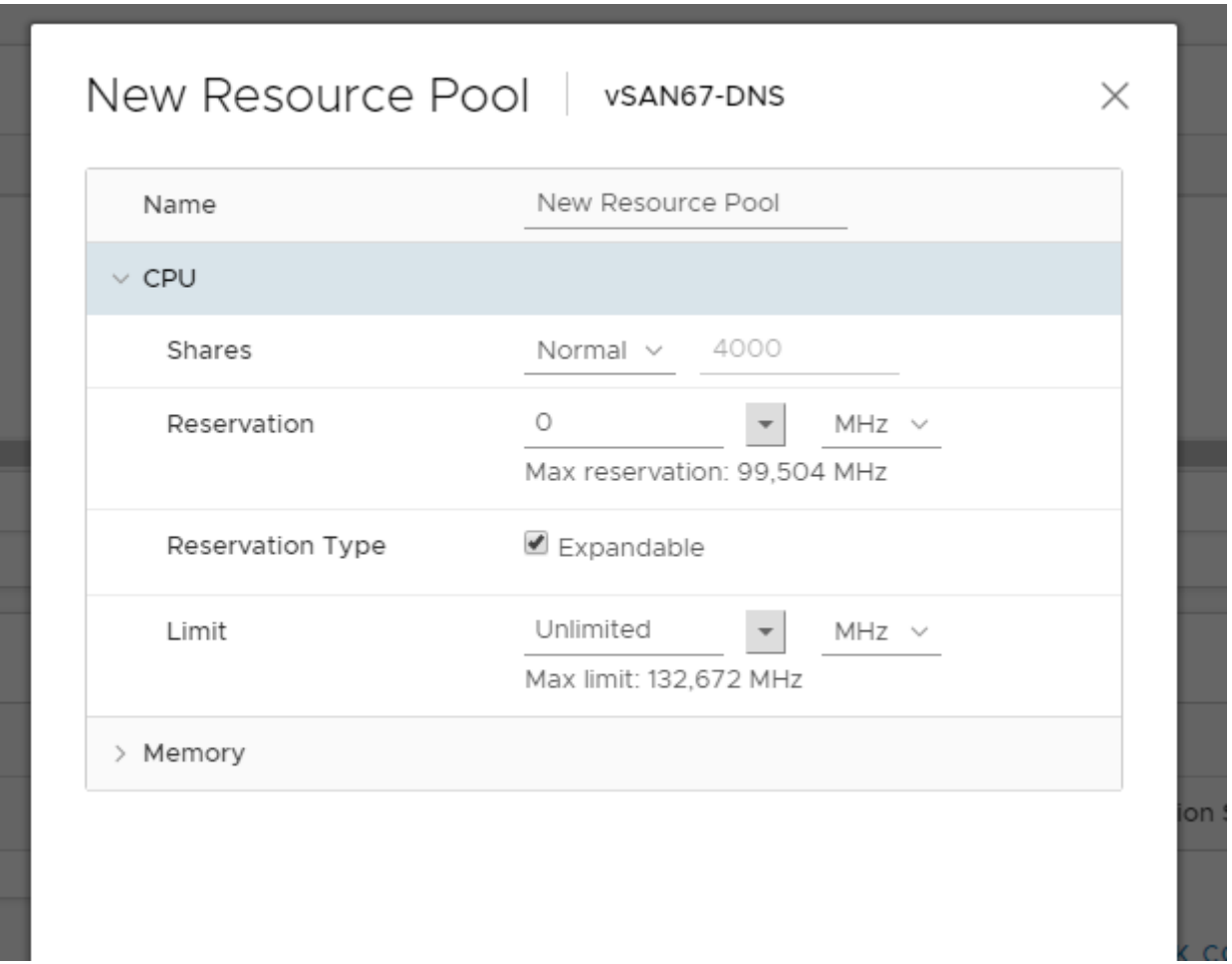

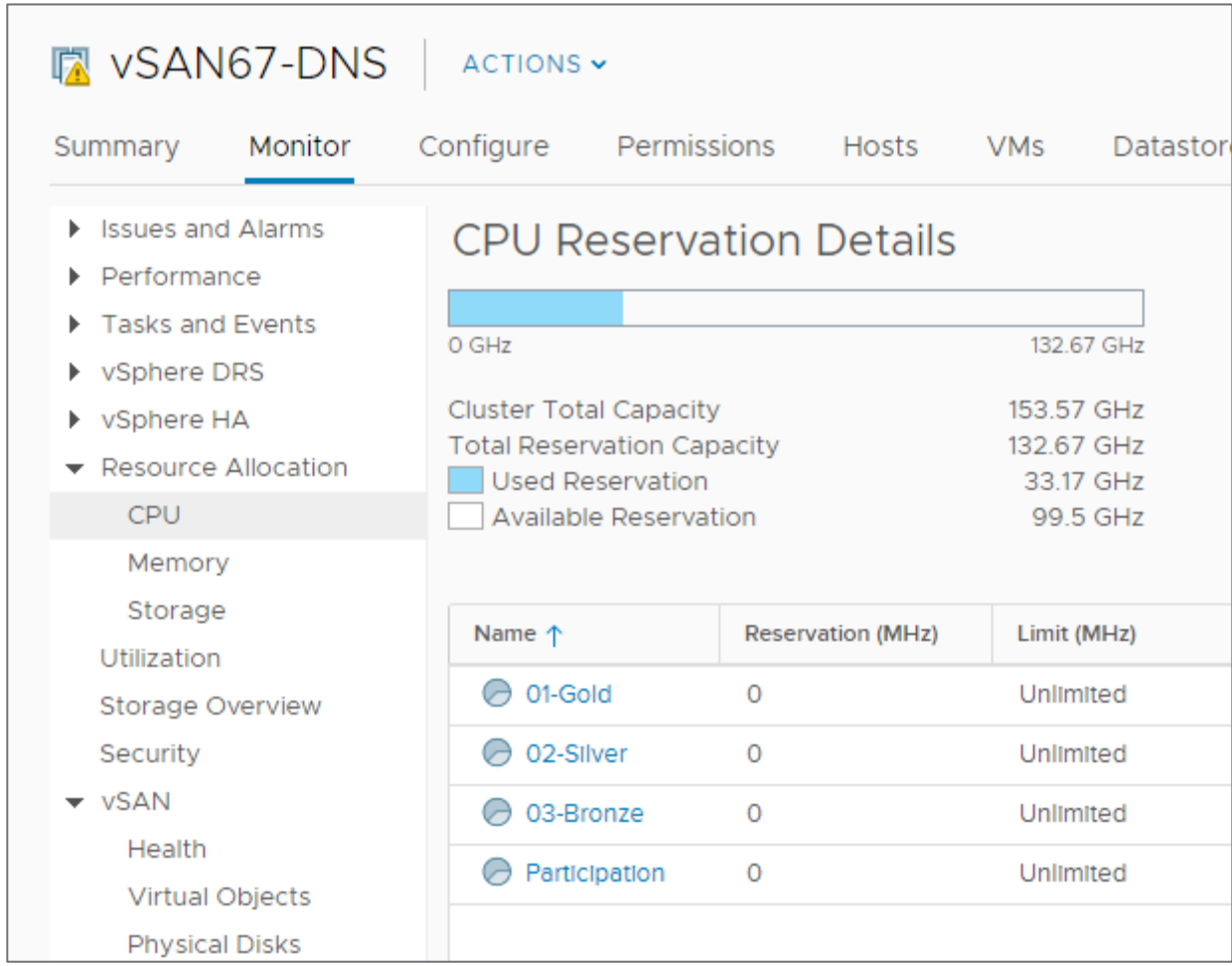

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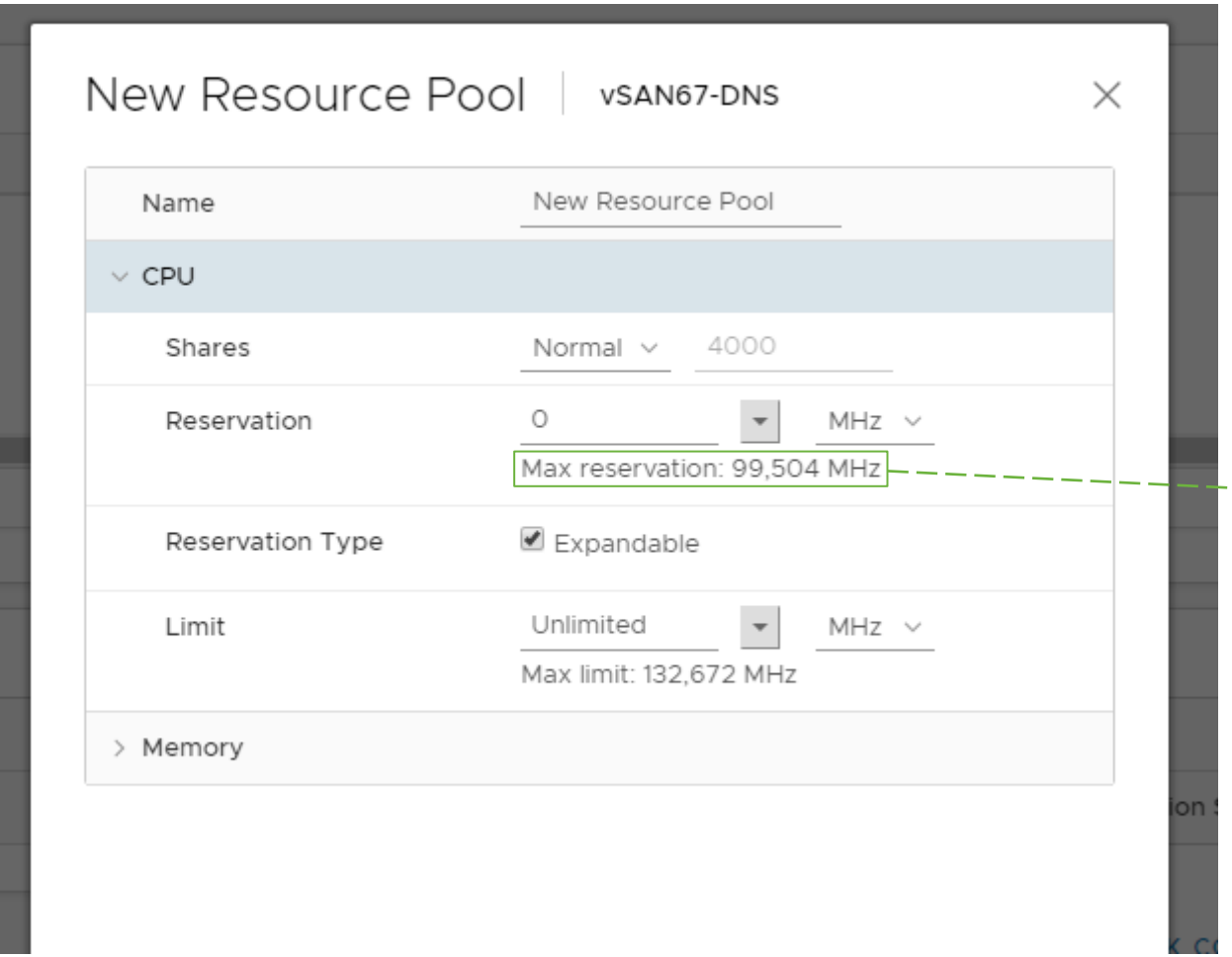

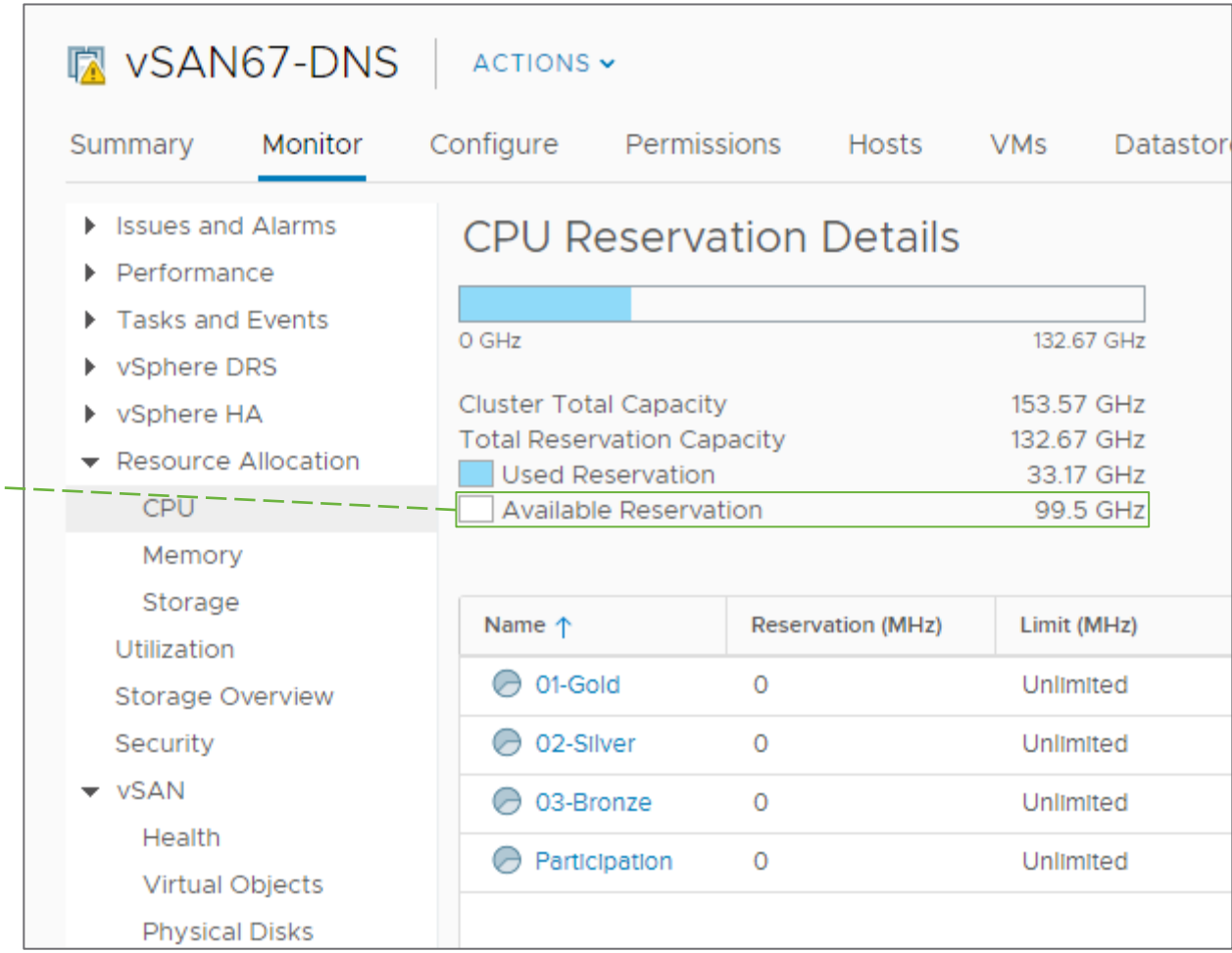

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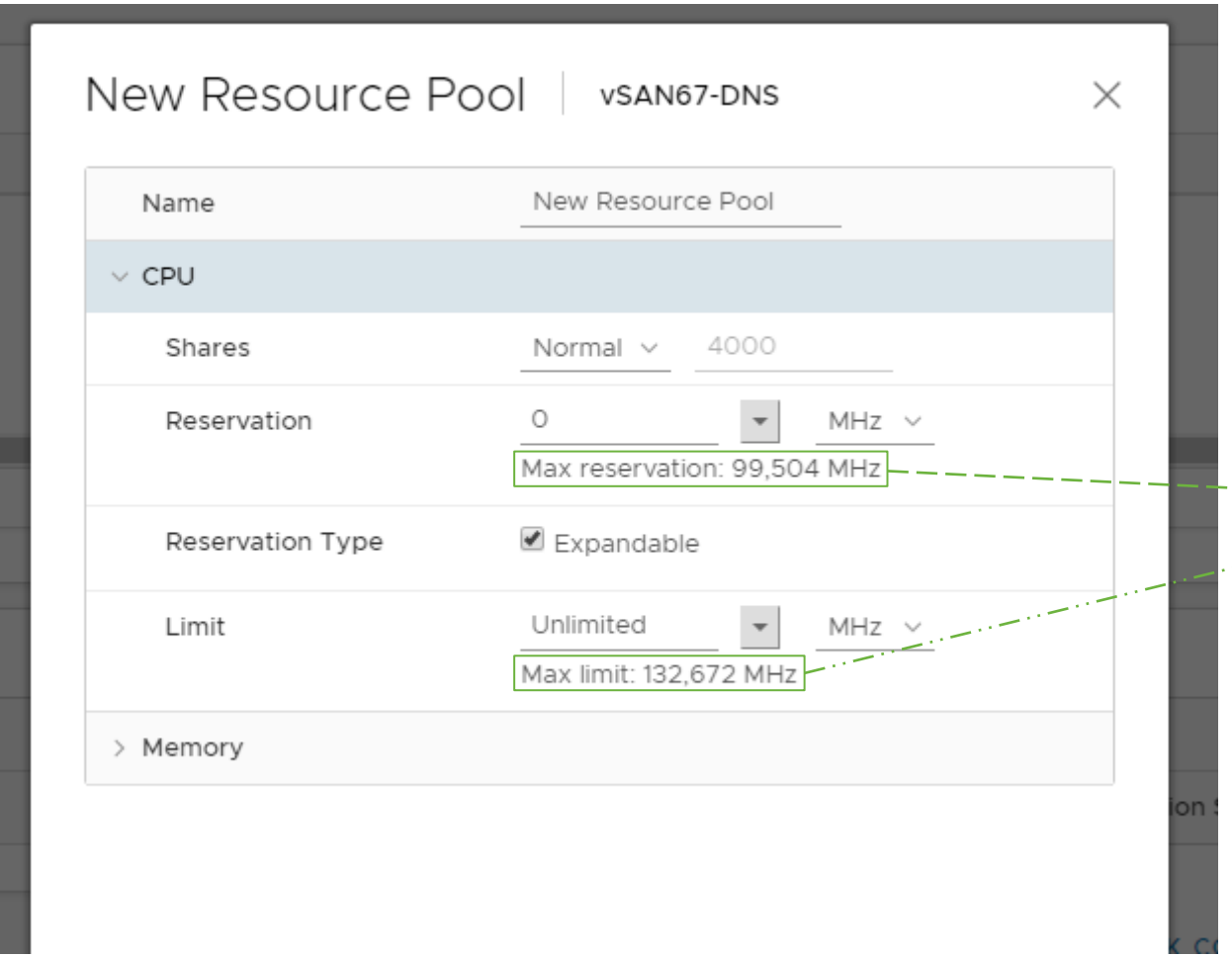
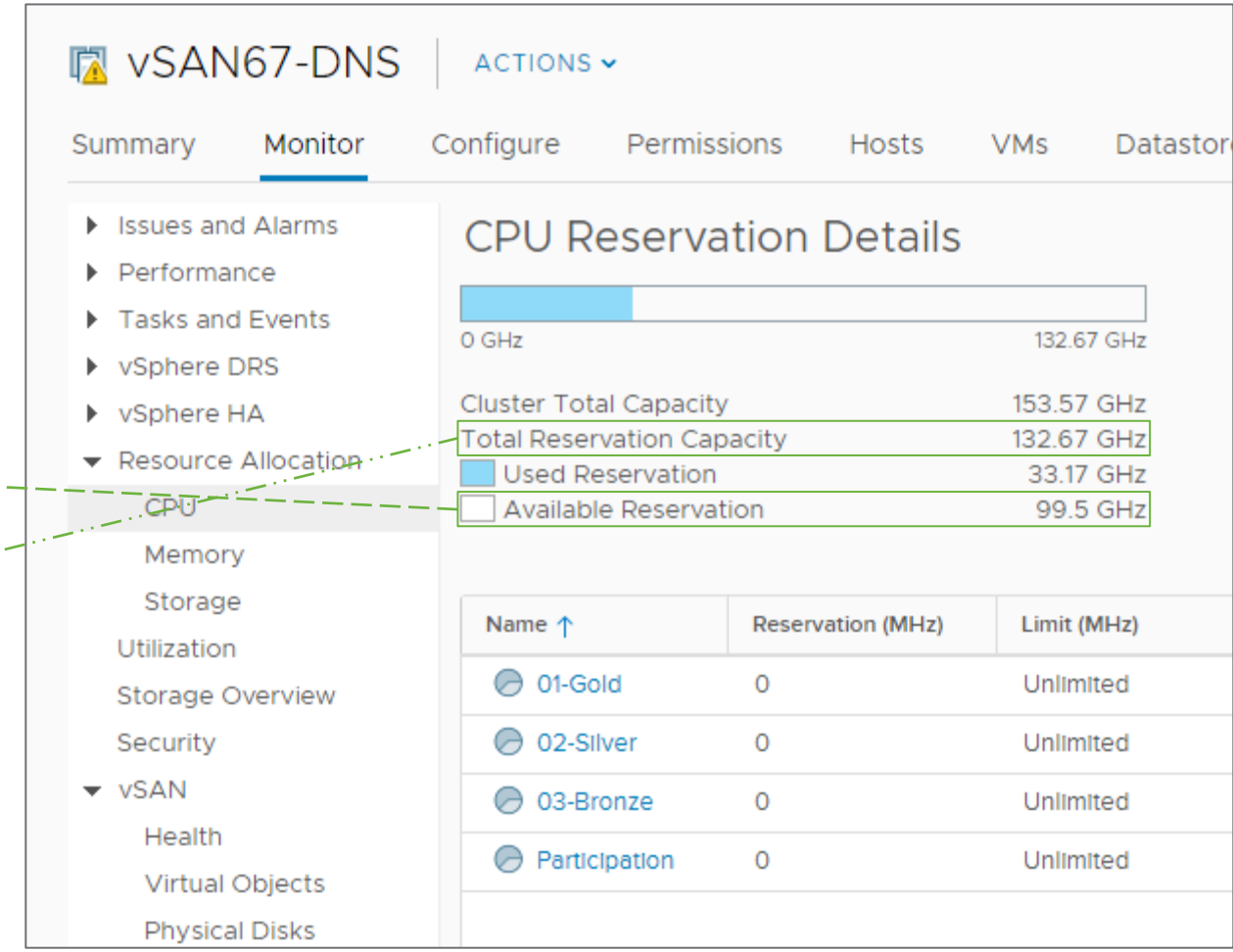
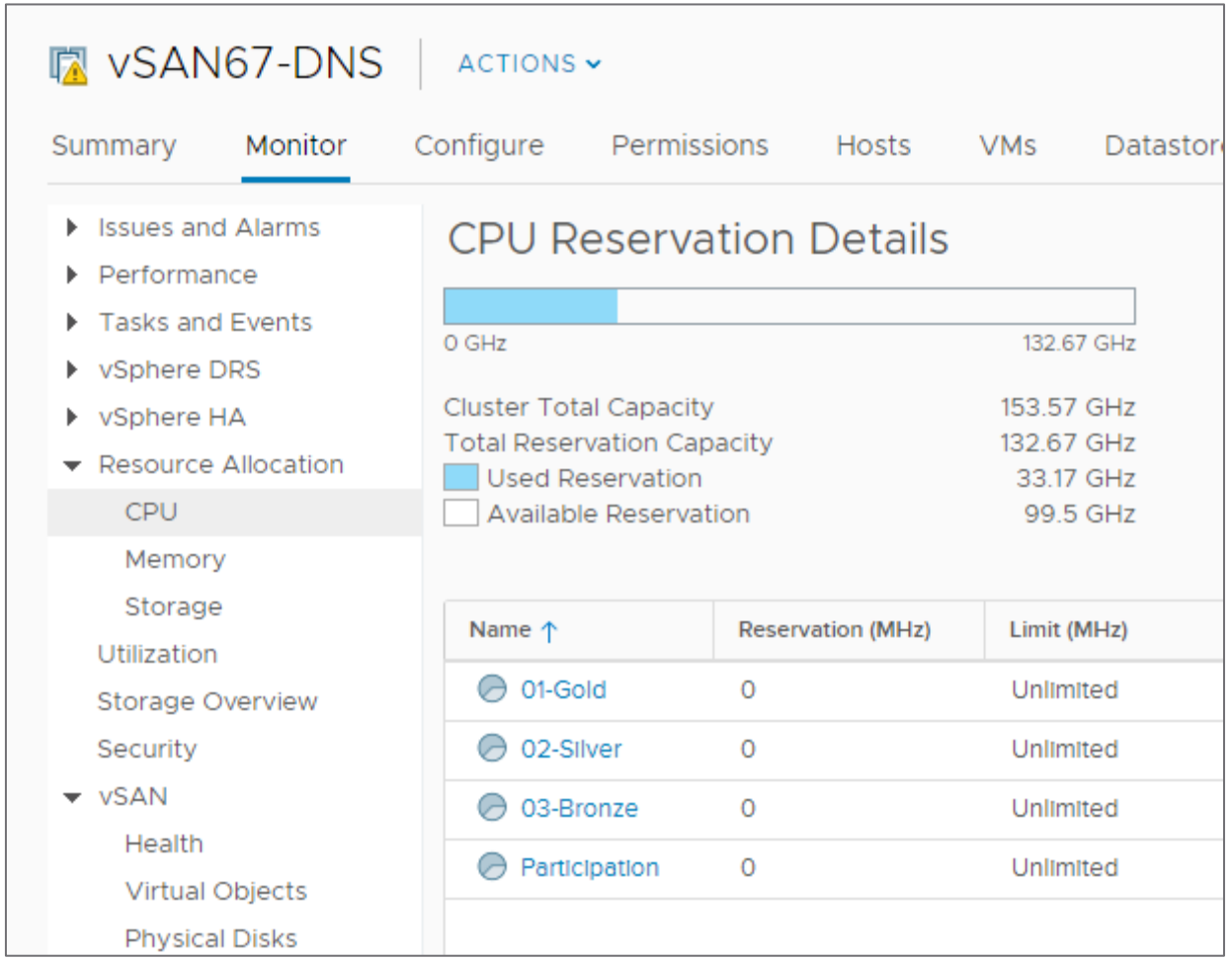




