

ACTiManager: An end-to-end interference aware cloud resource manager

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Methodology



- 4 dual-socket x86 servers
 - Intel Xeon CPU E5-2630 @ 2.2GHz
 - 10 cores per socket
 - 32KB L1 cache
 - 256KB L2 cache
 - 25MB L3 cache
- OpenStack Pike
 - KVM/QEMU 2.11.1
 - Libvirt 4.0.0

- Execution scenarios
 - Based on properties form Azure traces [SOSP'17]
 - 4 different VM flavors
 - 1 core with 2GB RAM
 - 2 core with 4GB RAM
 - 4 core with 8GB RAM
 - 8 core with 16GB RAM
 - Spec2006 benchmark suite

Demonstration Scenarios

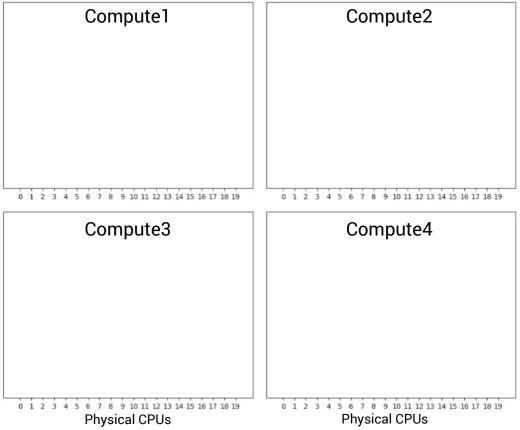


- 1. Full ACTiManager Demo
 - <u>ACTiManager.External</u> → chooses the appropriate physical server
 - <u>ACTiManager.Internal</u> → chooses the appropriate VCPU -> PCPU mapping
 - Demonstrates the overall functionality



4 20-core nodes cluster

Compute 2 Sourdown of Burgles VMs (articleut) Sourdown Start





ACTiManager.External:

- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** Gold/Silver VMs
- Considers VMs' characterization Noisy/Quiet and Sensitive/Insensitive VMs

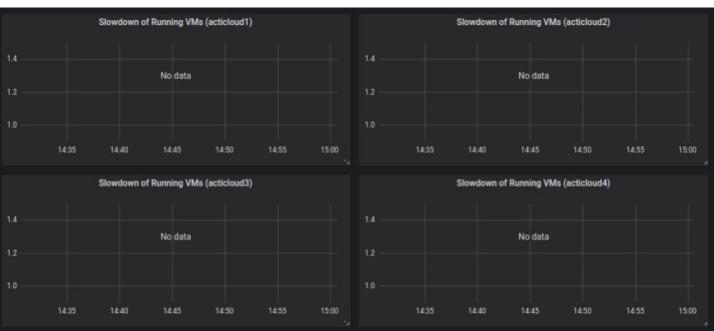
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Actual Slowdown of Gold VMs



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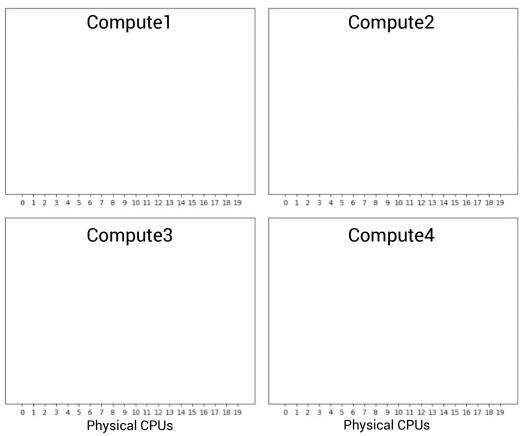
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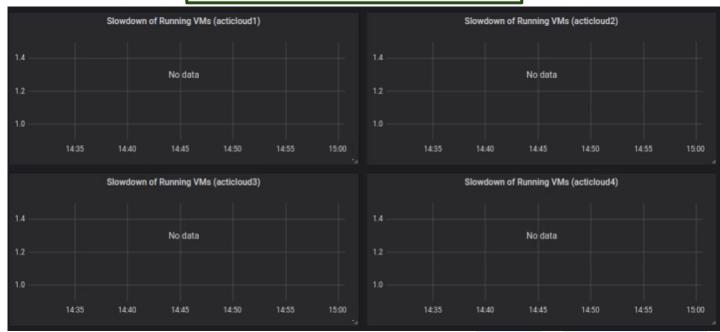
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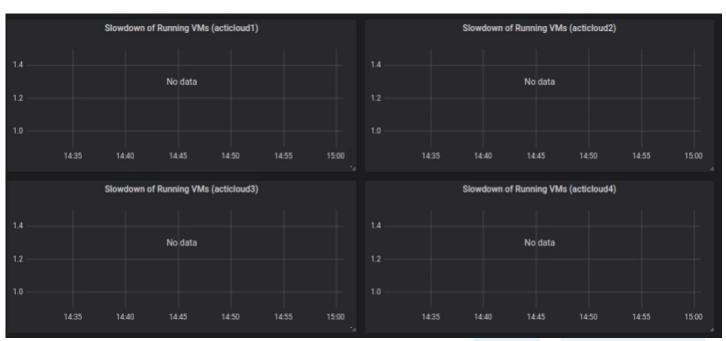