Resource Pools

What is consuming reservations? (CPU)



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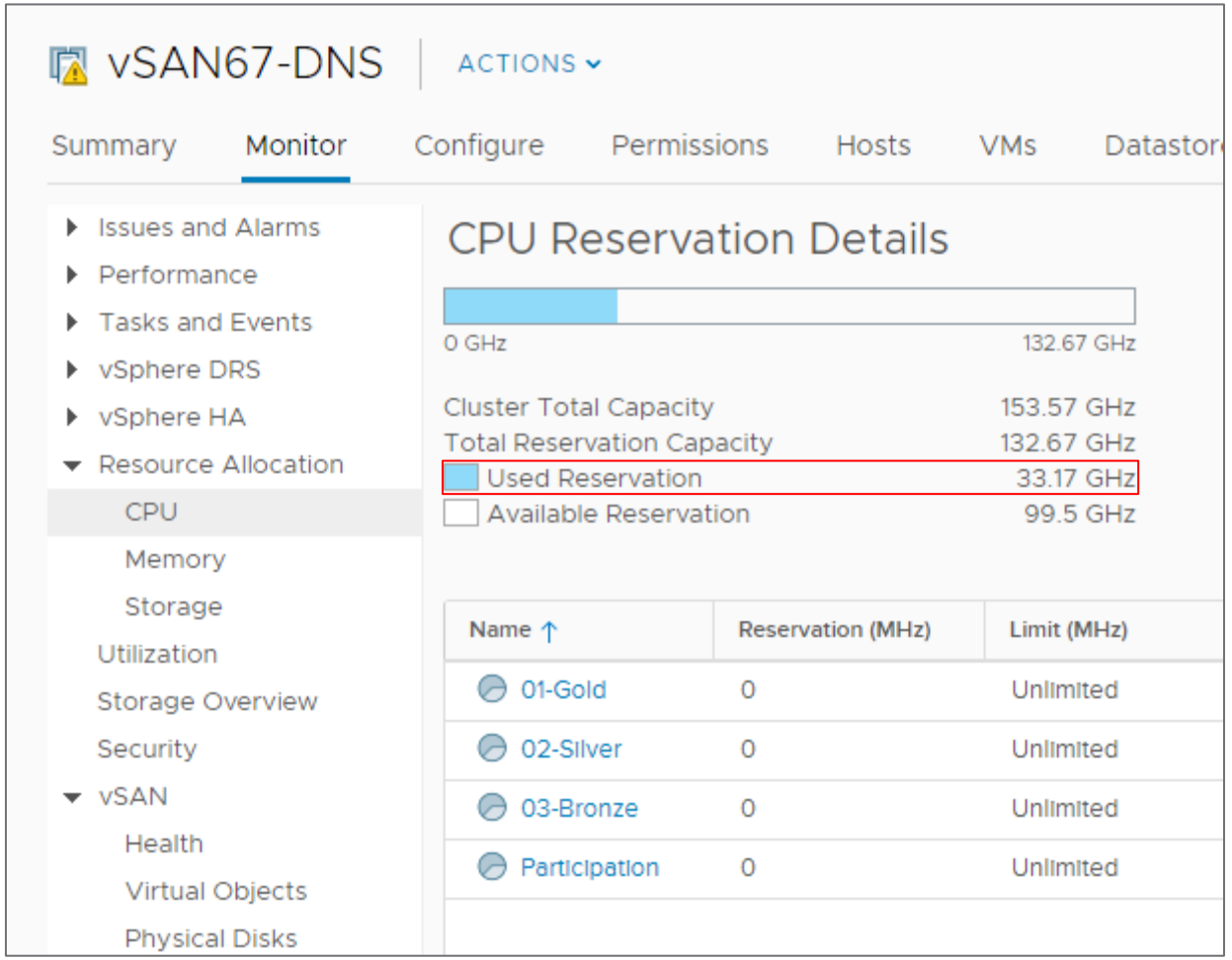

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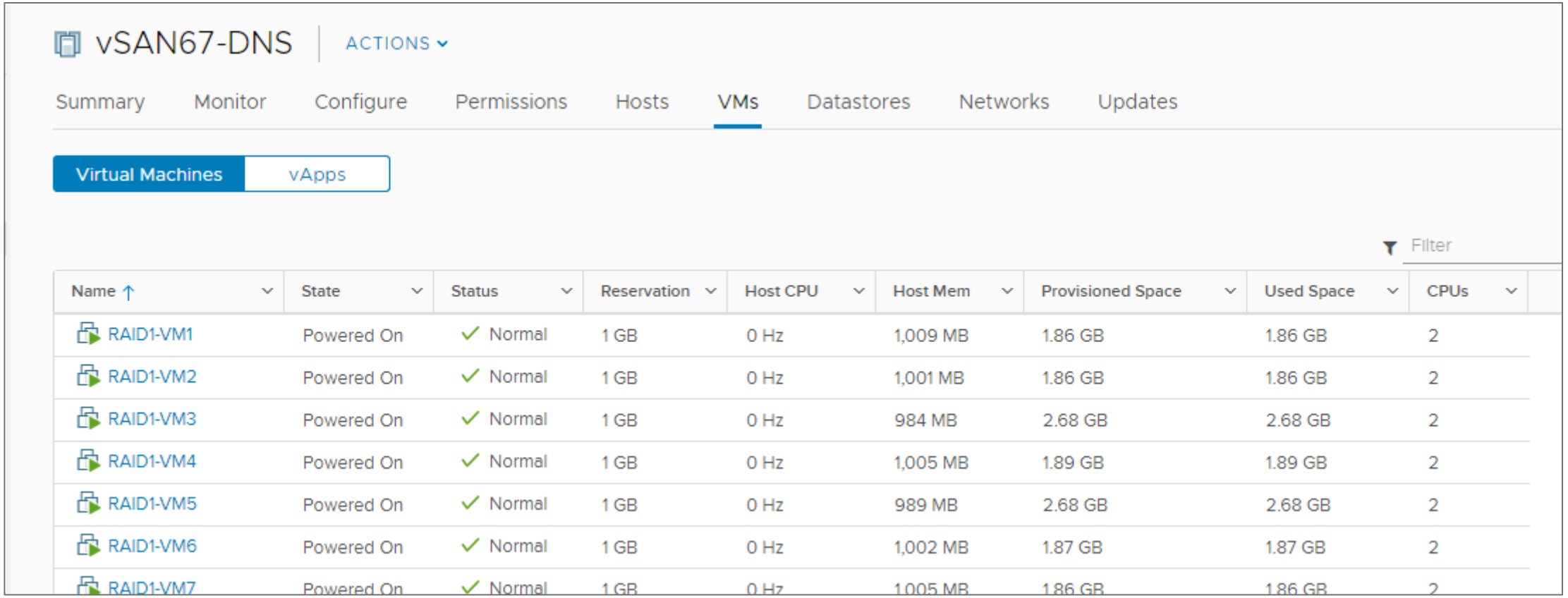

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RAID1-VM1	Powered On	Normal	1 GB	0 Hz	1,009 MB	1.86 GB	1.86 GB	2
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RAID1-VM3	Powered On	Normal	1 GB	0 Hz	984 MB	2.68 GB	2.68 GB	2
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RAID1-VM5	Powered On	Normal	1 GB	0 Hz	989 MB	2.68 GB	2.68 GB	2
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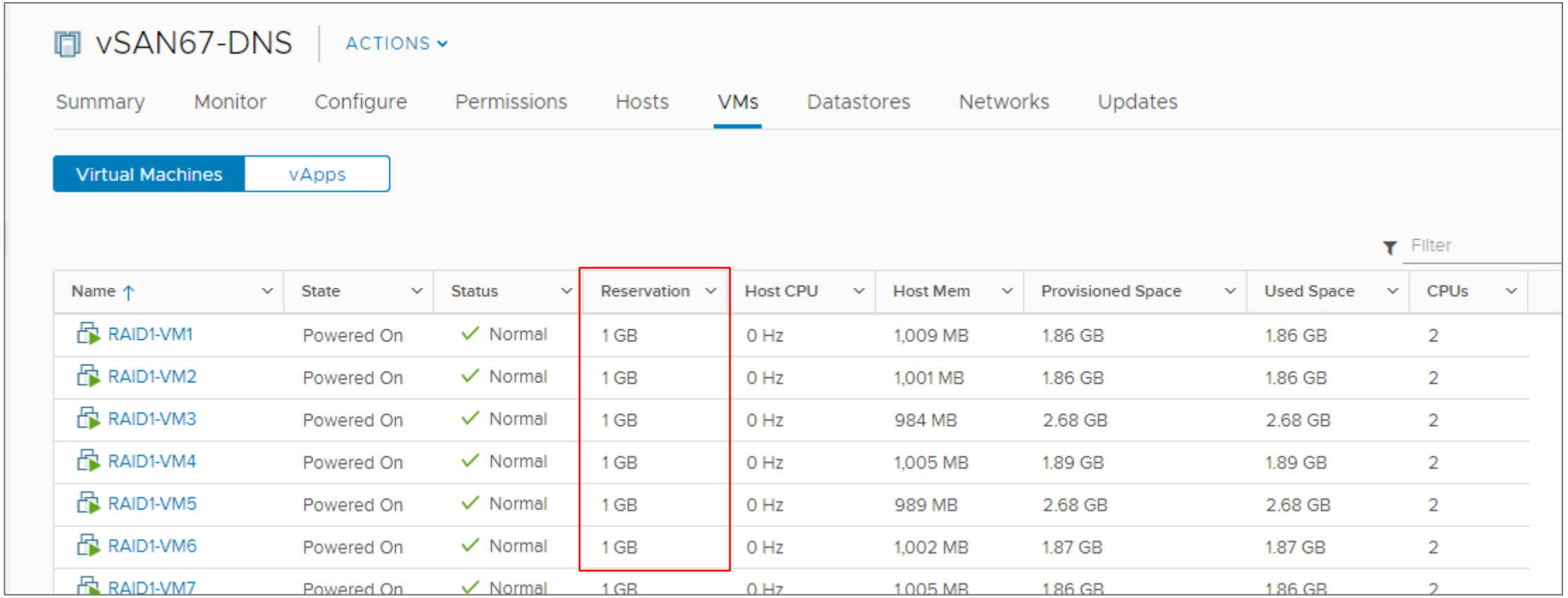

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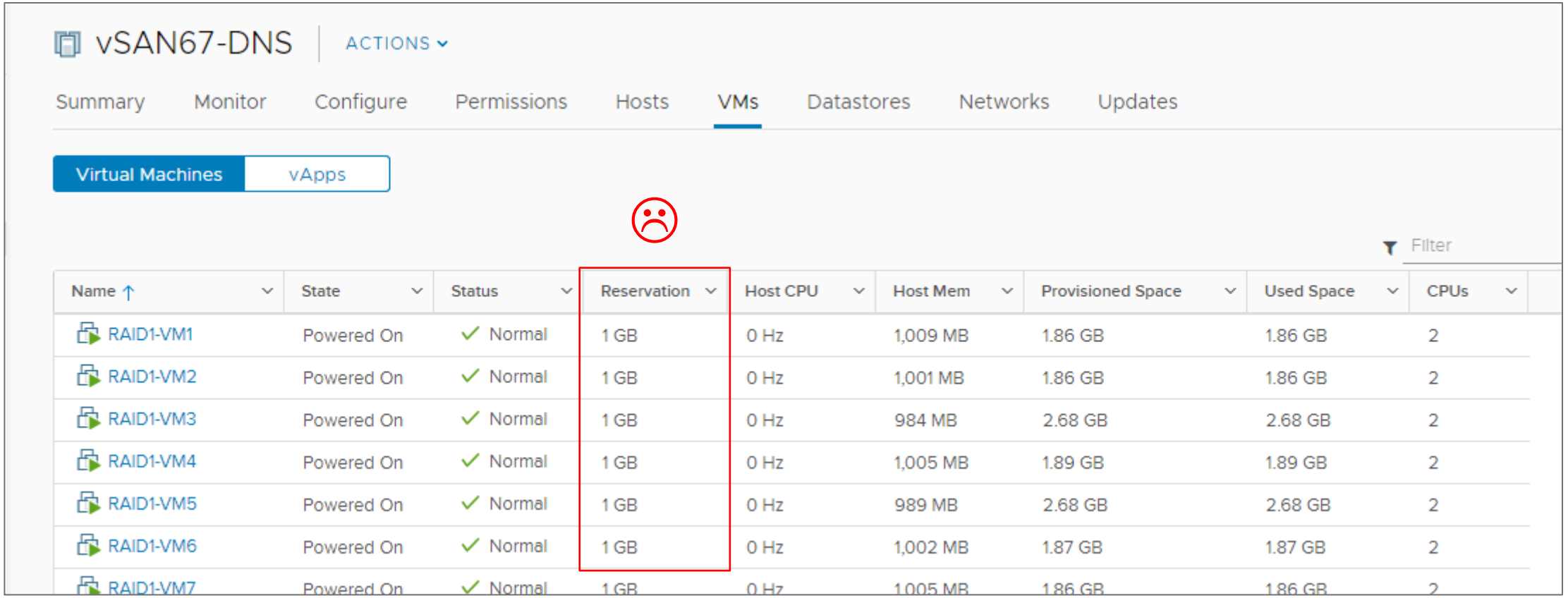

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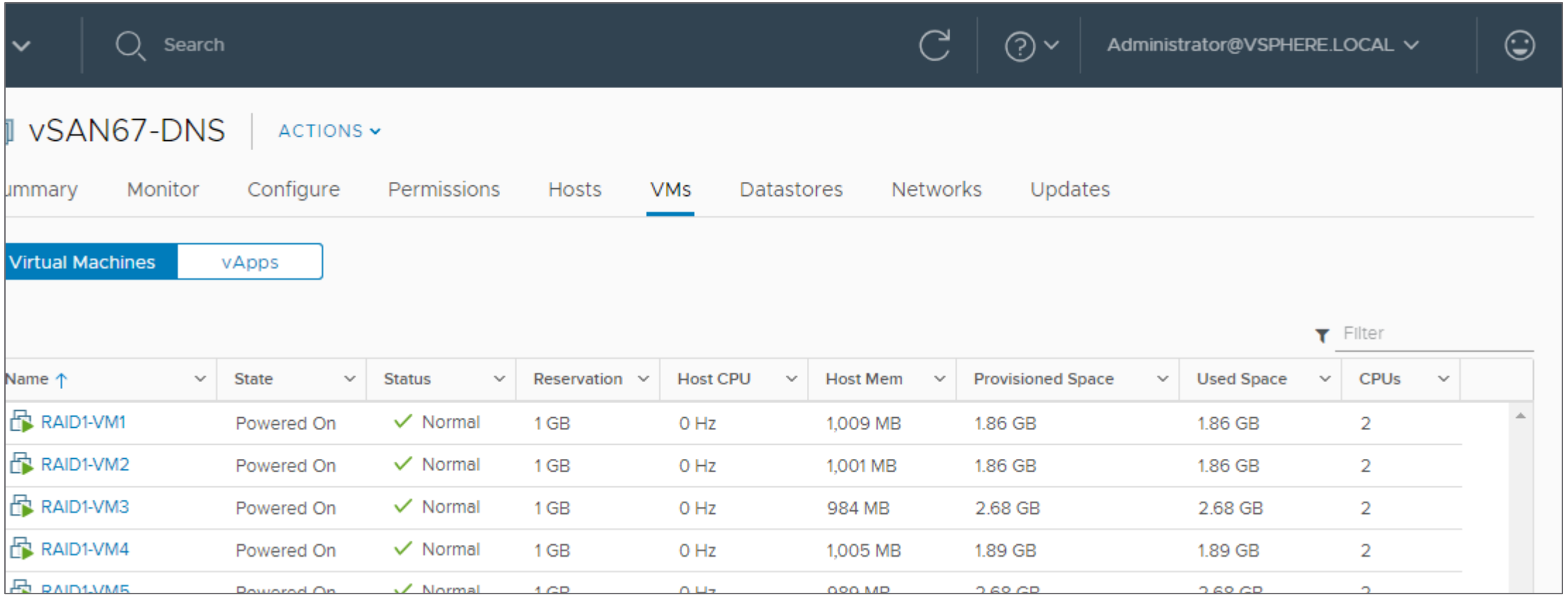

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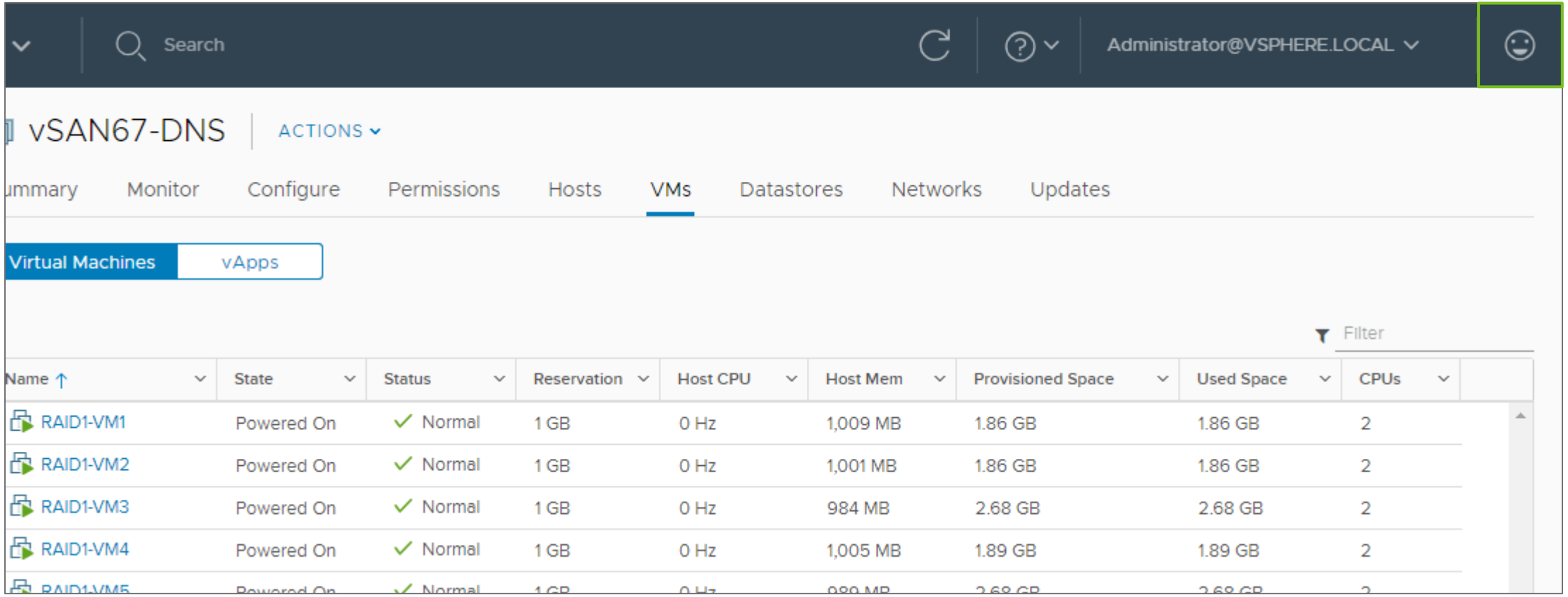

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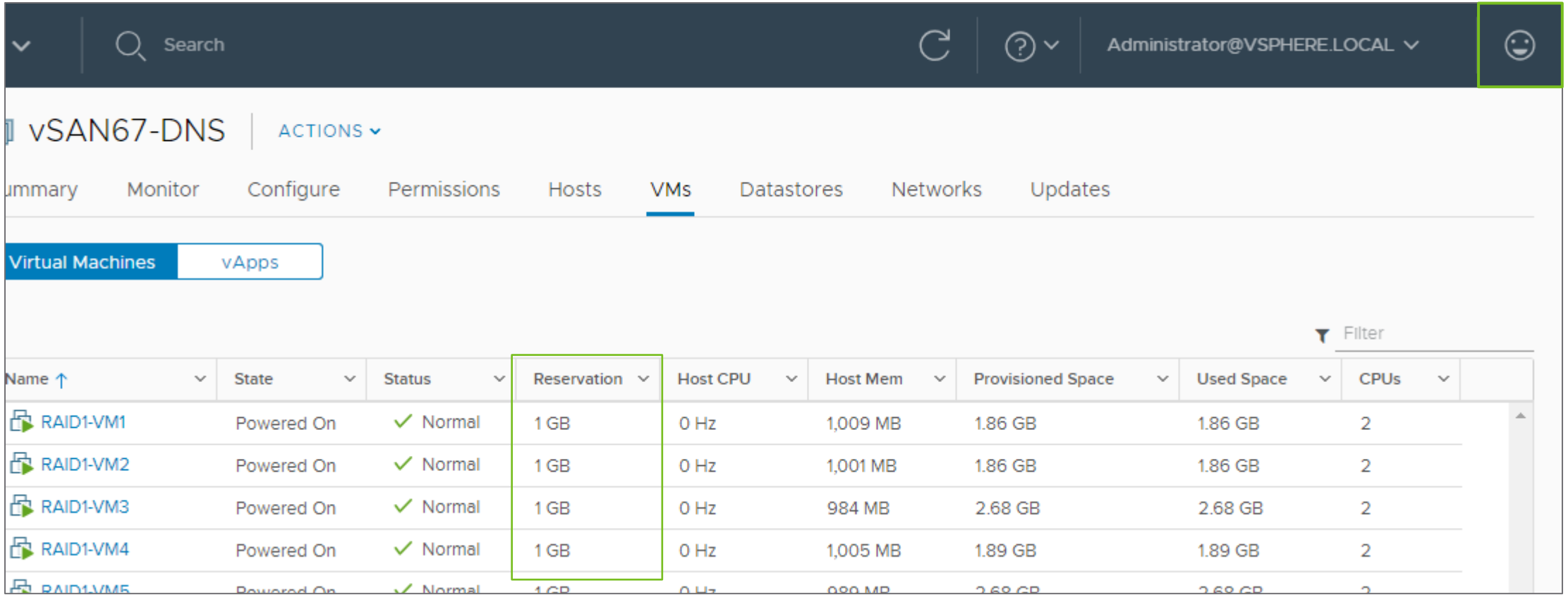

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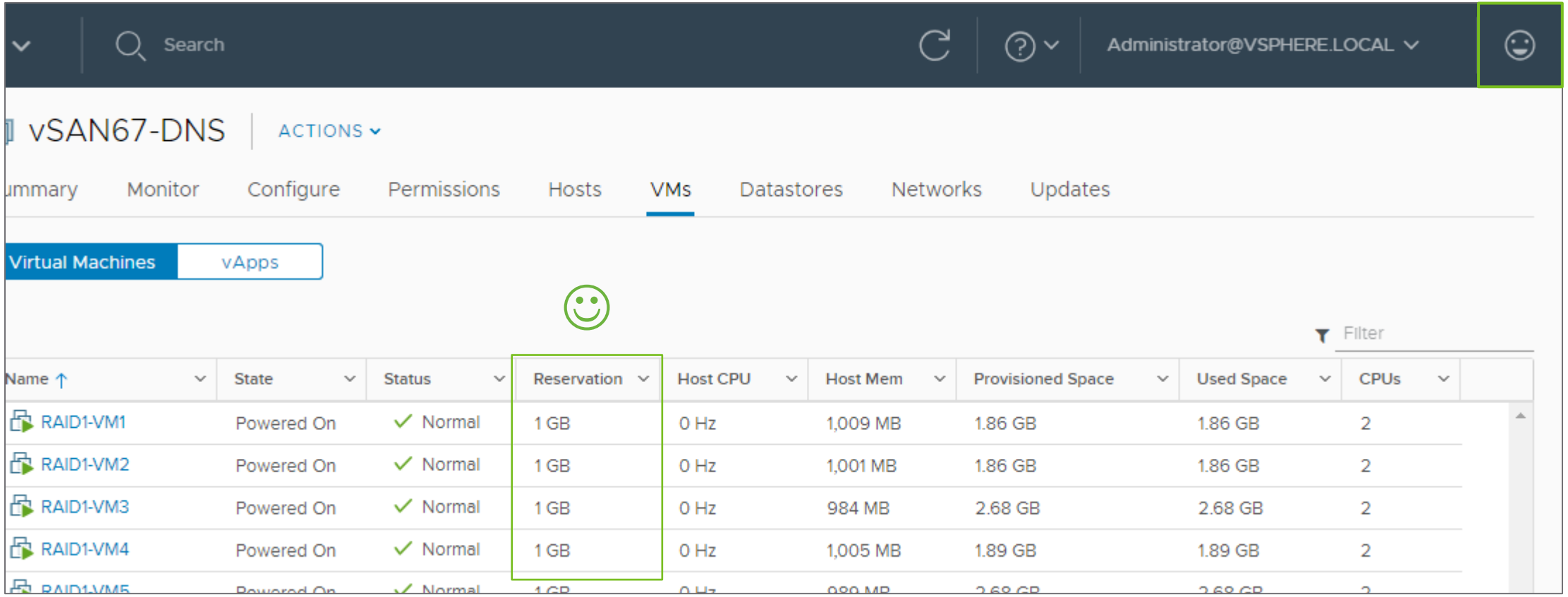

Resource Pools

What is consuming reservations? (CPU)

```
PowerCLI C:\> Get-Cluster -Name "vSAN67-DNS" | Get-VM | Get-VMResourceConfiguration | Select-Object VM,CpuReservationMhz | Sort-Object VM

VM         CpuReservationMhz
--         -----------------
RAID1-VM1                  0
RAID1-VM2                  0
RAID1-VM3                  0
RAID1-VM4                  0
RAID1-VM5                  0
RAID1-VM6                  0
RAID1-VM7                  0
RAID1-VM8                  0
RAID5-VM1                  0
RAID5-VM2                  0
RAID5-VM3                  0
RAID5-VM4                  0
RAID5-VM5                  0
RAID5-VM6                  0
RAID5-VM7                  0
RAID5-VM8                  0


PowerCLI C:\>
powershell.exe*[*64]:19544
```

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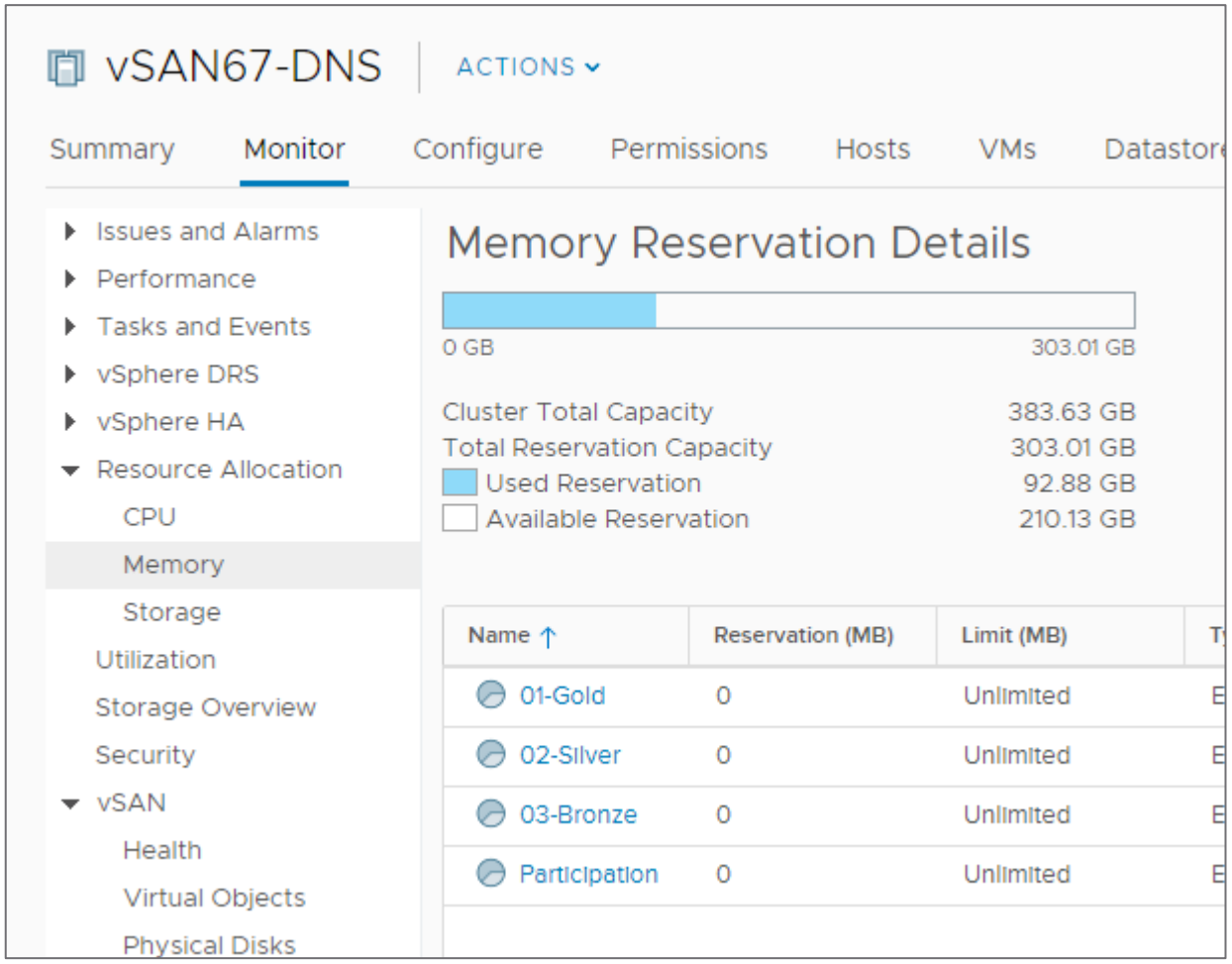
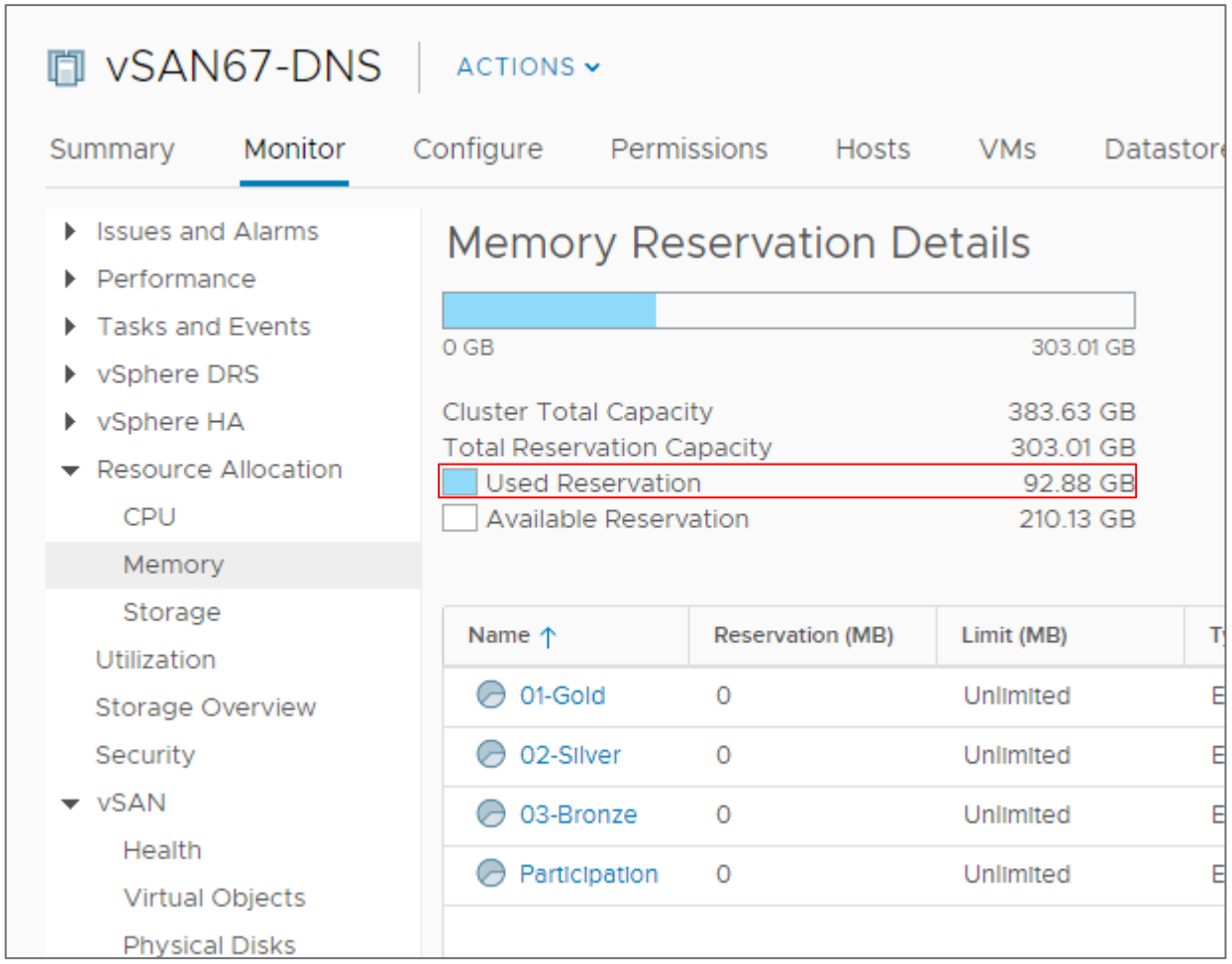
What is consuming reservations? (Memory)



Resource Pools

What is consuming reservations? (Memory)



 |

Resource Pools

What is consuming reservations? (Memory)

```
PowerCLI C:\> Get-Cluster -Name "vSAN67-DNS" | Get-VM | Get-VMResourceConfiguration | Select-Object VM,MemReservationGb | Sort-Object VM

VM        MemReservationGB
--        ----------------
RAID1-VM1                1
RAID1-VM2                1
RAID1-VM3                1
RAID1-VM4                1
RAID1-VM5                1
RAID1-VM6                1
RAID1-VM7                1
RAID1-VM8                1
RAID5-VM1                1
RAID5-VM2                1
RAID5-VM3                1
RAID5-VM4                1
RAID5-VM5                1
RAID5-VM6                1
RAID5-VM7                1
RAID5-VM8                1


PowerCLI C:\>
powershell.exe*[*64]:19544
```

PowerCLI C:\> Get-Cluster -Name "vSAN67-DNS" | Get-VM | Get-VMResourceConfiguration | Select-Object VM,MemReservationGb | Sort-Object VM

Resource Pools

What is consuming reservations? (Memory)

```
PowerCLI C:\> Get-Cluster -Name "vSAN67-DNS" | Get-VM | Get-VMResourceConfiguration | Measure-Object MemReservationGb -Sum | Select Sum

Sum
---
 16


PowerCLI C:\>
powershell.exe*[*64]:19544
```

Remember: 16 GB

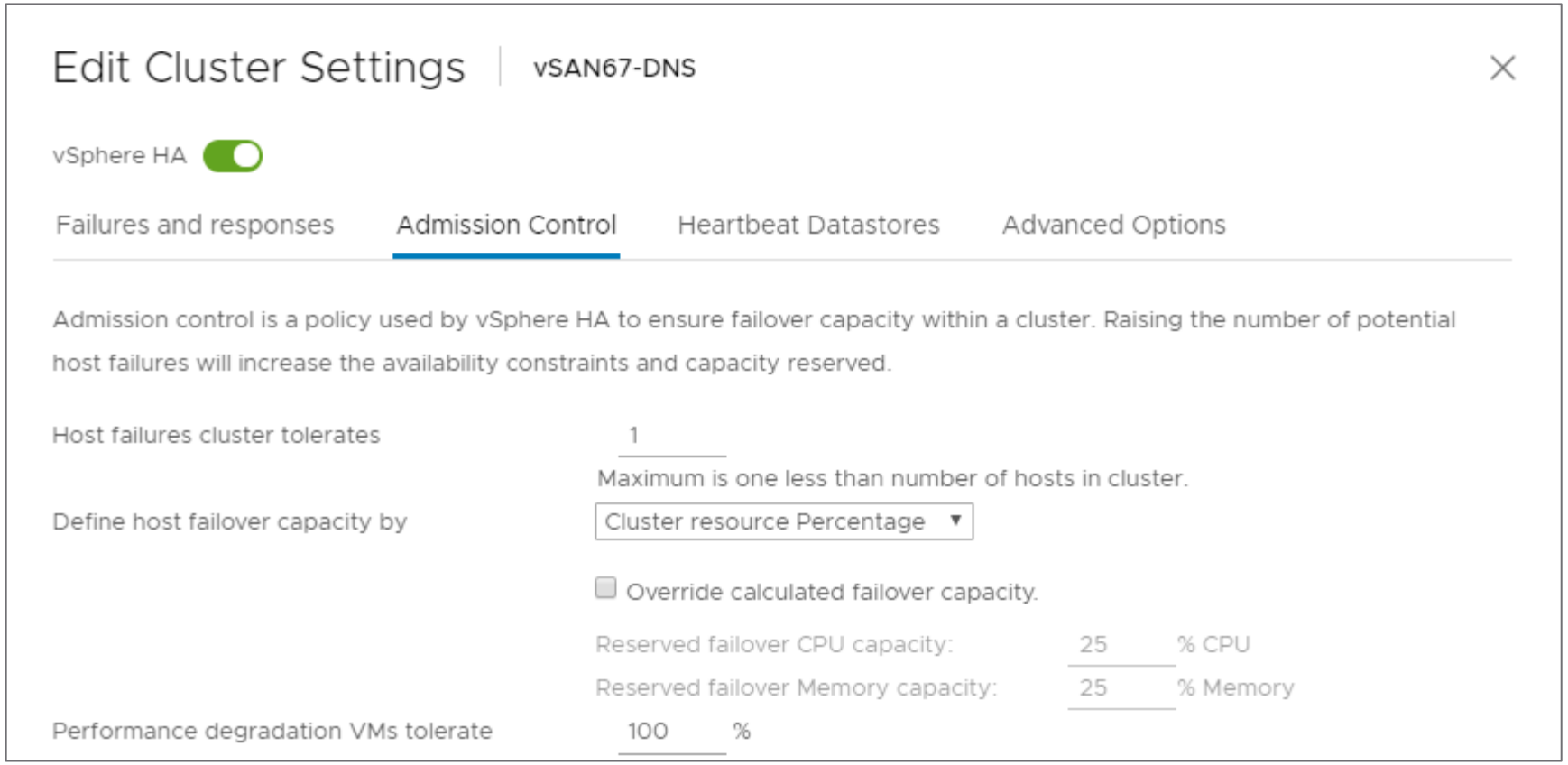
PowerCLI C:\> Get-Cluster -Name "vSAN67-DNS" | Get-VM | Get-VMResourceConfiguration | Measure-Object MemReservationGb -Sum | Select-Object Sum