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Compute1 Compute2 New VM: 2-core Gold **Quiet & Sensitive** 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 Compute3 Compute4 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19

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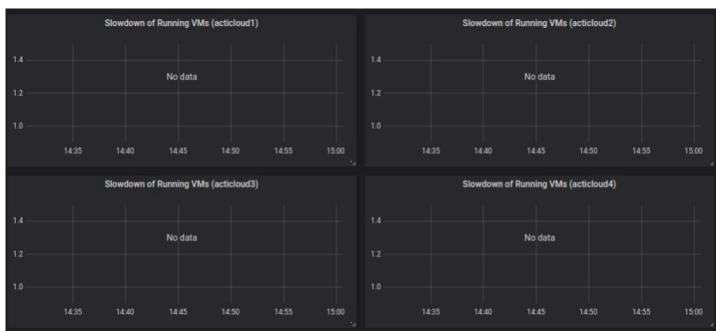
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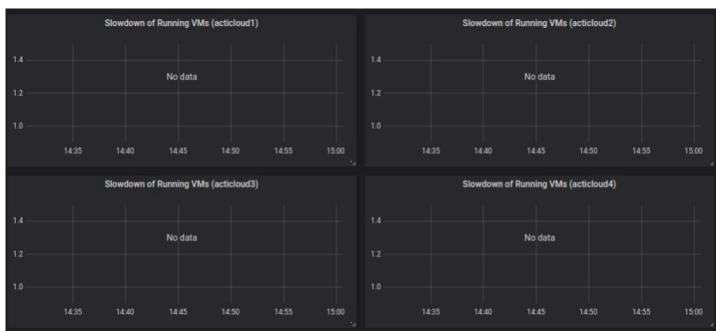
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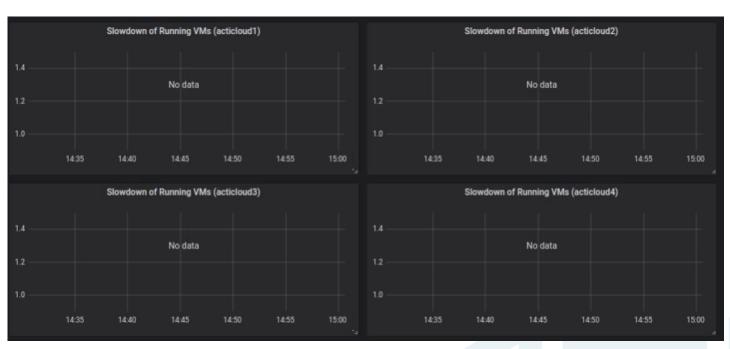
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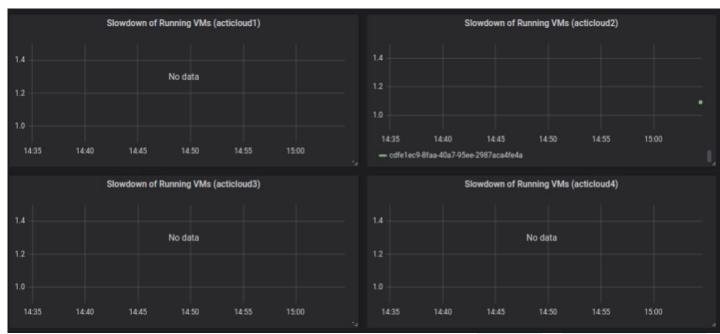
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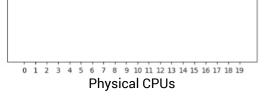
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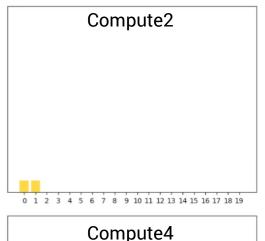
Compute2