What could cause the difference? *

* 33.17 GHz vs 0 and 92.88 GB vs 16

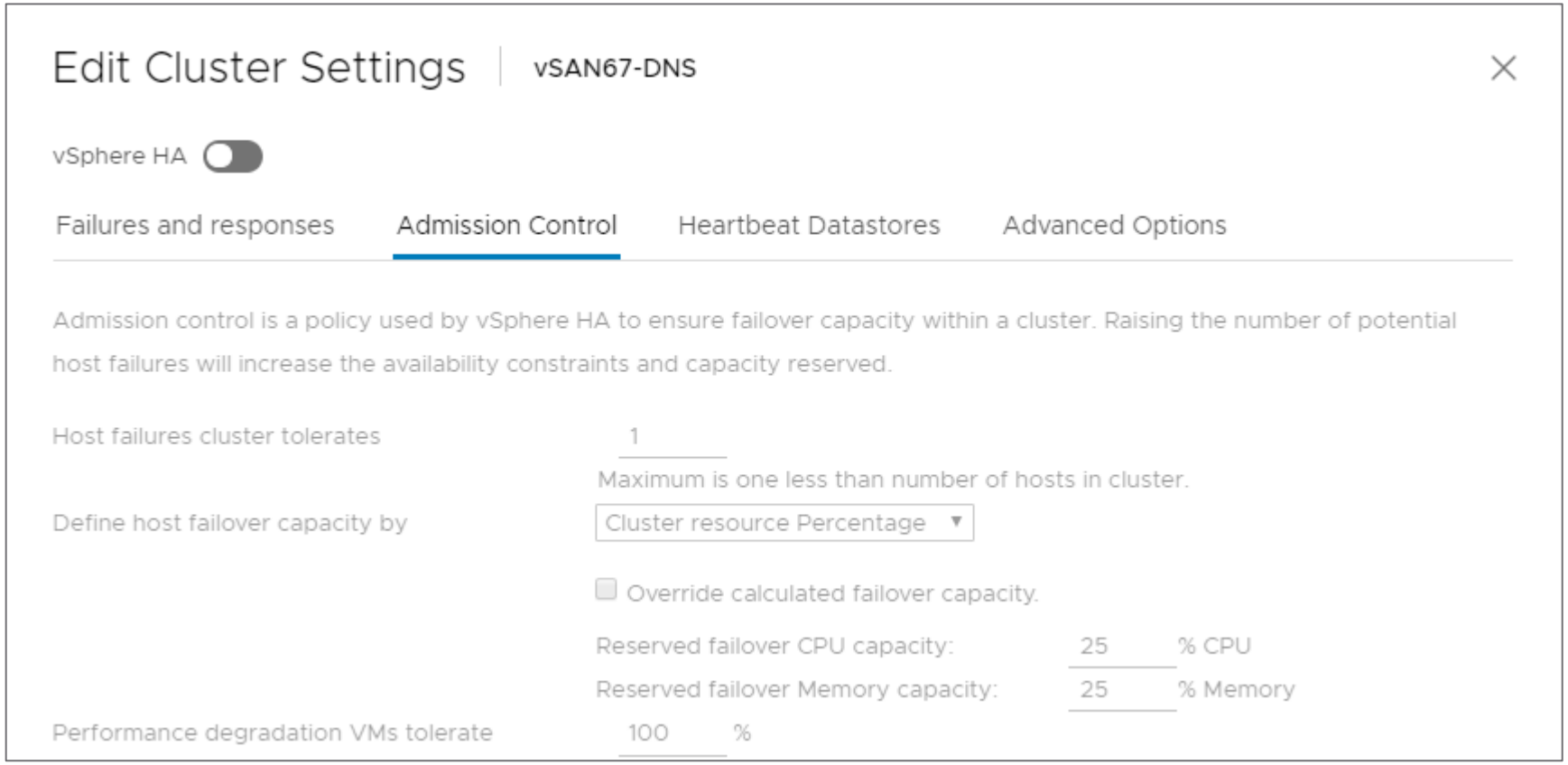
Resource Pools

Admission Control



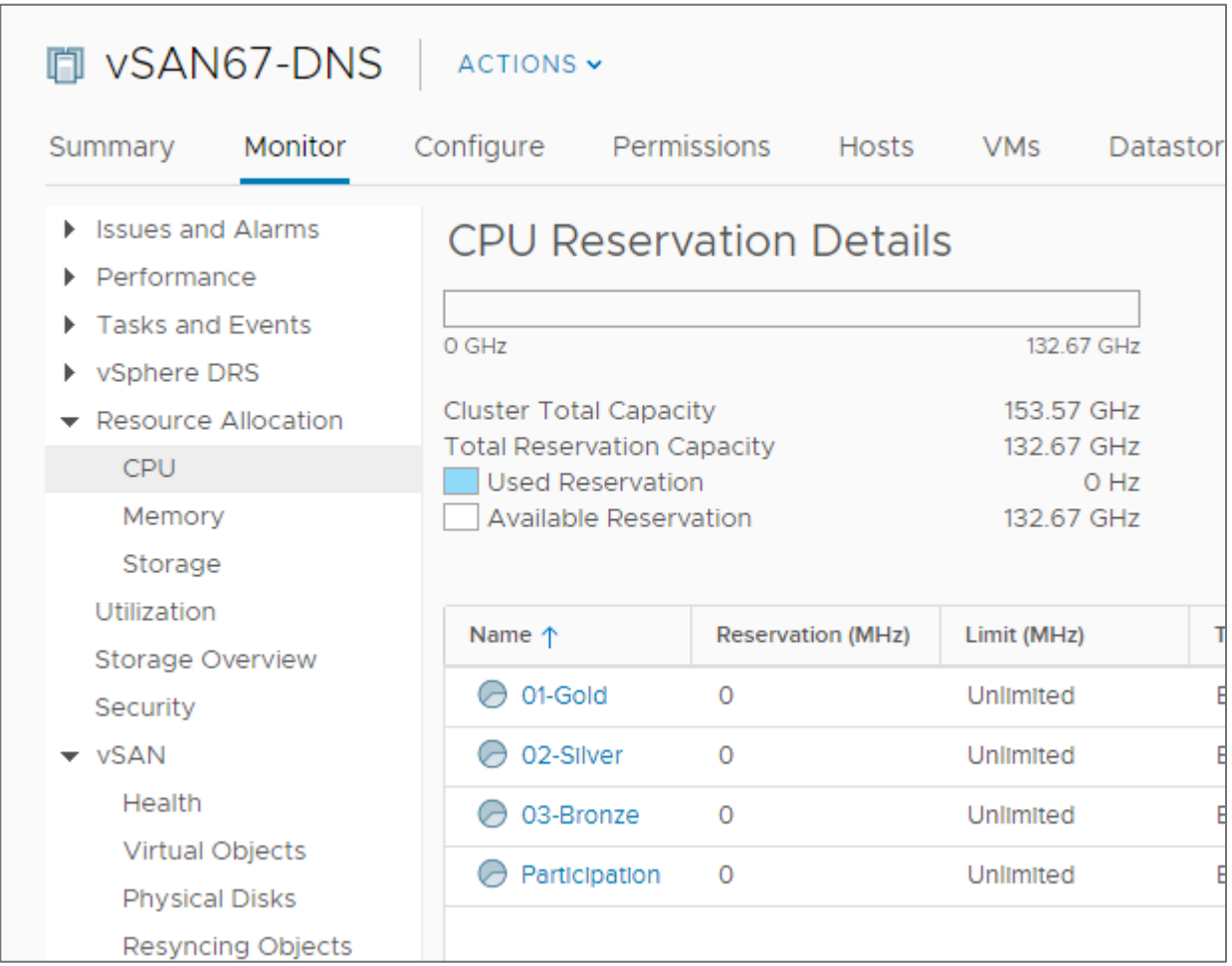
Resource Pools

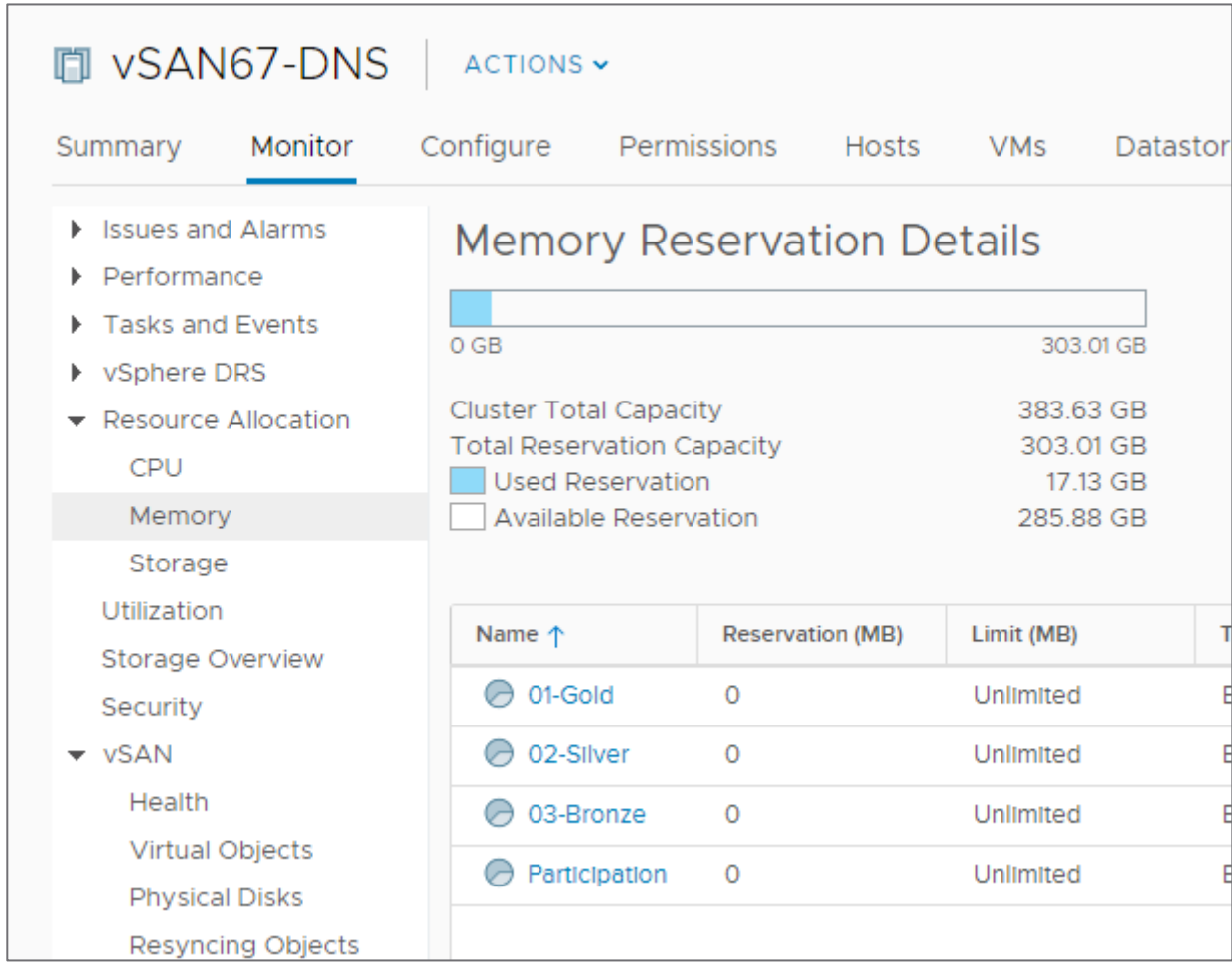
Admission Control



Resource Pools

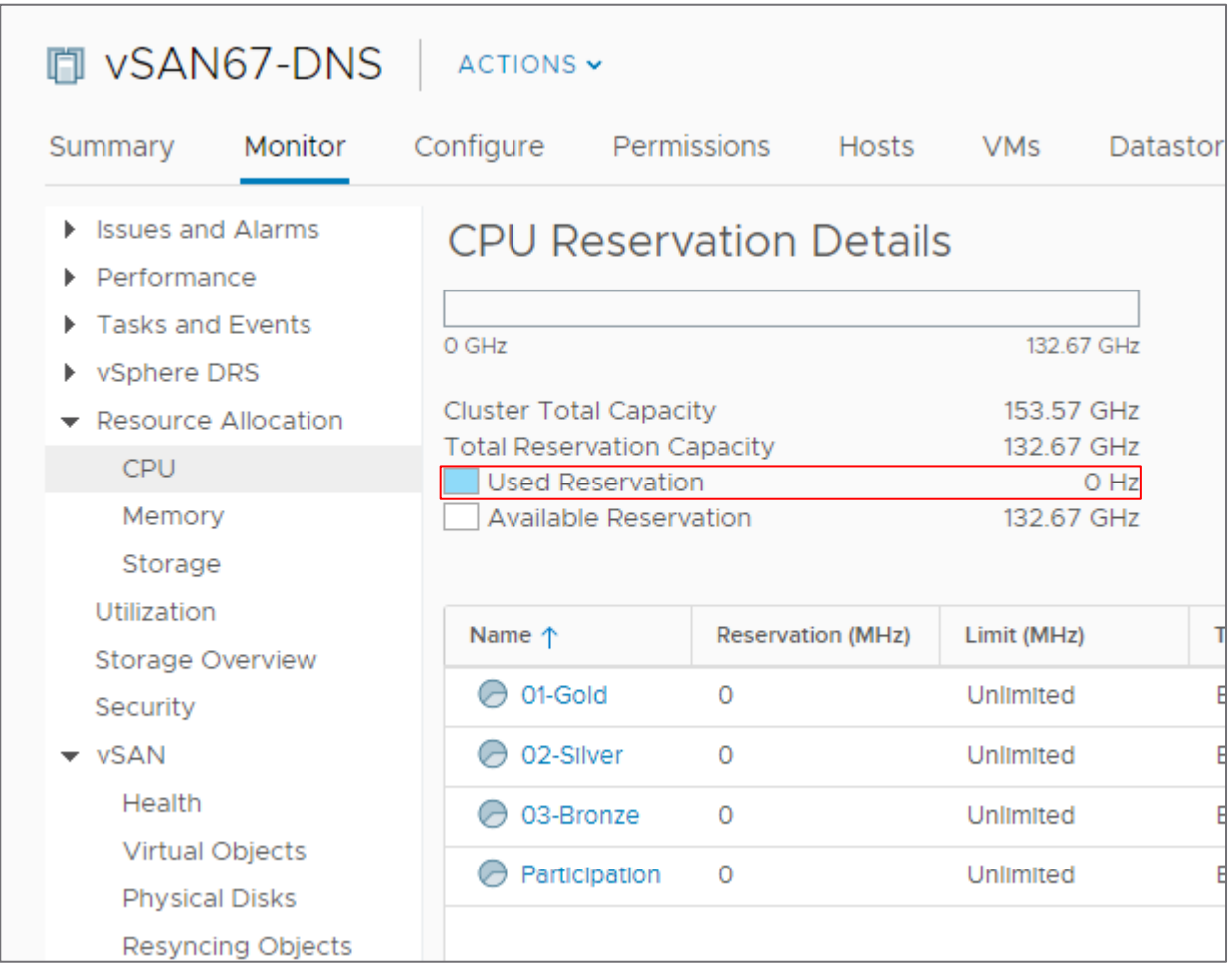
Without Admission Control

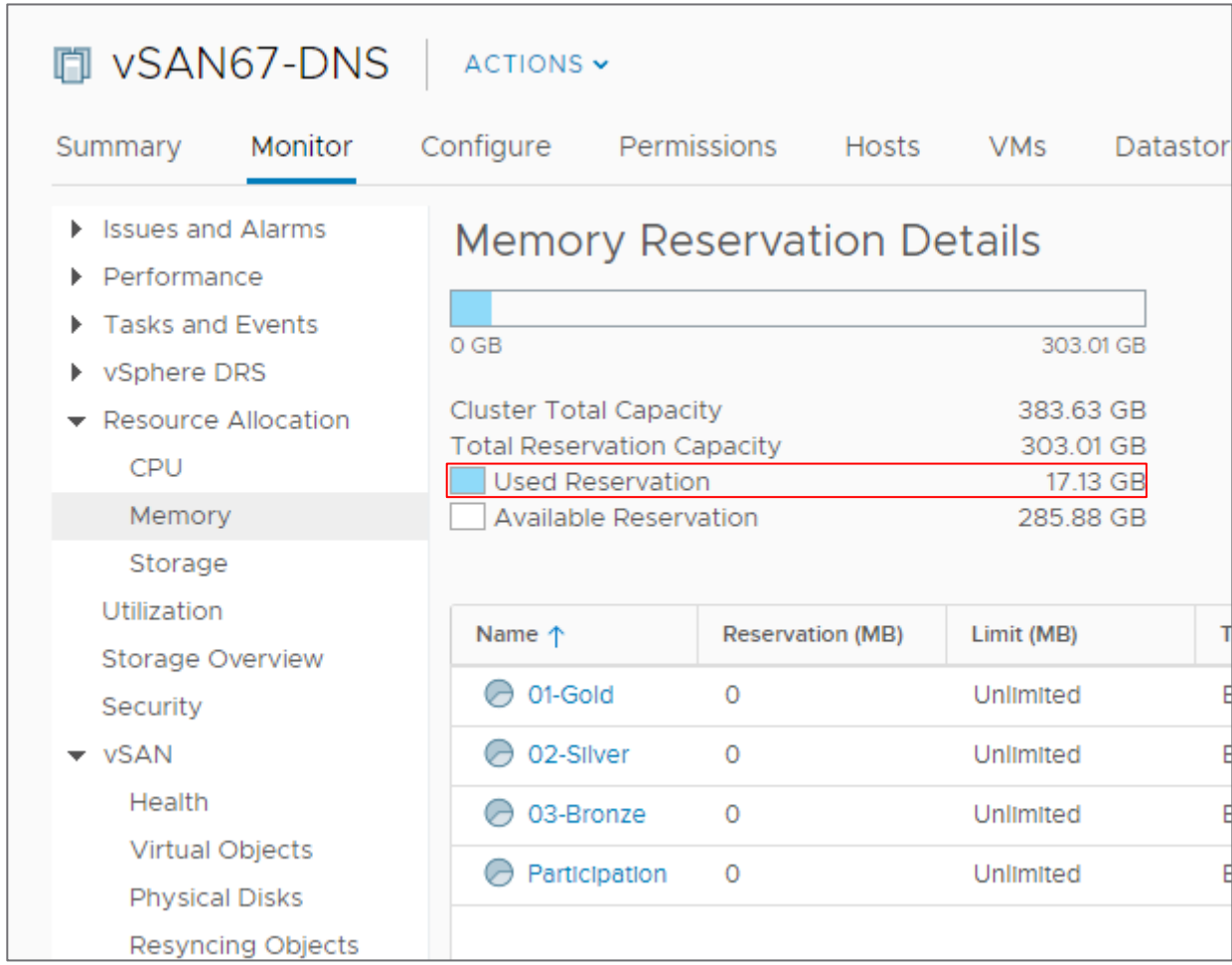




Resource Pools

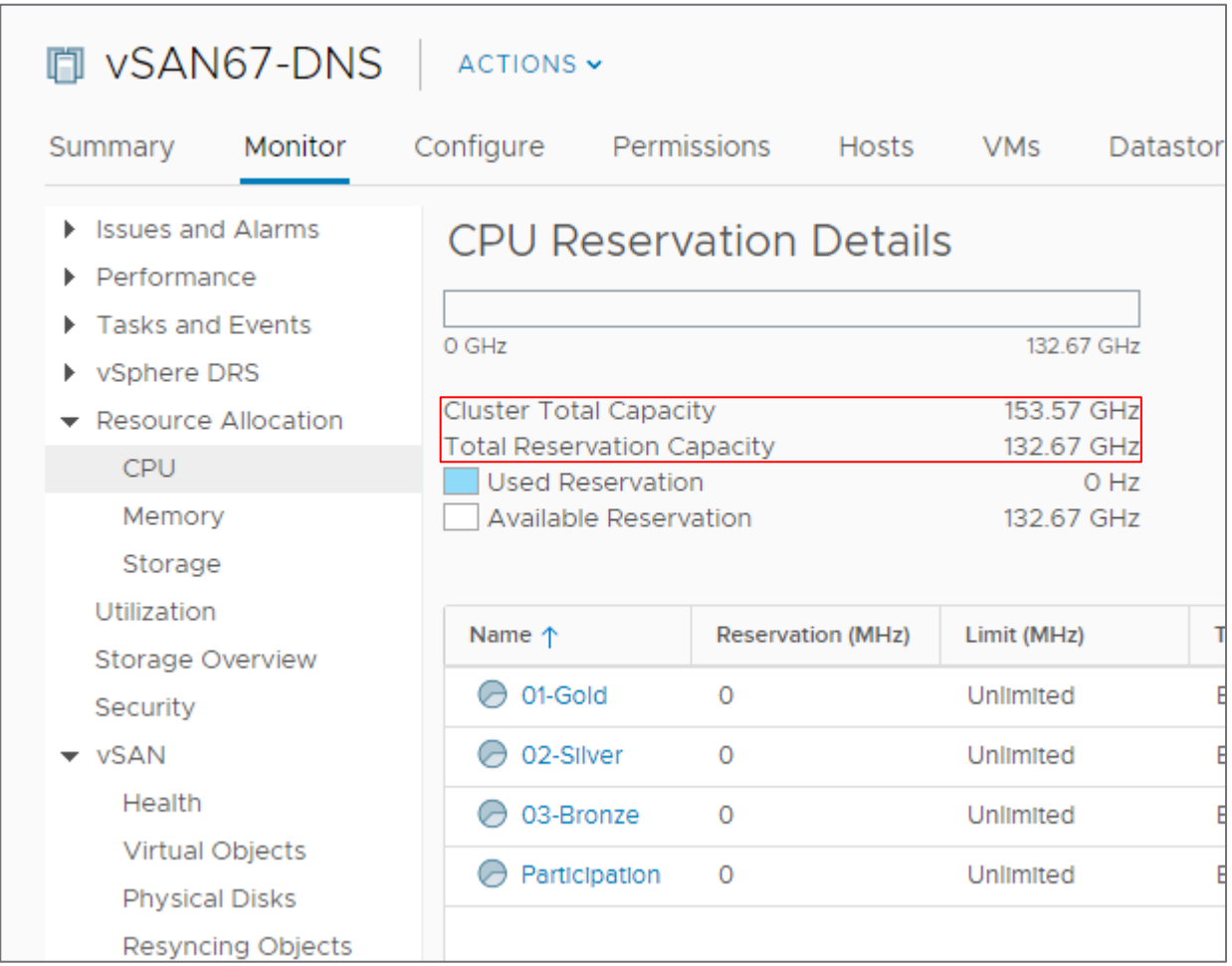
Without Admission Control

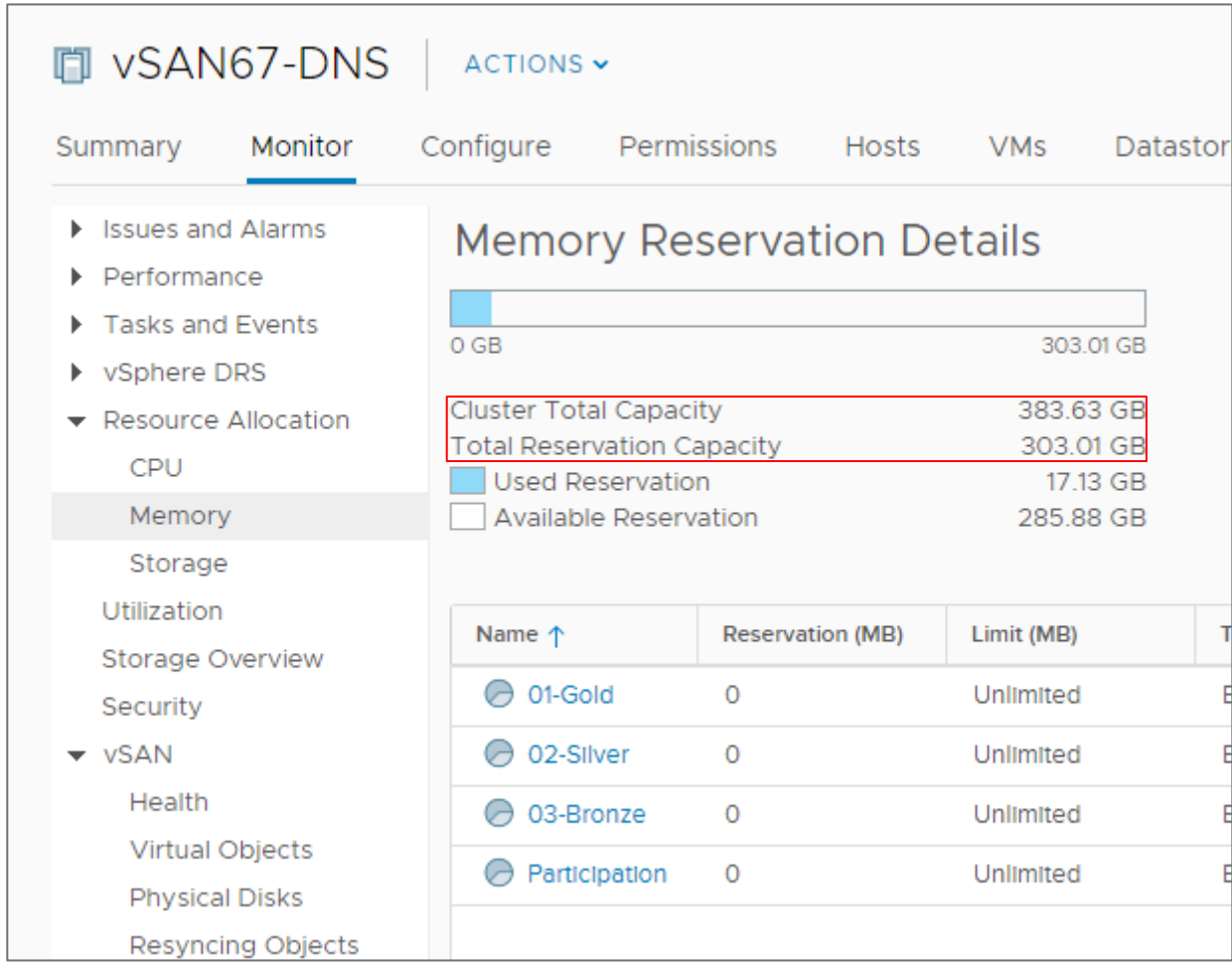




Resource Pools

Creation and Maximums





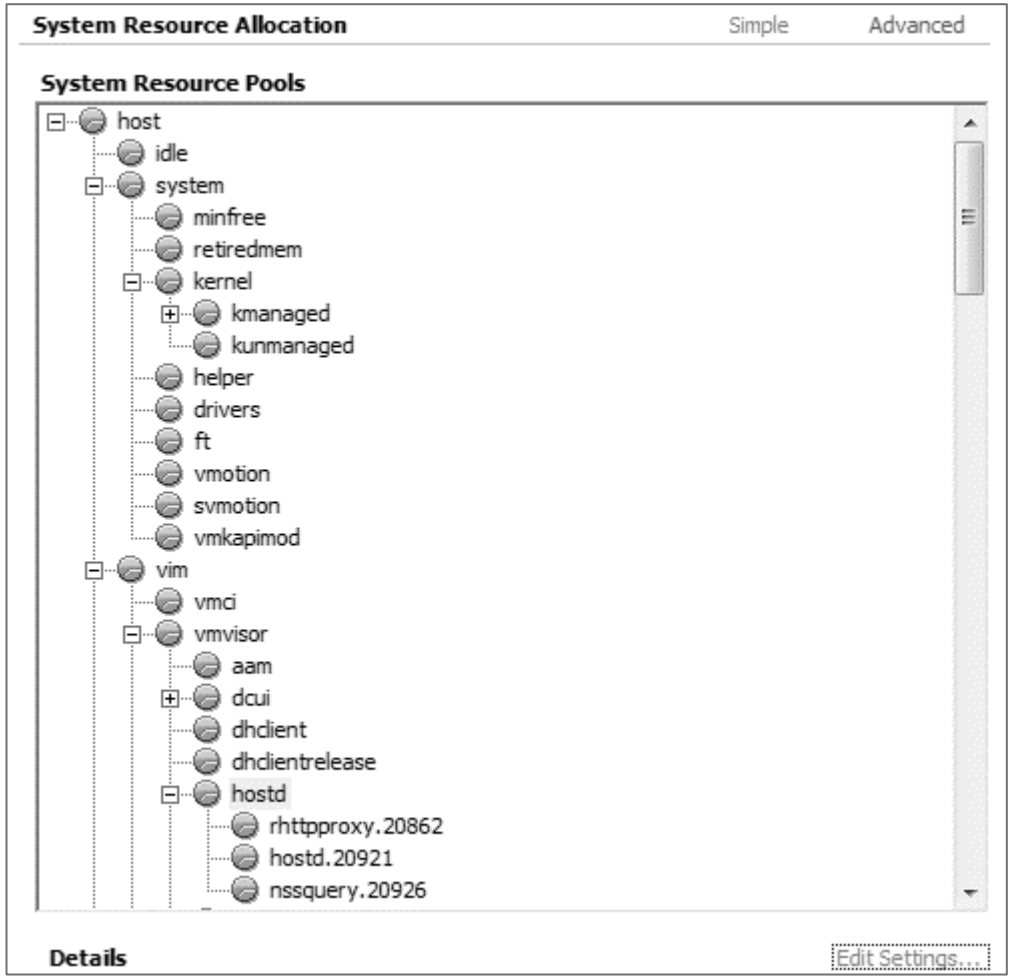
20.90 GHz
80.62 GB

Hierarchical Resource Groups

From an ESXi perspective

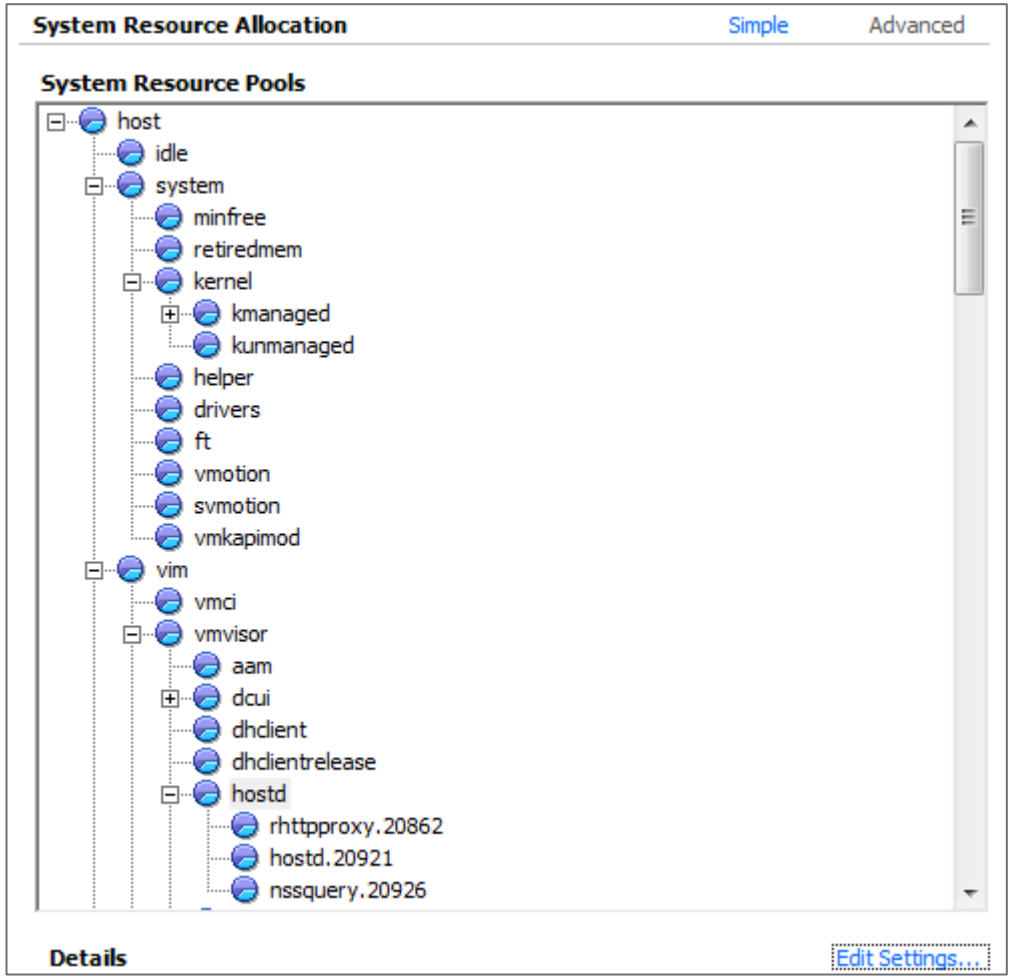
Hierarchical Resource Groups

From an ESXi perspective



Hierarchical Resource Groups

From an ESXi perspective



Hierarchical Resource Groups

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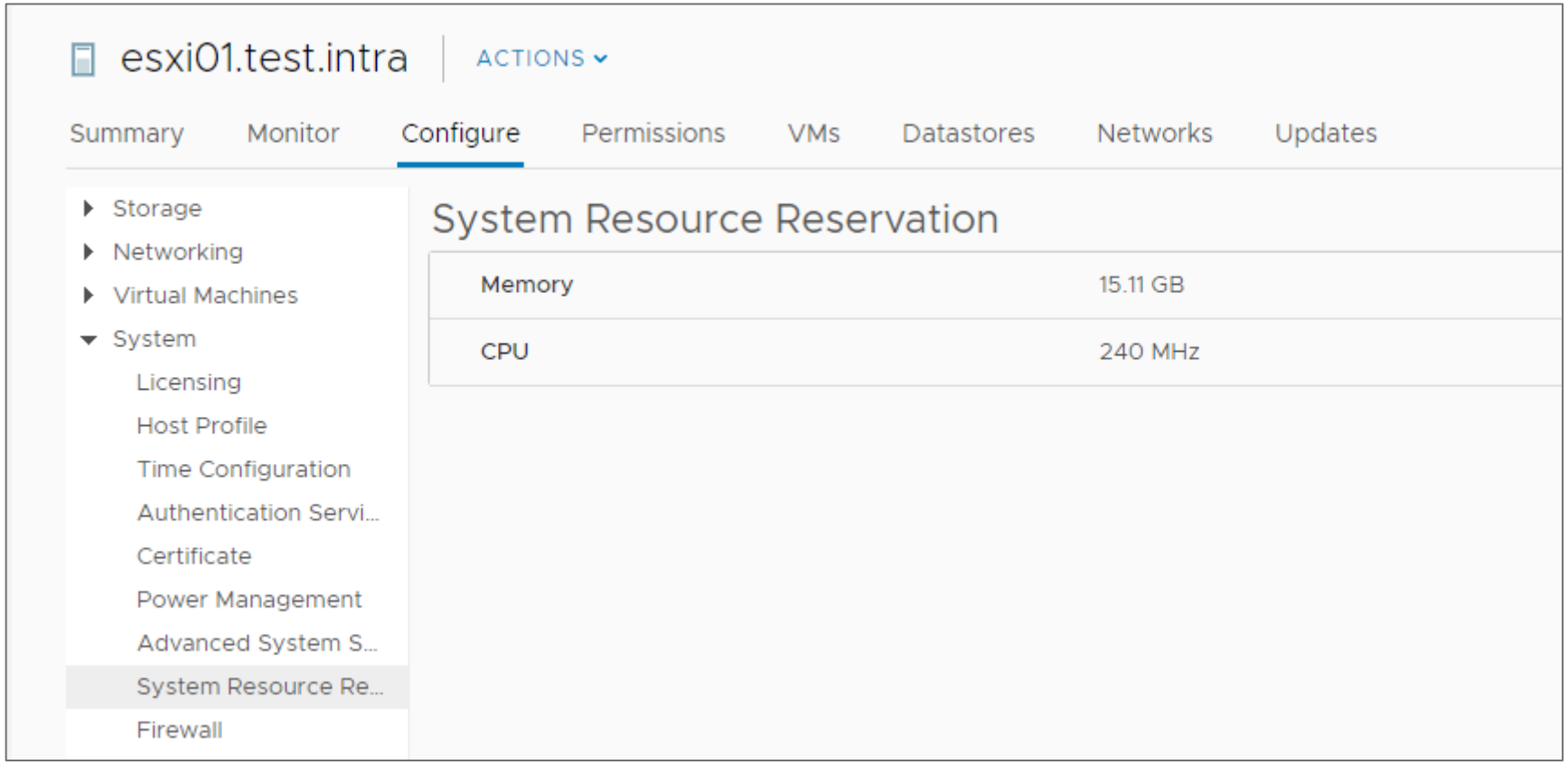
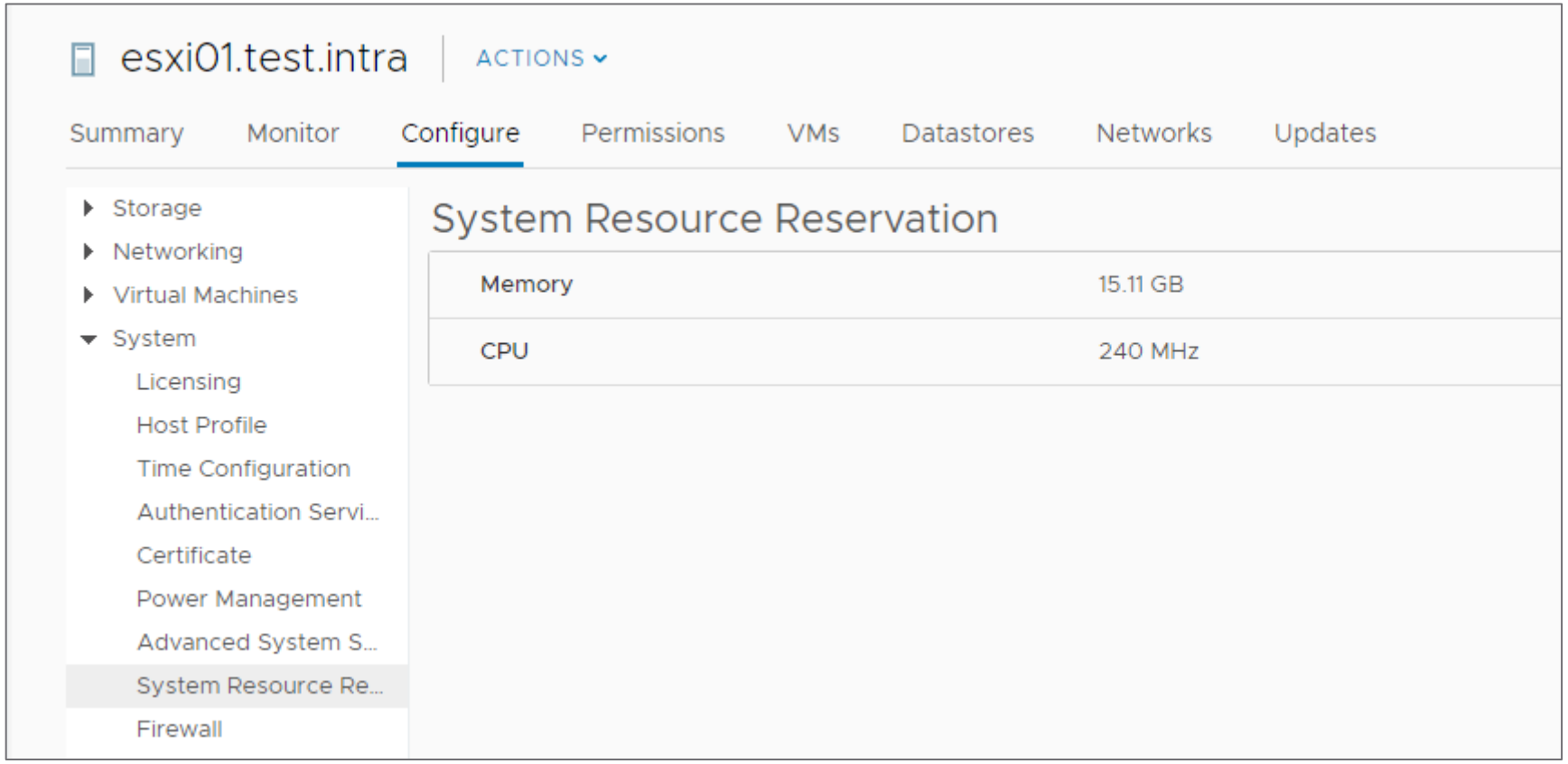


Hierarchical Resource Groups

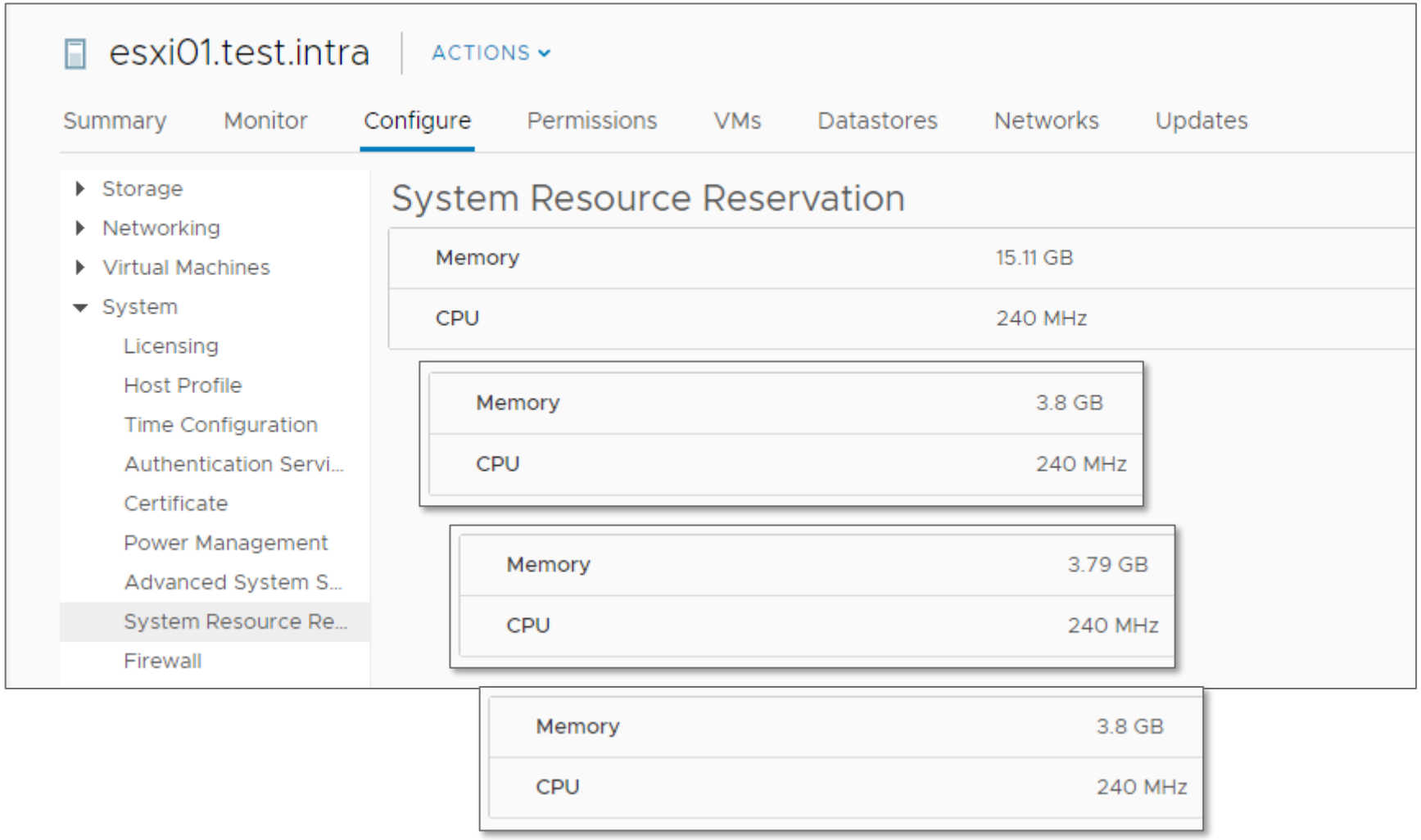
From an ESXi perspective



No hidden edit button off screen

Hierarchical Resource Groups

From an ESXi perspective



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Hierarchical Resource Groups

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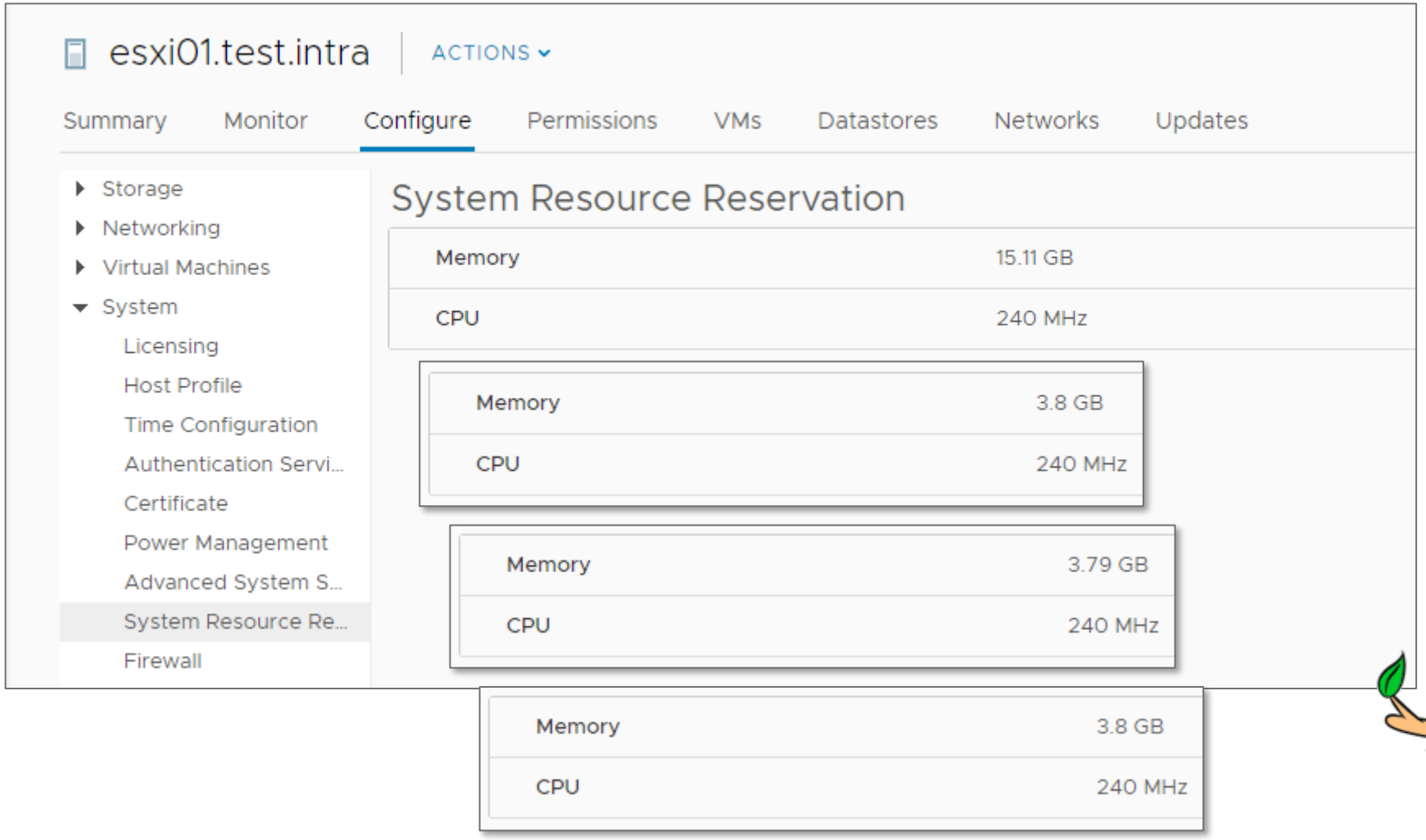


No hidden edit button off screen

20.90 GHz
80.62 GB

20.90 GHz - 4 x 240 MHz
80.62 GB - 15.11 GB - 3 x 3.8 GB

20.90 GHz - 4 x 240 MHz != 0

80.62 GB - 15.11 GB - 3 x 3.8 GB != 0

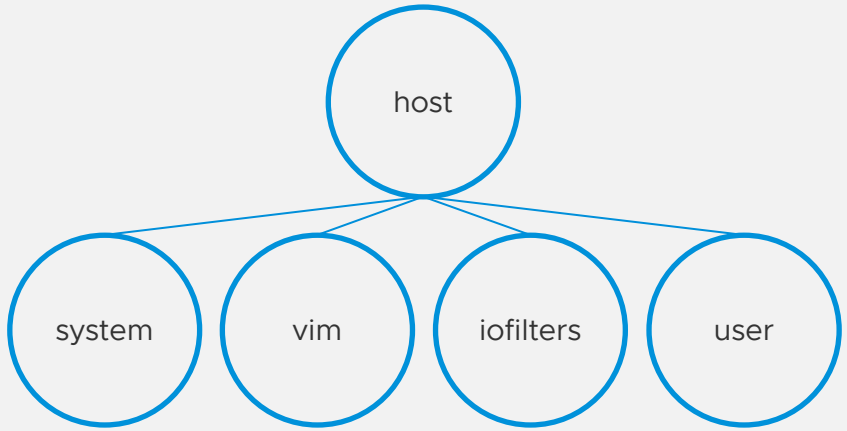
Hierarchical Resource Groups

From an ESXi perspective

The host owns all resources

Hierarchical Resource Groups

From an ESXi perspective



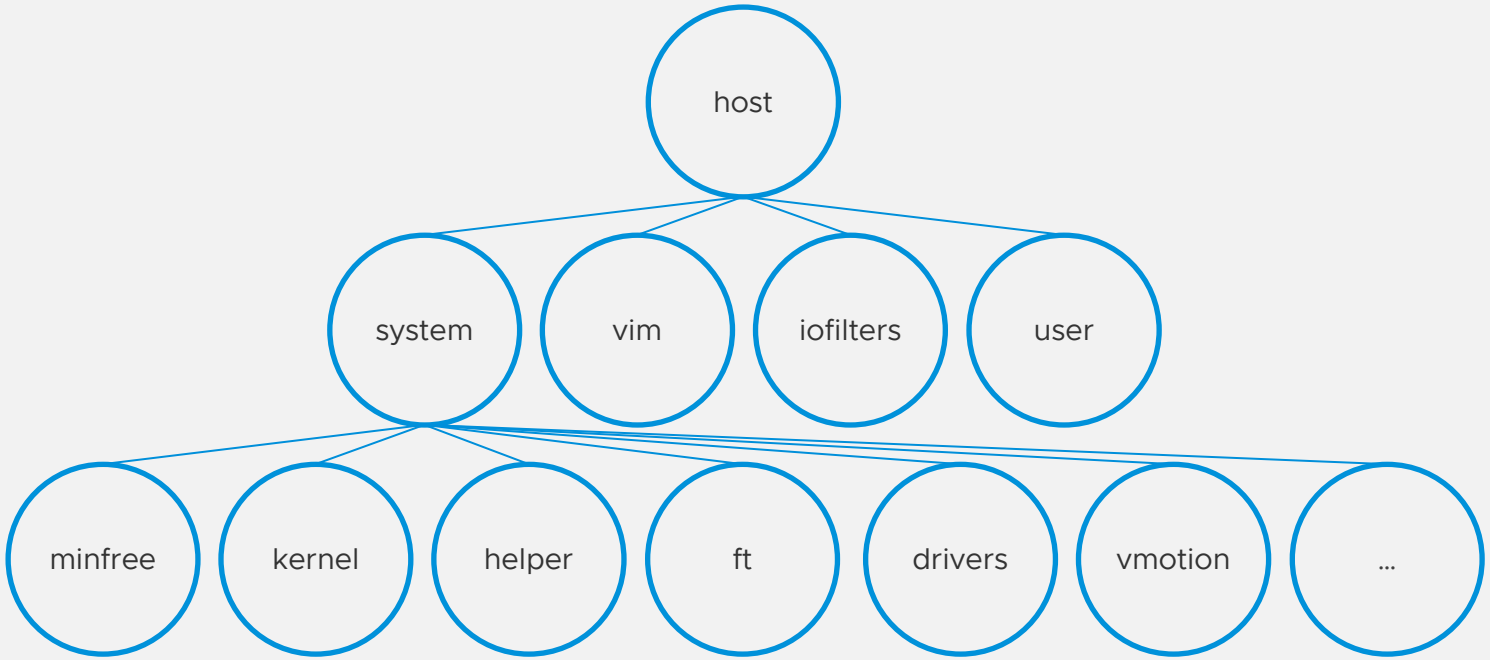
The host owns all resources

Those are distributed by hierarchical resource groups

 |

Hierarchical Resource Groups

From an ESXi perspective



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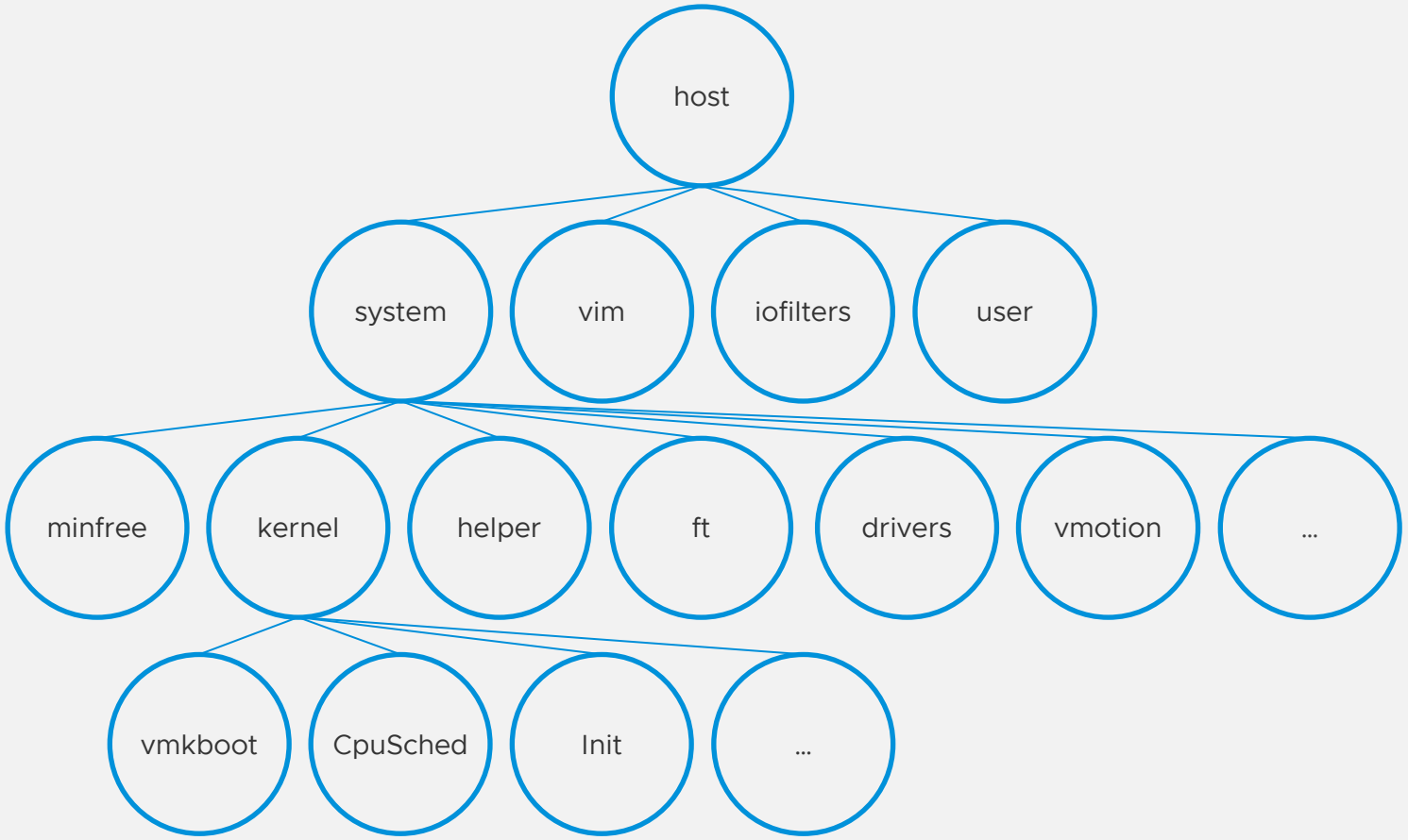
Hierarchical Resource Groups

From an ESXi perspective



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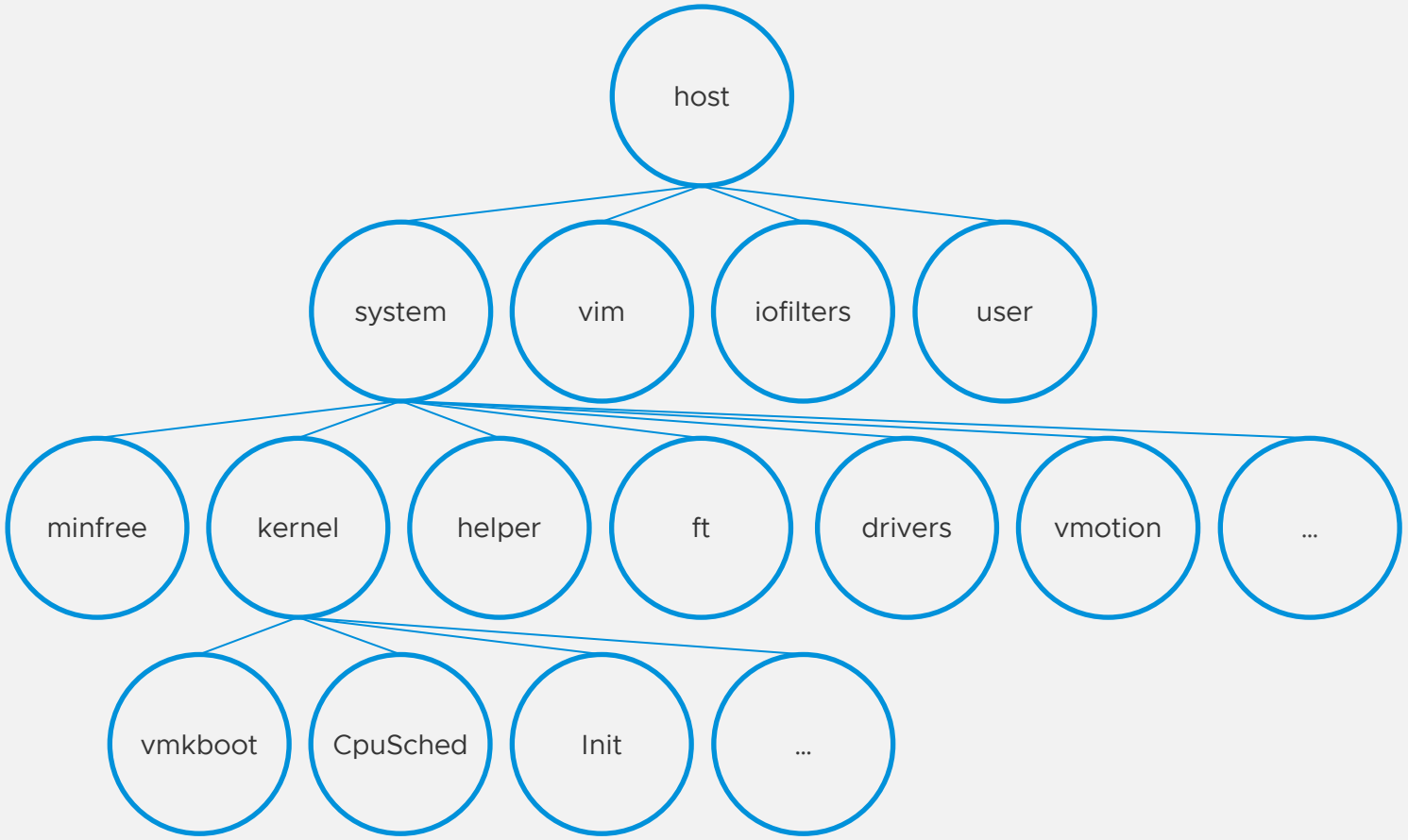
Hierarchical Resource Groups

From an ESXi perspective



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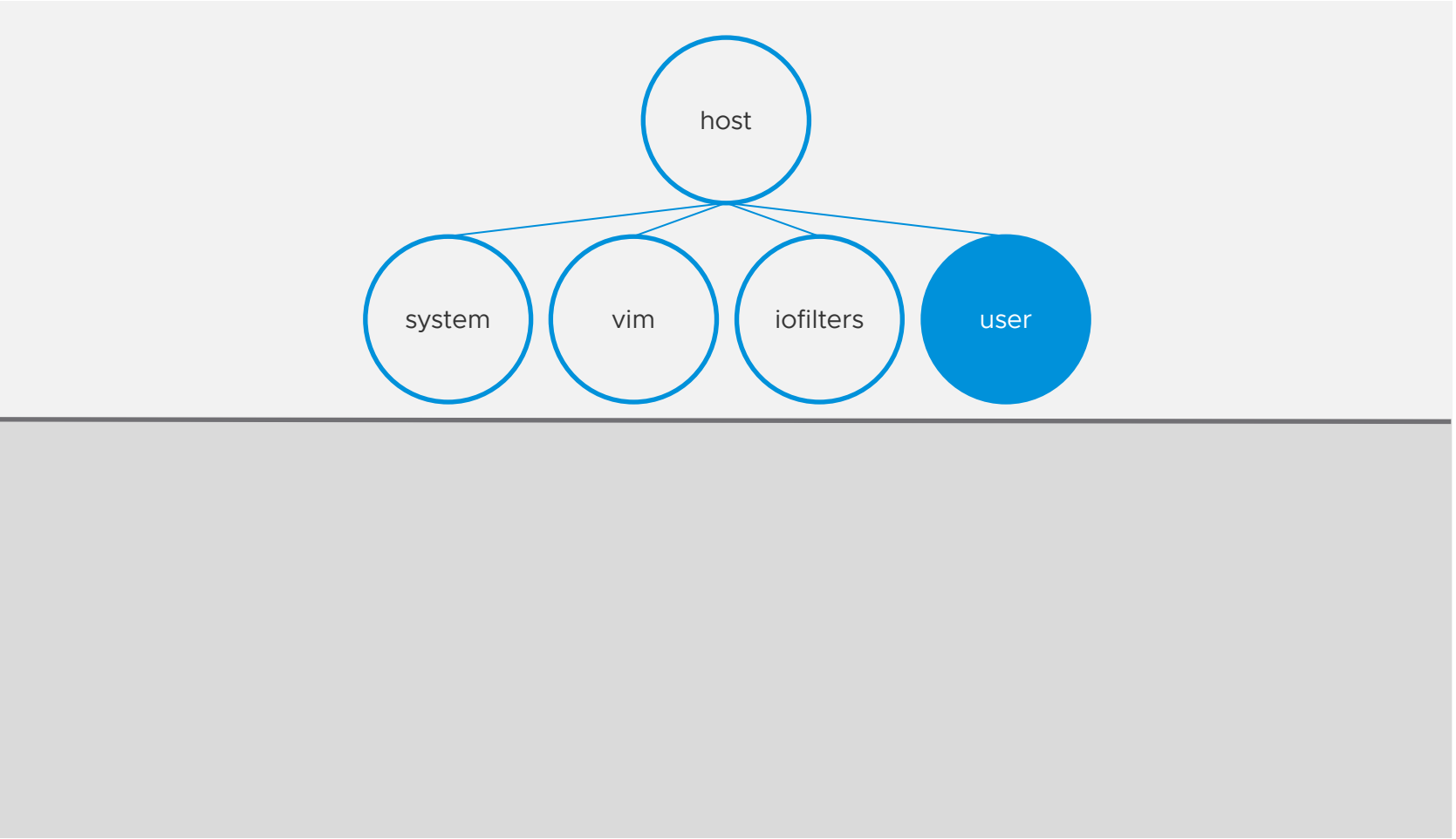
Consumers can demand (request) resources

Hierarchical Resource Groups

From an ESXi perspective



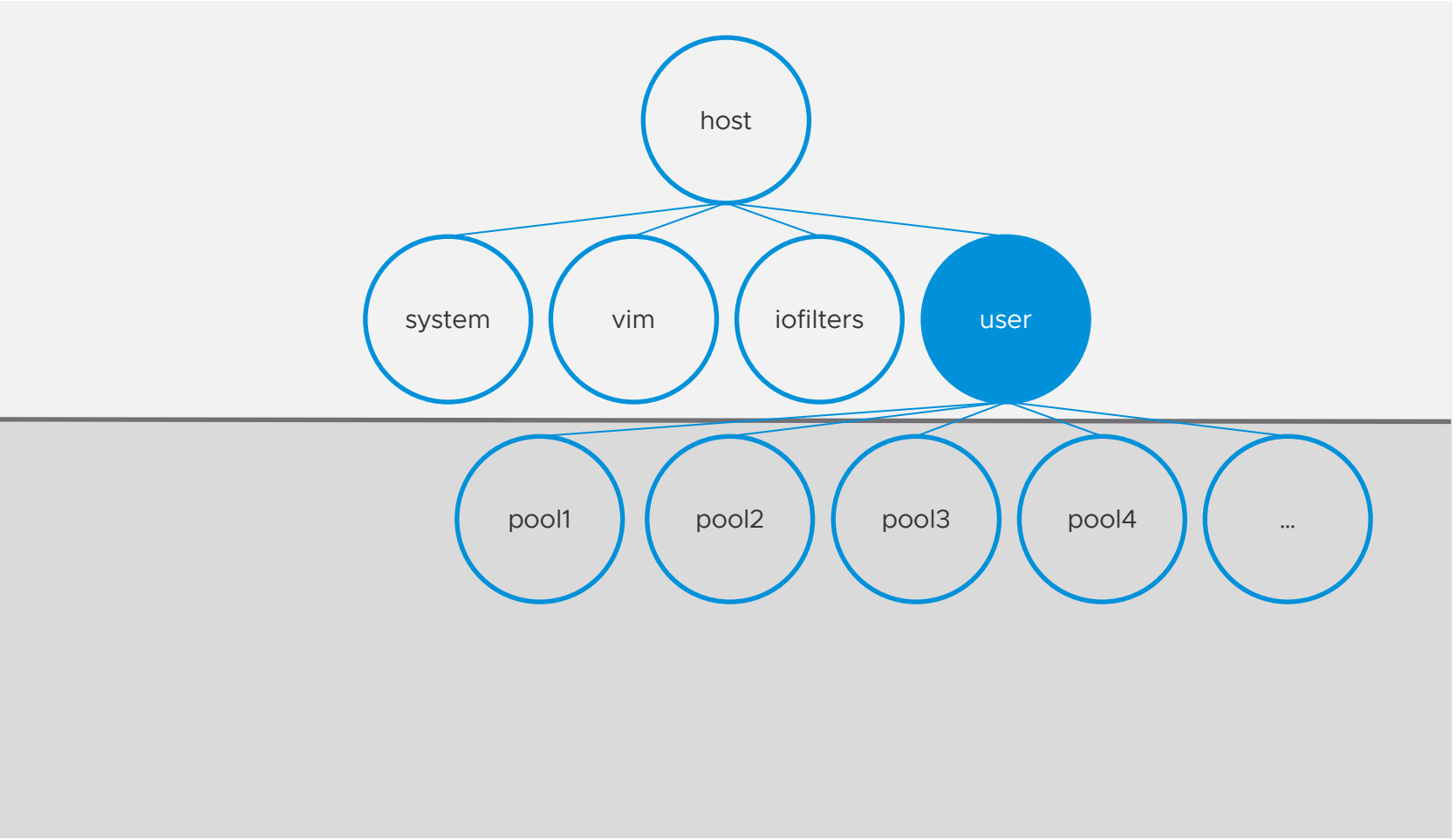
vCenter shows the sum of all user resources as:

Total Reservation Capacity

 |

Hierarchical Resource Groups

From an ESXi perspective



vCenter shows the sum of all user resources as:

Total Reservation Capacity

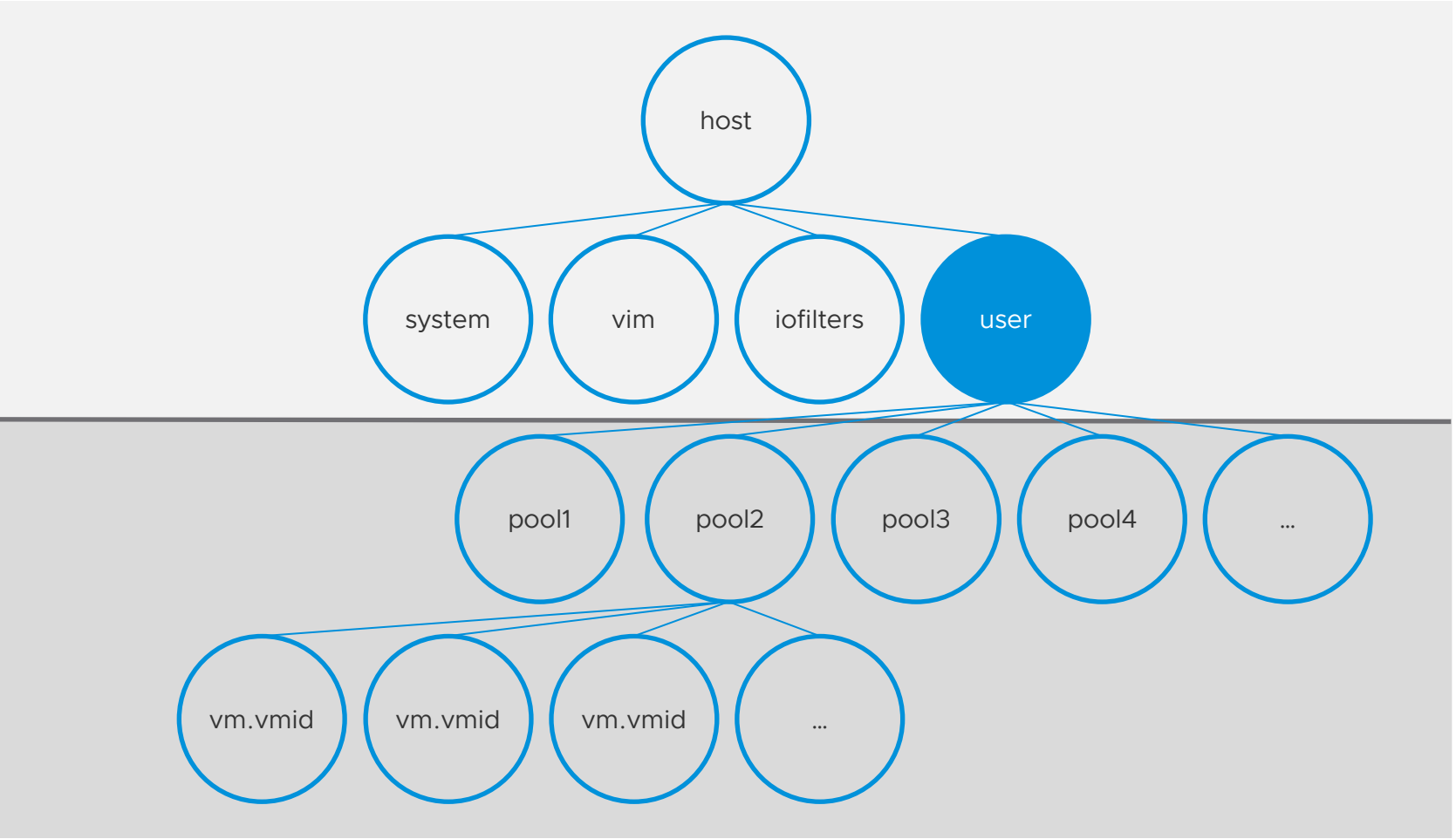
Global Resource Pools are then distributed back to hosts into Local RPs

- Based on VMs demand

 |

Hierarchical Resource Groups

From an ESXi perspective



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Hierarchical Resource Groups

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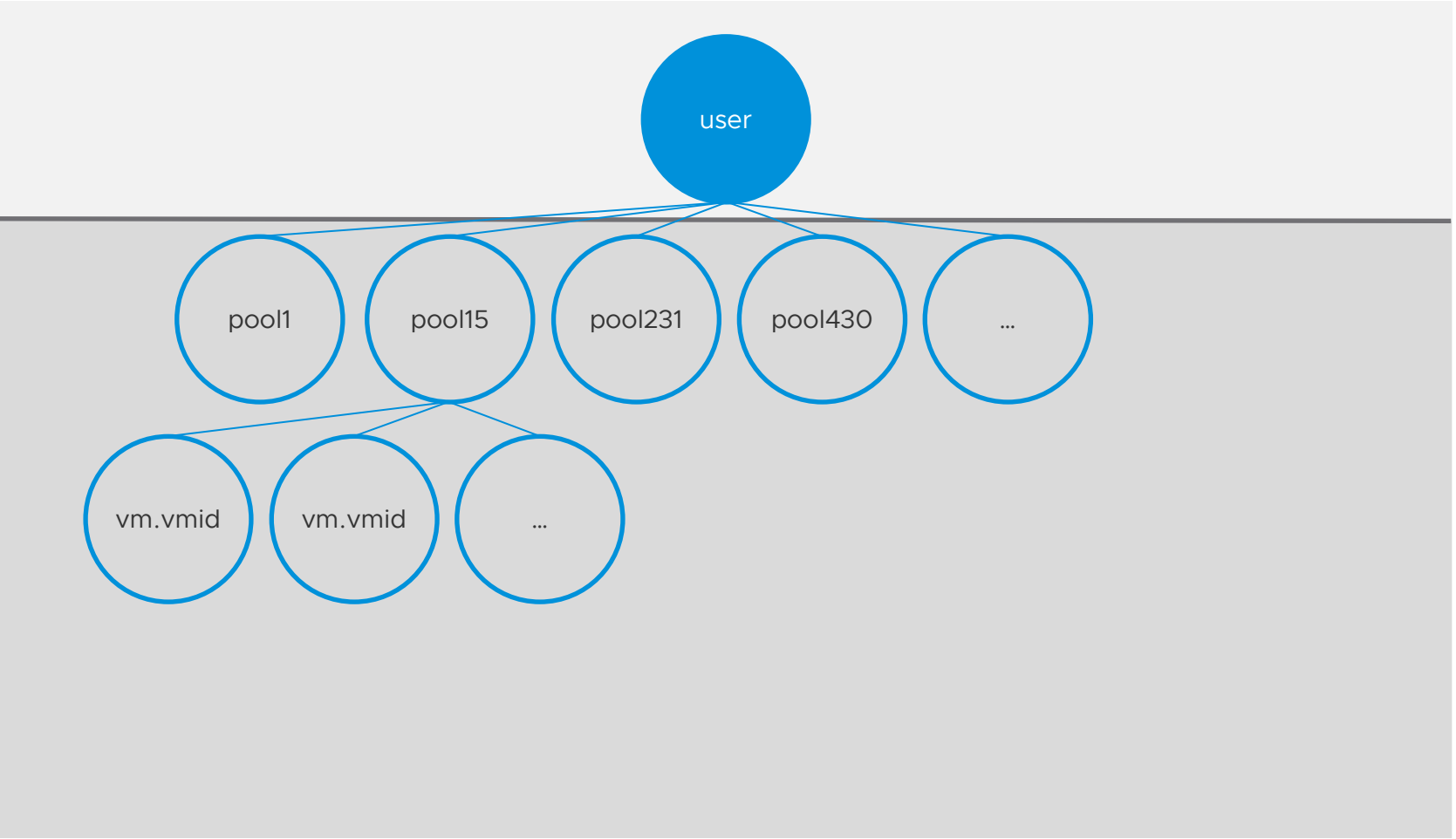
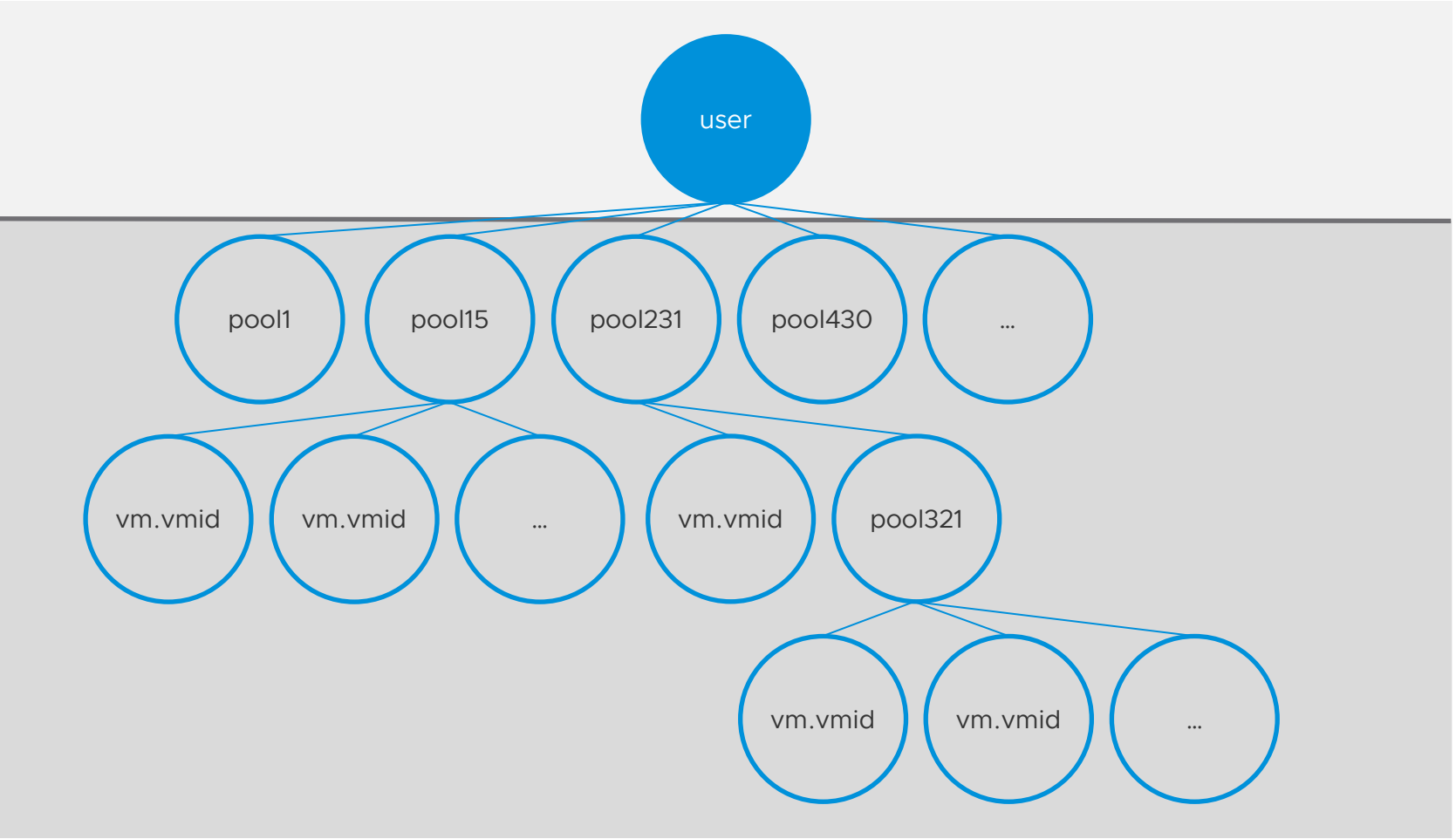


Local Resource Groups are created and incrementally numbered when clients are instantiated:

- VM starts / vMotions etc.
- Based on VMs demand

Hierarchical Resource Groups

From an ESXi perspective



Local Resource Groups are created and incrementally numbered when clients are instantiated:

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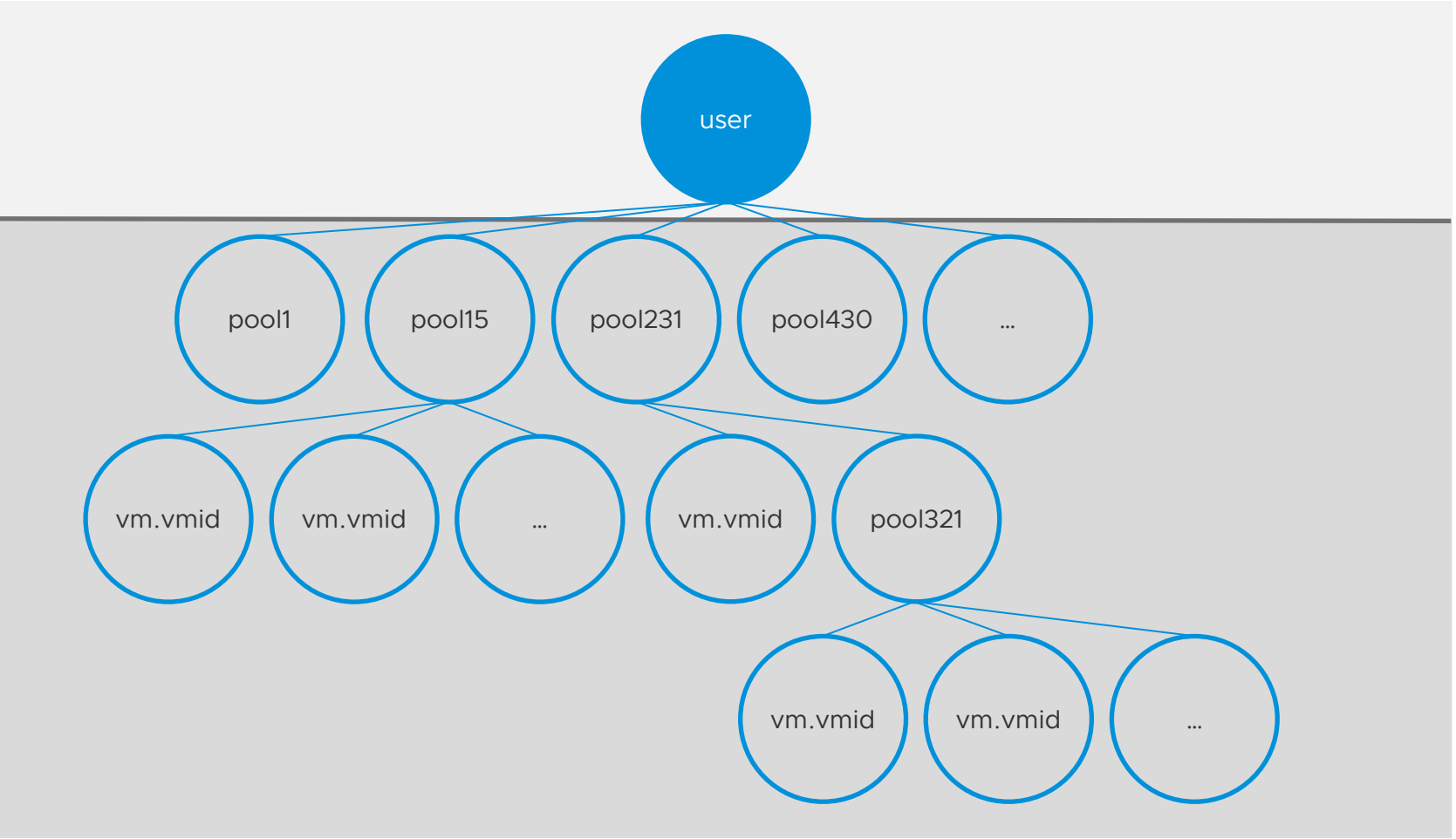
The local hierarchy is equal to the global one

- Check for VM / LRG siblings

Hierarchical Resource Groups

From an ESXi perspective



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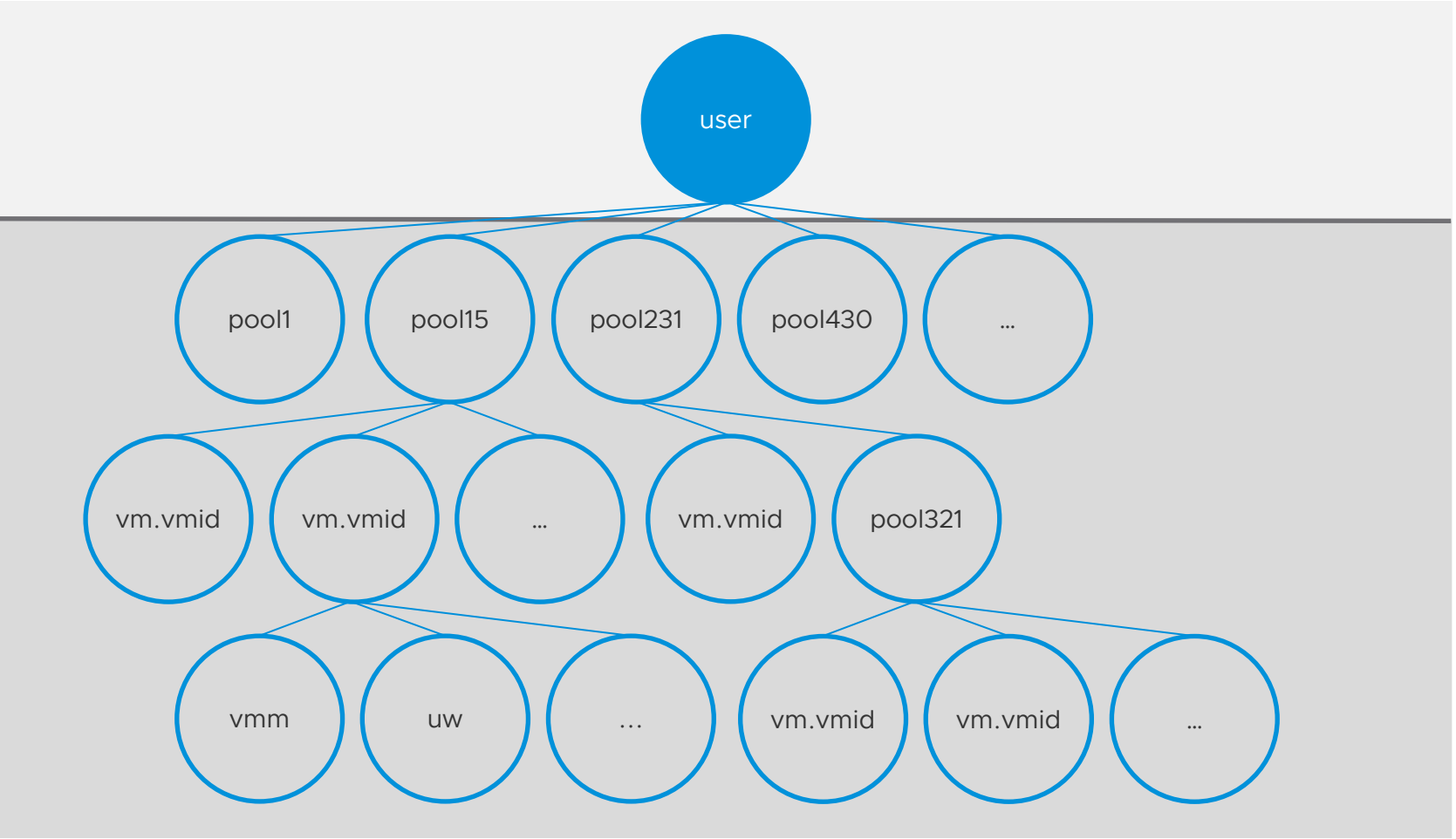
Hierarchical Resource Groups

From an ESXi perspective



Local Resource Groups are created and incrementally numbered when clients are instantiated:

- VM starts / vMotions etc.
- Based on VMs demand

The local hierarchy is equal to the global one

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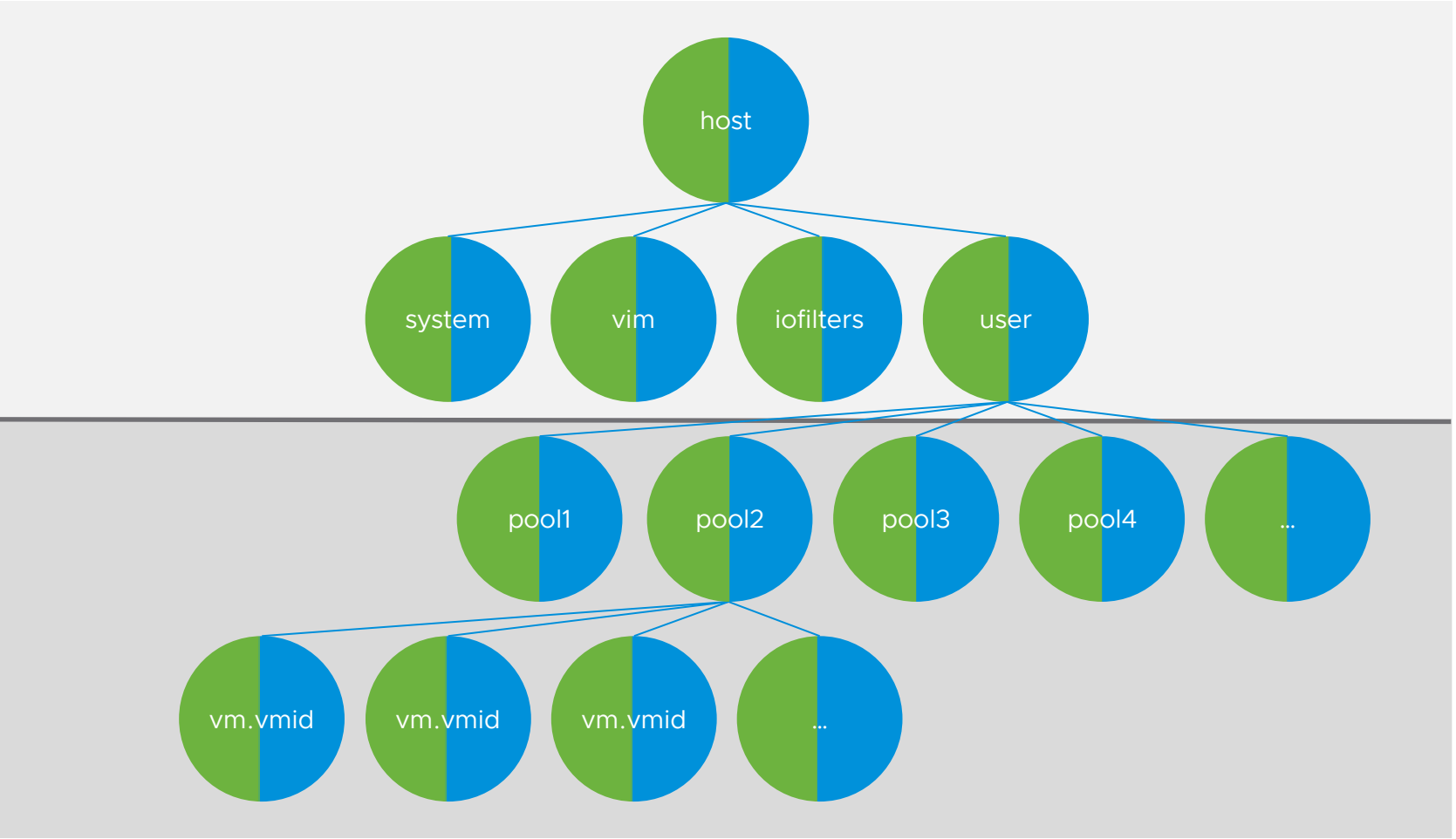
VM groups have multiple leaf consumers

- vmid is local, not global

Hierarchical Resource Groups

Both Memory and CPU resources



Memory

mem.resv	Reservation
mem.limit	Limit
mem.shares	Shares
mem.resvLimit	Expandable*

CPU

cpu.resv	Reservation
cpu.limit	Limit
cpu.shares	Shares
cpu.resvLimit	Expandable*

Tools

ESXi CLI (via SSH)



sched-stats	memstats	esxtop
… for CPU	… for Memory	… for comparison

Tools

cmdline for local groups (no VMs)

sched-stats

Tools

cmdline for local groups (no VMs)

sched-stats

```
# sched-stats -t groups | awk 'NR == 1
```

Tools

cmdline for local groups (no VMs)

sched-stats

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  || $2 ~ /^(vm\.|pool)[0-9]+/
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Tools

cmdline for local groups (no VMs)

sched-stats

```
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  || $2 ~ /^(vm\.|pool)[0-9]+/
  || /^ +[0-4] /
```

Tools

cmdline for local groups (no VMs)

sched-stats

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  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
  ,$1, $2, $3, $6, $8, $9, $10, $11, $12, $13, $14)}'
```

Tools

cmdline for local groups (no VMs)

sched-stats

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  || $2 ~ /^(vm\.|pool)[0-9]+/
  || /^ +[0-4] /
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  ,$1, $2, $3, $6, $8, $9, $10, $11, $12, $13, $14)}'
```

vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
0	host	0	933	1600	1600	1600	pct	4096000	**5232**	33168
1	system	0	659	10	-1	-1	pct	500	288	33168
2	vim	0	271	4944	-1	-1	mhz	500	4344	33768
3	iofilters	0	3	0	-1	-1	pct	1000	0	33168
4	user	0	0	0	-1	-1	pct	9000	0	**33168**

Tools

cmdline for local groups (no VMs)

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cmdline for local groups (no VMs)

sched-stats

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  || /^ +[0-4] /
  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
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vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
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Tools

cmdline for local groups (no VMs)

sched-stats

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  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
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vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
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Tools

cmdline for local groups (with VMs)

sched-stats

vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
0	host	0	995	1600	1600	1600	pct	4096000	5232	33168
1	system	0	664	10	-1	-1	pct	500	288	33168
2	vim	0	268	4944	-1	-1	mhz	500	4344	33768
3	iofilters	0	3	0	-1	-1	pct	1000	0	33168
4	user	0	60	0	-1	-1	pct	9000	0	33168
148269	vm.2118564	14605942	12	0	-1	-1	mhz	2000	0	33168
148279	vm.2118565	13787844	12	0	-1	-1	mhz	2000	0	33168
149779	vm.2118803	13787842	12	0	-1	-1	mhz	2000	0	33168
149810	vm.2118821	13787844	12	0	-1	-1	mhz	2000	0	33168
314753	vm.2139855	13787843	12	0	-1	-1	mhz	2000	0	33168
14605942	pool4	13787844	12	0	-1	-1	mhz	4000	0	33168
13787842	pool1	4	12	0	-1	-1	mhz	4000	0	33168
13787843	pool2	4	12	0	-1	-1	mhz	4000	0	33168
13787844	pool3	4	36	0	-1	-1	mhz	1142	0	33168

Tools

cmdline for local groups (with VMs)

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vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
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13787844	pool3	4	36	0	-1	-1	mhz	1142	0	33168

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cmdline for local groups (with VMs)

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13787842	pool1	4	12	0	-1	-1	mhz	4000	0	33168
13787843	pool2	4	12	0	-1	-1	mhz	4000	0	33168
13787844	pool3	4	36	0	-1	-1	mhz	1142	0	33168

Tools

VM name / CPU information

sched-stats

```
# esxcli vm process list | grep -B3 -A3 2118564
RAID5-VM8
   World ID: 2118566
   Process ID: 0
   VMX Cartel ID: 2118564
   UUID: 42 09 74 3e 4d f5 23 86-41 82 44 84 d3 17 ef b3
   Display Name: RAID5-VM8
   Config File: /vmfs/volumes/vsan:(…)/loadtestvm-8.vmx
```

Tools

VM name / CPU information

sched-stats

```
# esxcli vm process list | grep -B3 -A3 2118564
RAID5-VM8
   World ID: 2118566
   Process ID: 0
   VMX Cartel ID: 2118564
   UUID: 42 09 74 3e 4d f5 23 86-41 82 44 84 d3 17 ef b3
   Display Name: RAID5-VM8
   Config File: /vmfs/volumes/vsan:(…)/loadtestvm-8.vmx

# sched-stats -t ncpus
32 PCPUs
16 cores
 2 packages
 1 NUMA nodes
```

Tools

VM name / CPU information

sched-stats

```
# esxcli vm process list | grep -B3 -A3 2118564
RAID5-VM8
   World ID: 2118566
   Process ID: 0
   VMX Cartel ID: 2118564
   UUID: 42 09 74 3e 4d f5 23 86-41 82 44 84 d3 17 ef b3
   Display Name: RAID5-VM8
   Config File: /vmfs/volumes/vsan:(…)/loadtestvm-8.vmx

# sched-stats -t ncpus
32 PCPUs
16 cores
 2 packages
 1 NUMA nodes

# vsish -e get /hardware/cpu/cpuModelName
Intel(R) Xeon(R) CPU E5-2630 v3 @ 2.40GHz
```

Tools

cmdline for specific VM group

sched-stats

```
# sched-stats -t cpu | awk 'NR == 1
  || $(NF-5) ~ /^vm\.2118564/
  {printf ("%-8s %-5s %-25s %-5s %-5s %-7s %-8s %-11s %-5s %-5s\n"
  ,$1, $3, $4, $13, $14, $15, $16, $17, $19, $22)}'
```

Tools

cmdline for specific VM group

sched-stats

```
# sched-stats -t cpu | awk 'NR == 1
  || $(NF-5) ~ /^vm\.2118564/
  {printf ("%-8s %-5s %-25s %-5s %-5s %-7s %-8s %-11s %-5s %-5s\n"
  ,$1, $3, $4, $13, $14, $15, $16, $17, $19, $22)}'
```

```
vcpu     type  name                      min  max  units  shares  group         cpu  affinity
2118564  U     vmx                       0    -1   pct    1000    vm.2118564   16   0-31
2118568  SA    NUMASchedRemapEpochI      0    -1   pct    1000    vm.2118564   26   0-31
2118574  SA    vmast.2118566             0    -1   pct    100     vm.2118564   28   0-31
2118579  U     vmx-vthread-211           0    -1   pct    1000    vm.2118564   5    0-31
2118581  U     vmx-filtPoll:RAID5-V      0    -1   pct    1000    vm.2118564   19   0-31
2118582  U     vmx-vthread-211:RAID      0    -1   pct    1000    vm.2118564   26   0-31
2118586  U     vmx-mks:RAID5-VM8         0    -1   pct    1000    vm.2118564   28   0-31
2118588  U     vmx-svga:RAID5-VM8        0    -1   pct    1000    vm.2118564   18   0-31
2118590  U     vmx-vcpu-0:RAID5-VM8      0    -1   pct    2000    vm.2118564   15   0-15
2118593  U     vmx-vcpu-1:RAID5-VM8      0    -1   pct    2000    vm.2118564   6    0-15
2118591  SA    PVSCSI-2118566:0          0    -1   pct    1000    vm.2118564   6    0-31
2118592  SA    PVSCSI-2118566:1          0    -1   pct    1000    vm.2118564   13   0-31
2118567  SA    NetWorld-VM-2118566       0    -1   pct    2000    vm.2118564   17   0-31
```

Tools

cmdline for specific VM group

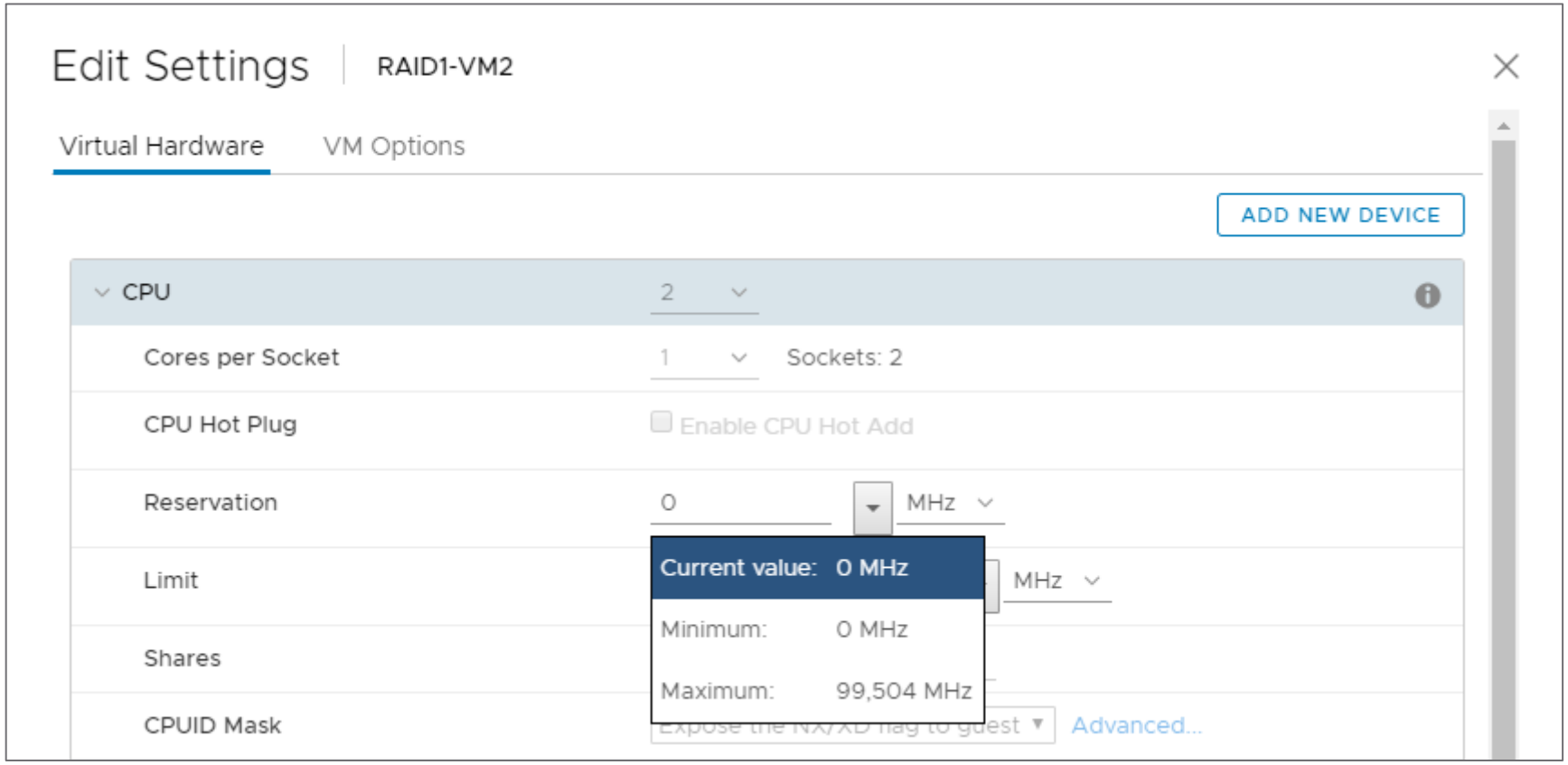
sched-stats

```
# sched-stats -t cpu | awk 'NR == 1
  || $(NF-5) ~ /^vm\.2118564/
  {printf ("%-8s %-5s %-25s %-5s %-5s %-7s %-8s %-11s %-5s %-5s\n"
  ,$1, $3, $4, $13, $14, $15, $16, $17, $19, $22)}'
```

vcpu	type	name	min	max	units	shares	group	cpu	affinity
2118564	U	vmx	0	-1	pct	1000	vm.2118564	16	0-31
2118568	SA	NUMASchedRemapEpochI	0	-1	pct	1000	vm.2118564	26	0-31
2118574	SA	vmast.2118566	0	-1	pct	100	vm.2118564	28	0-31
2118579	U	vmx-vthread-211	0	-1	pct	1000	vm.2118564	5	0-31
2118581	U	vmx-filtPoll:RAID5-V	0	-1	pct	1000	vm.2118564	19	0-31
2118582	U	vmx-vthread-211:RAID	0	-1	pct	1000	vm.2118564	26	0-31
2118586	U	vmx-mks:RAID5-VM8	0	-1	pct	1000	vm.2118564	28	0-31
2118588	U	vmx-svga:RAID5-VM8	0	-1	pct	1000	vm.2118564	18	0-31
2118590	U	vmx-vcpu-0:RAID5-VM8	0	-1	pct	2000	vm.2118564	15	0-15
2118593	U	vmx-vcpu-1:RAID5-VM8	0	-1	pct	2000	vm.2118564	6	0-15
2118591	SA	PVSCSI-2118566:0	0	-1	pct	1000	vm.2118564	6	0-31
2118592	SA	PVSCSI-2118566:1	0	-1	pct	1000	vm.2118564	13	0-31
2118567	SA	NetWorld-VM-2118566	0	-1	pct	2000	vm.2118564	17	0-31

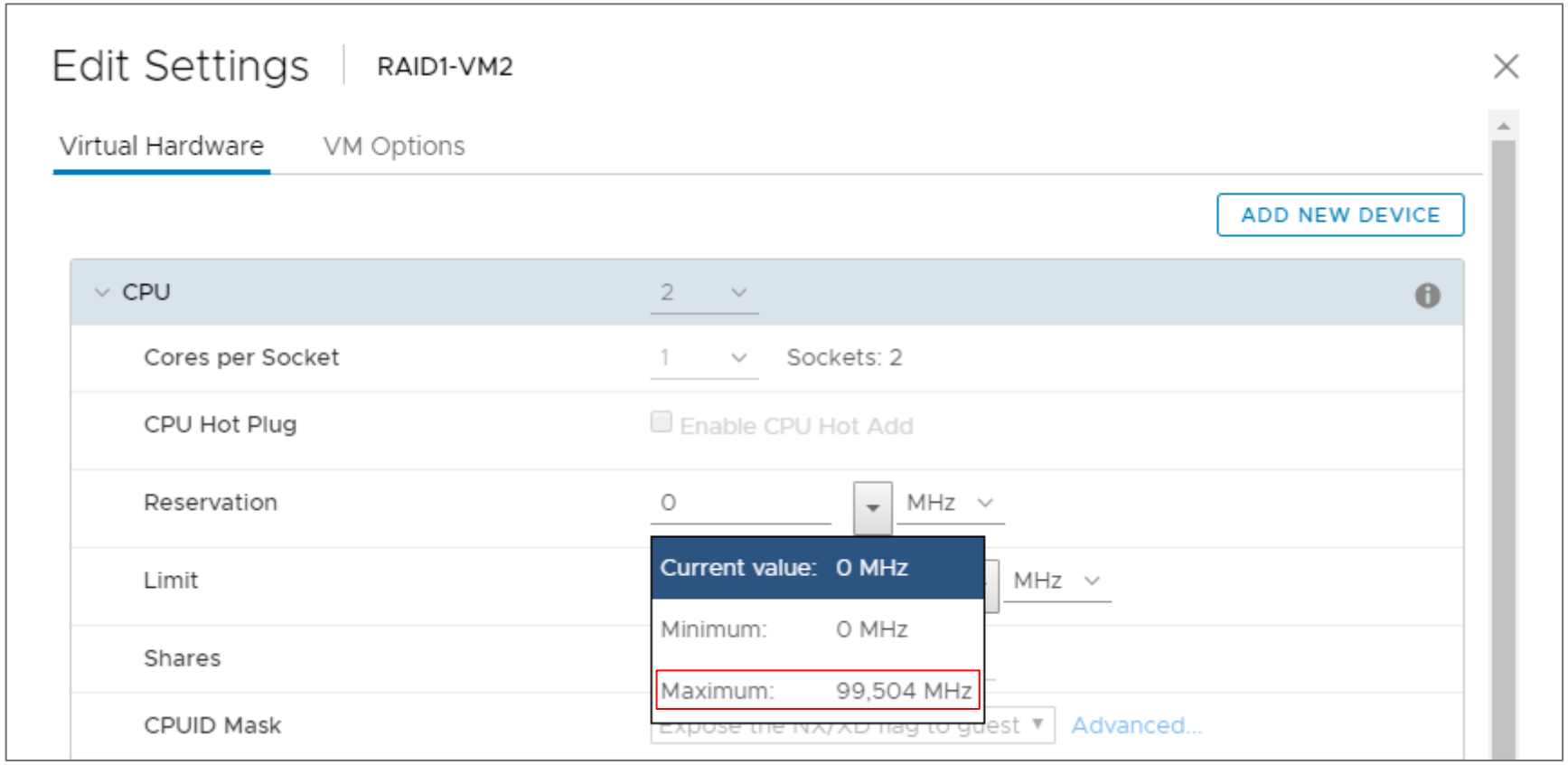
VM Resource Control

Maximum Reservation



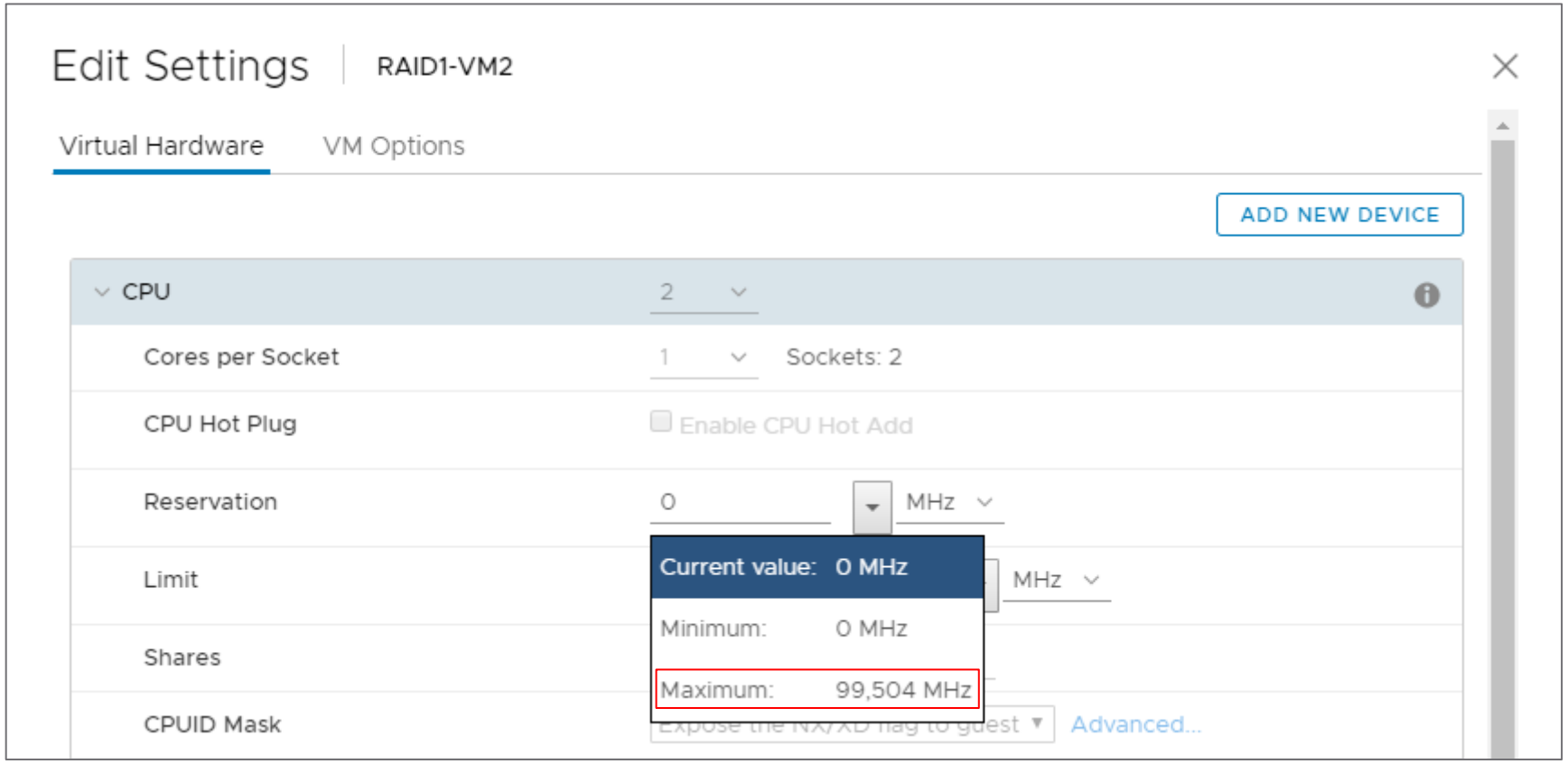
VM Resource Control

Maximum Reservation



VM Resource Control

Maximum Reservation



2 vCPUs x 2.4 GHz = 4.8 GHz (maximum reservation the VM powers on with)

Tools

cmdline for identifying CPU reservations

sched-stats

```
# sched-stats -t groups | awk 'NR == 1
  || $8 !~ /^0/
  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
  ,$1, $2, $3, $6, $8, $9, $10, $11, $12, $13, $14)}'
```

Tools

cmdline for identifying CPU reservations

sched-stats

```
# sched-stats -t groups | awk 'NR == 1
  || $8 !~ /^0/
  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
  ,$1, $2, $3, $6, $8, $9, $10, $11, $12, $13, $14)}'
```

vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
0	host	0	995	1600	1600	1600	pct	4096000	**5232**	33168
1	system	0	664	10	-1	-1	pct	500	288	33168
2	vim	0	268	4944	-1	-1	mhz	500	4344	33768
8	helper	1	269	3	-1	-1	pct	1000	0	33240
9	lfhelper	1	0	3	-1	-1	pct	1000	0	33240
10	drivers	1	12	3	-1	-1	pct	1000	0	33240
15	vmvisor	2	263	35	-1	-1	pct	1000	4344	33768
271	vmkapimod	1	0	3	-1	-1	pct	1000	0	33240
758	hostd	15	53	3192	-1	-1	mhz	1000	0	36960
777	logging	15	4	432	-1	-1	mhz	1000	0	34200
809	vpxa	15	39	720	-1	-1	mhz	1000	0	34488

Tools

cmdline for identifying CPU reservations

sched-stats

```
# sched-stats -t groups | awk 'NR == 1
  || $8 !~ /^0/
  {printf ("%-10s%-12s%-9s%-6s%-6s%-6s%-9s%-6s%-9s%-9s%-10s\n"
  ,$1, $2, $3, $6, $8, $9, $10, $11, $12, $13, $14)}'
```

vmgid	name	pgid	vsmps	amin	amax	minLimit	units	ashares	resvMHz	availMHz
0	host	0	995	1600	1600	1600	pct	4096000	**5232**	33168
1	system	0	664	10	-1	-1	pct	500	288	33168
2	vim	0	268	4944	-1	-1	mhz	500	4344	33768
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9	lfhelper	1	0	3	-1	-1	pct	1000	0	33240
10	drivers	1	12	3	-1	-1	pct	1000	0	33240
15	vmvisor	2	263	35	-1	-1	pct	1000	4344	33768
271	vmkapimod	1	0	3	-1	-1	pct	1000	0	33240
758	hostd	15	53	3192	-1	-1	mhz	1000	0	36960
777	logging	15	4	432	-1	-1	mhz	1000	0	34200
809	vpxa	15	39	720	-1	-1	mhz	1000	0	34488

Why the high hostd / vpxa reservation?

Having a look around ..

```
# egrep -o "host/vim/vmvisor/hostd\".*"  /usr/lib/vmware/rp/bin/configRP
```

Why the high hostd / vpxa reservation?

Having a look around ..

```
# egrep -o "host/vim/vmvisor/hostd\".*"  /usr/lib/vmware/rp/bin/configRP

host/vim/vmvisor/hostd",
memMin=getHostdMemMax(),
memMax=getHostdMemMax(),
cpuShares=1000,
cpuMin=getHostdCpuMin(),
(…)
```

Why the high hostd / vpxa reservation?

Having a look around ..

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host/vim/vmvisor/hostd",
memMin=getHostdMemMax(),
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cpuMin=getHostdCpuMin(),
(…)
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Having a look around ..

```
# egrep -A4 "def getHostdCpuMin"  /usr/lib/vmware/rp/bin/configRP
```

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Having a look around ..

```
# egrep -A4 "def getHostdCpuMin"  /usr/lib/vmware/rp/bin/configRP

def getHostdCpuMin():
   """@return The cpu reservation for hostd
   """
   # PR562745
   return 25 + int(ceil(0.21 * getNumVMs()))
```

Why the high hostd / vpxa reservation?

Having a look around ..

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   """@return The cpu reservation for hostd
   """
   # PR562745
   return 25 + int(ceil(0.21 * getNumVMs()))

# egrep -A4 "def getNumVMs"  /usr/lib/vmware/rp/bin/configRP

def getNumVMs():
   """@return The number of supported VMs
   """
   return vsi.get("/system/supportedVMs")
```

Why the high hostd / vpxa reservation?

Having a look around ..

```
# egrep -A4 "def getHostdCpuMin"  /usr/lib/vmware/rp/bin/configRP

def getHostdCpuMin():
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def getNumVMs():
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# vsish -e get /system/supportedVMs
```

Why the high hostd / vpxa reservation?

Having a look around ..

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def getNumVMs():
   """@return The number of supported VMs
   """
   return vsi.get("/system/supportedVMs")

# vsish -e get /system/supportedVMs
512
```

Why the high hostd / vpxa reservation?

Having a look around ..

> Usually never an issue *

We are looking into it though

Tools

cmdline for local groups (with VMs)

memstats

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
  -u mb
```

Tools

cmdline for local groups (with VMs)

memstats

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# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid        min        max   minLimit     shares    conResv  availResv    memSize
-------------------------------------------------------------------------------
       0      97823      97823      97823 2147483647      28916      68908      24665
       1      20023         -1         -1        500      20007      68924      18645
       2          0         -1         -1        500       3378      68908        588
       3          0         -1         -1        500         25      68908          9
       4          0         -1         -1       9000       5490      68908       5425
-------------------------------------------------------------------------------
```

Tools

cmdline for local groups (with VMs)

memstats

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# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
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```

```
-----------------------------------------------------------------------------
     gid        min        max   minLimit     shares    conResv  availResv    memSize
-----------------------------------------------------------------------------
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       1      20023         -1         -1        500      20007      68924      18645
       2          0         -1         -1        500       3378      68908        588
       3          0         -1         -1        500         25      68908          9
       4          0         -1         -1       9000       5490      68908       5425
-----------------------------------------------------------------------------
```

Tools

cmdline for local groups (with VMs)

memstats

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# memstats -r group-stats
  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

gid	min	max	minLimit	shares	conResv	availResv	memSize
0	97823	97823	97823	2147483647	28916	68908	24665
1	20023	-1	-1	500	20007	68924	18645
2	0	-1	-1	500	3378	68908	588
3	0	-1	-1	500	25	68908	9
4	0	-1	-1	9000	5490	68908	5425

Tools

cmdline for local groups (with VMs)

memstats

```
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  -g0 -l2
  -s gid:min:max:minlimit:shares:conResv:availResv:memSize
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid        min        max   minLimit     shares    conResv  availResv    memSize
-------------------------------------------------------------------------------
       0      97823      97823      97823 2147483647      28916      68908      24665
       1      20023         -1         -1        500      20007      68924      18645
       2          0         -1         -1        500       3378      68908        588
       3          0         -1         -1        500         25      68908          9
       4          0         -1         -1       9000       5490      68908       5425
-------------------------------------------------------------------------------
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:name:min:max::conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid                              name        min        max     conResv  availResv
-------------------------------------------------------------------------------
       0                              host      97823      97823       28917      68907
       1                            system      20024         -1       20008      68923
       2                               vim          0         -1        3378      68907
       3                         iofilters          0         -1          25      68907
       4                              user          0         -1        5490      68907
-------------------------------------------------------------------------------
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:name:min:max::conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
--------------------------------------------------------------------------------
     gid                          name        min        max    conResv  availResv
--------------------------------------------------------------------------------
       0                          host      97823      97823      28917      68907
       1                        system      20024         -1      20008      68923
       2                           vim          0         -1       3378      68907
       3                     iofilters          0         -1         25      68907
       4                          user          0         -1       5490      68907
--------------------------------------------------------------------------------
```

Tools

cmdline for local groups (with VMs)

memstats

```
# memstats -r group-stats
  -g0 -l2
  -s gid:name:min:max::conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

gid	name	min	max	conResv	availResv
0	host	97823	97823	28917	68907
1	system	20024	-1	20008	68923
2	vim	0	-1	3378	68907
3	iofilters	0	-1	25	68907
4	user	0	-1	5490	68907

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l2
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l2
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid                            name         min         max     conResv   availResv
-------------------------------------------------------------------------------
       4                            user           0          -1        5490       68906
13787842                           pool1        1098          -1        1065       68939
13787843                           pool2        1098          -1        1065       68939
13787844                           pool3        3294          -1        3227       68973
-------------------------------------------------------------------------------
```

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l2
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid                                  name         min         max    conResv  availResv
-------------------------------------------------------------------------------
       4                                  user           0          -1       5490      68906
13787842                                 pool1        1098          -1       1065      68939
13787843                                 pool2        1098          -1       1065      68939
13787844                                 pool3        3294          -1       3227      68973
-------------------------------------------------------------------------------
```

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'

--------------------------------------------------------------------------------
     gid                         name          min          max     conResv   availResv
--------------------------------------------------------------------------------
       4                         user            0           -1        5490       68904
13787842                        pool1         1098           -1        1065       68937
  149779                   vm.2118803            0           -1        1065          34
13787843                        pool2         1098           -1        1065       68937
  314753                   vm.2139855            0           -1        1065          34
13787844                        pool3         3294           -1        3227       68971
  149810                   vm.2118821            0           -1        1065          34
  148279                   vm.2118565            0           -1        1065          34
14605942                        pool4         1098           -1        1065       69004
--------------------------------------------------------------------------------
```

Tools

cmdline for local groups under user (with VMs)

memstats

```
# memstats -r group-stats
  -g4 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  | sed -n '/^-\+/,/.*\n/p'
```

gid	name	min	max	conResv	availResv
4	user	0	-1	5490	68904
13787842	pool1	1098	-1	1065	68937
149779	vm.2118803	0	-1	1065	34
13787843	pool2	1098	-1	1065	68937
314753	vm.2139855	0	-1	1065	34
13787844	pool3	3294	-1	3227	68971
149810	vm.2118821	0	-1	1065	34
148279	vm.2118565	0	-1	1065	34
14605942	pool4	1098	-1	1065	69004

Tools

Per VM (“container”) limit / reservation

esxtop

```
 9:49:14am up 7 days 21:17, 1001 worlds, 5 VMs, 10 vCPUs; MEM overcommit avg: 0.00, 0.00, 0.00
PMEM  /MB: 98208   total: 17053     vmk,5400 other, 75754 free
VMKMEM/MB: 97822 managed:  1592 minfree, 28915 rsvd,  68907 ursvd,  high state
NUMA  /MB: 49054 (36855), 49152 (38514)
PSHARE/MB:      68  shared,       51  common:       17 saving
SWAP  /MB:       0    curr,        0 rclmtgt:                  0.00 r/s,   0.00 w/s
ZIP   /MB:       0  zipped,        0   saved
MEMCTL/MB:       0    curr,        0  target,    3238 max

    GID NAME                    AMIN         AMAX  ASHRS        AMLMT   AUNITS
 148269 RAID5-VM8                  0           -1     -3      1124352       kb
 149779 RAID1-VM2                  0           -1     -3      1124352       kb
 148279 RAID5-VM3                  0           -1     -3      1124352       kb
 314753 RAID1-VM3                  0           -1     -3      1124352       kb
 149810 RAID1-VM8                  0           -1     -3      1124352       kb
```

Tools

Per VM (“container”) limit / reservation

esxtop

```
 9:49:14am up 7 days 21:17, 1001 worlds, 5 VMs, 10 vCPUs; MEM overcommit avg: 0.00, 0.00, 0.00
PMEM  /MB: 98208   total: 17053     vmk,5400 other, 75754 free
VMKMEM/MB: 97822 managed:  1592 minfree, 28915 rsvd,  68907 ursvd,  high state
NUMA  /MB: 49054 (36855), 49152 (38514)
PSHARE/MB:      68  shared,       51  common:       17 saving
SWAP  /MB:       0    curr,        0 rclmtgt:                  0.00 r/s,   0.00 w/s
ZIP   /MB:       0  zipped,        0   saved
MEMCTL/MB:       0    curr,        0  target,    3238 max

    GID NAME                      AMIN        AMAX  ASHRS        AMLMT   AUNITS
 148269 RAID5-VM8                    0          -1     -3      1124352       kb
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 148279 RAID5-VM3                    0          -1     -3      1124352       kb
 314753 RAID1-VM3                    0          -1     -3      1124352       kb
 149810 RAID1-VM8                    0          -1     -3      1124352       kb
```

Tools

cmdline for a specific pool with flags

memstats

```
# memstats -r group-stats
  -g13787842 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  -i pre:vm:vmm:ug
  | sed -n '/^-\+/,/.*\n/p'
```

Tools

cmdline for a specific pool with flags

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```
# memstats -r group-stats
  -g13787842 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  -i pre:vm:vmm:ug
  | sed -n '/^-\+/,/.*\n/p'
```

```
-------------------------------------------------------------------------------
     gid                              name        min        max     conResv  availResv
-------------------------------------------------------------------------------
13787842                             pool1       1098         -1       1065      68937
  149779                       vm.2118803          0         -1       1065         34
  149789                      vmm.2118803       1024         -1          0       1058
-------------------------------------------------------------------------------
```

Tools

cmdline for a specific pool with flags

memstats

```
# memstats -r group-stats
  -g13787842 -l3
  -s gid:name:min:max:conResv:availResv
  -u mb
  -i pre:vm:vmm:ug
  | sed -n '/^-\+/,/.*\n/p'
```

```
---------------------------------------------------------------------------------
     gid                          name          min          max      conResv   availResv
---------------------------------------------------------------------------------
13787842                         pool1         1098           -1         1065       68937
  149779                    vm.2118803            0           -1         1065          34
  149789                   vmm.2118803         1024           -1            0        1058
---------------------------------------------------------------------------------
```

Tools

cmdline for a specific pool with world flags

memstats

```
# memstats -r group-stats -g149779 -l2 -s gid:name:min:max:conResv:availResv -u mb | etc.
```

Tools

cmdline for a specific pool with world flags

memstats

```
# memstats -r group-stats -g149779 -l2 -s gid:name:min:max:conResv:availResv -u mb | etc.
-----------------------------------------------------------------------------
     gid                          name         min         max     conResv  availResv
-----------------------------------------------------------------------------
  149779                    vm.2118803           0          -1        1065         34
  149780           worldGroup.2118803           0          -1           0         34
  149781                    uw.2118803          19          -1           0         52
  149782               vsiHeap.2118803           0          -1           0         34
  149783                    pt.2118803           1          -1           0         35
  149784           cartelheap.2118803           0          -1           0         34
  149785            uwshmempt.2118803           0          -1           0         34
  149786     uwAsyncRemapHeap.2118803           0          -1           0         34
  149787              uwCrypt.2118803           4           4           0          4
  149788            uwregbmp.2118803           1          -1           0         34
  149789                 vmm.2118803        1024          -1           0       1058
  149790              vmmanon.2118803          17          -1           0         50
  149791                vmcpt.2118804           1          -1           0         34
  149792           vmmregbmp.2118803           0          -1           0         34
  149793    vmmAsyncRemapHeap.2118803           0          -1           0         34
-----------------------------------------------------------------------------
```

Tools

cmdline for a specific pool with world flags

memstats

```
# memstats -r group-stats -g149779 -l2 -s gid:name:min:max:conResv:availResv -u mb | etc.
-----------------------------------------------------------------------------
     gid                          name         min         max     conResv  availResv
-----------------------------------------------------------------------------
  149779                    vm.2118803           0          -1        1065         34
  149780           worldGroup.2118803           0          -1           0         34
  149781                   uw.2118803          19          -1           0         52
  149782              vsiHeap.2118803           0          -1           0         34
  149783                   pt.2118803           1          -1           0         35
  149784           cartelheap.2118803           0          -1           0         34
  149785            uwshmempt.2118803           0          -1           0         34
  149786     uwAsyncRemapHeap.2118803           0          -1           0         34
  149787              uwCrypt.2118803           4           4           0          4
  149788            uwregbmp.2118803           1          -1           0         34
  149789                  vmm.2118803        1024          -1           0       1058
  149790            vmmanon.2118803          17          -1           0         50
  149791              vmcpt.2118804           1          -1           0         34
  149792           vmmregbmp.2118803           0          -1           0         34
  149793    vmmAsyncRemapHeap.2118803           0          -1           0         34
-----------------------------------------------------------------------------
```

Tools

cmdline for any world's reservations

memstats

```
# memstats -r group-stats -l7 -s gid:name:min -u mb | sed -n '/^-\+/,/.*\n/p'
  | awk 'NR == 3 || $3 !~ /^0/
  {printf ("%-10s%-50s%-9s%-6s%-6s%-6s\n",$1, $2, $3)}'
```

Tools

cmdline for any world's reservations

memstats

```
# memstats -r group-stats -l7 -s gid:name:min -u mb | sed -n '/^-\+/,/.*\n/p'
  | awk 'NR == 3 || $3 !~ /^0/
  {printf ("%-10s%-50s%-9s%-6s%-6s%-6s\n",$1, $2, $3)}'
```

Tools

cmdline for any world's reservations

memstats

```
# memstats -r group-stats -l7 -s gid:name:min -u mb | sed -n '/^-\+/,/.*\n/p'
  | awk 'NR == 3 || $3 !~ /^0/
  {printf ("%-10s%-50s%-9s%-6s%-6s%-6s\n",$1, $2, $3)}'

-----------------------------------------------
gid       name                                              min
-----------------------------------------------
0         host                                              97823
1         system                                            20025
(…)
66644     dom-Owner-traceTblSlab-0x4300a6c8c140             67
66645     dom-Owner-objSlab-0x4300a6c8c440                  1463
66646     dom-Owner-subscrEntrySlab-0x4300a6c8c740          201
66647     dom-Owner-rdtHdrSlab-0x4300a6c8ca40               9
(…)
109524    LSOM_UnmapLsnEntrySlab-0x4300a6c94540             243
109527    LSOMDiskGroup_002                                 7737
(…)
```

Tools

cmdline for any world's reservations

memstats

```
# memstats -r group-stats -l7 -s gid:name:min -u mb | sed -n '/^-\+/,/.*\n/p'
  | awk 'NR == 3 || $3 !~ /^0/
  {printf ("%-10s%-50s%-9s%-6s%-6s%-6s\n",$1, $2, $3)}'

-----------------------------------------------
gid       name                                              min
-----------------------------------------------
0         host                                              97823
1         system                                            20025
(…)
66644     dom-Owner-traceTblSlab-0x4300a6c8c140             67
66645     dom-Owner-objSlab-0x4300a6c8c440                  1463
66646     dom-Owner-subscrEntrySlab-0x4300a6c8c740          201
66647     dom-Owner-rdtHdrSlab-0x4300a6c8ca40               9
(…)
109524    LSOM_UnmapLsnEntrySlab-0x4300a6c94540             243
109527    LSOMDiskGroup_002                                 7737
(…)
```

Tools

Why doesn't e.g. vSAN use CPU reservations?

```
# /tmp/foo.sh
host/system logSysAlert
host/system serialLogger
host/system netLegacyRx
host/system NetEventWorld
host/system netCoalesce2World
(…)
host/system VSAN_0x430e986f2fe8_Client
host/system VSAN_0x430e986ee298_Client
host/system VSAN_0x430e986efc18_Client
host/system VSAN_0x430fff7e3418_Owner
(…)
host/system VSAN_0x430f24818f18_PLOG
host/system VSAN_0x430f2481d618_PLOG
host/system VSAN_0x430f25070598_LSOMLLOG
host/system VSAN_0x430f25070918_LSOMLLOG
```

Tools

Why doesn't e.g. vSAN use CPU reservations?

```
# cat /tmp/foo.sh
for vcpuid in $(vsish -e ls /sched/Vcpus/)
do
        priority=$(vsish -e get /sched/Vcpus/${vcpuid}stats/summaryStats | (linebreak)
        sed -n 's/^   highPriority:\([0-9]\)$/\1/p') 2> /dev/null
        if [ ${priority} ] && [ ${priority} == 1 ]
        then
                gpname=$(vsish -e get /sched/Vcpus/${vcpuid}groupPathName)
                wname=$(vsish -e get /sched/Vcpus/${vcpuid}worldName)
                echo -e "${gpname} ${wname}"
        fi
done
```

Tools

Why doesn't e.g. vSAN use CPU reservations?

```
# cat /tmp/foo.sh
for vcpuid in $(vsish -e ls /sched/Vcpus/)
do
        priority=$(vsish -e get /sched/Vcpus/${vcpuid}stats/summaryStats |  (linebreak)
        sed -n 's/^   highPriority:\([0-9]\)$/\1/p') 2> /dev/null
        if [ ${priority} ] && [ ${priority} == 1 ]
        then
                gpname=$(vsish -e get /sched/Vcpus/${vcpuid}groupPathName)
                wname=$(vsish -e get /sched/Vcpus/${vcpuid}worldName)
                echo -e "${gpname} ${wname}"
        fi
done
```

Changes in vSphere 6.7

New in 6.7

Resource Pool entitlement is now calculated with consumed then active

Changes in vSphere 6.7

New in 6.7

Resource Pool entitlement is now calculated with consumed then active

Global to Local distribution happens every minute

Changes in vSphere 6.7

New in 6.7

Resource Pool entitlement is now calculated with consumed then active

Global to Local distribution happens every minute

Local Pool reservations are distributed more eagerly

Changes in vSphere 6.7

New in 6.7

Resource Pool entitlement is now calculated with consumed then active

Global to Local distribution happens every minute

Local Pool reservations are distributed more eagerly

A CPU reservation now ensures core throughput if behind vtime

Thank You