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Compute1

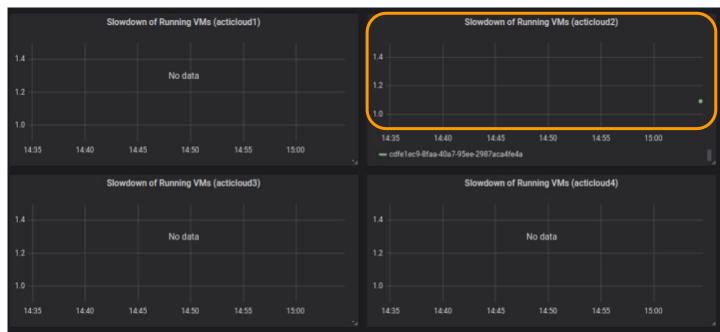








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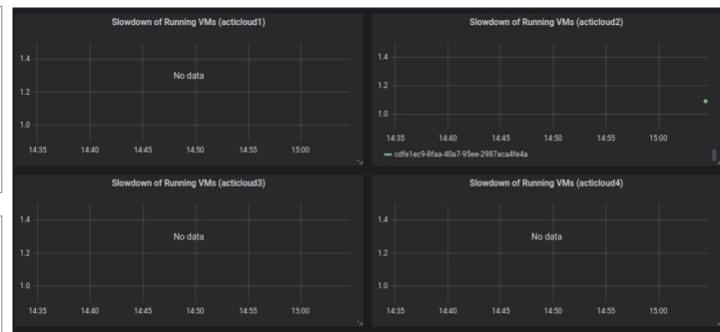
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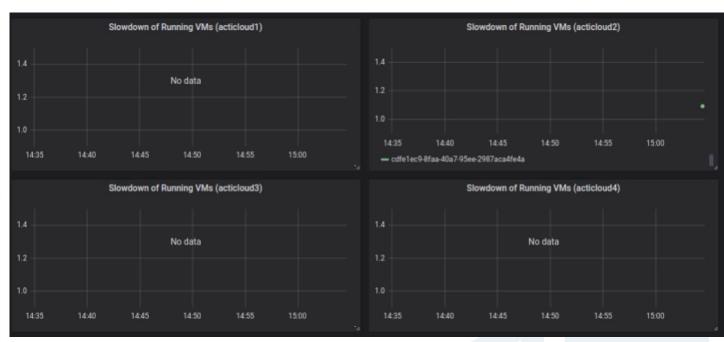
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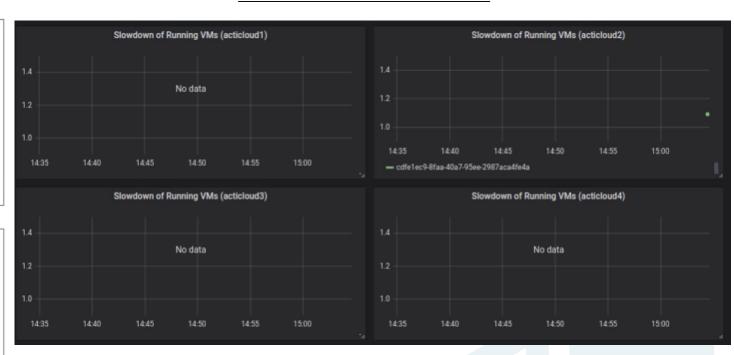


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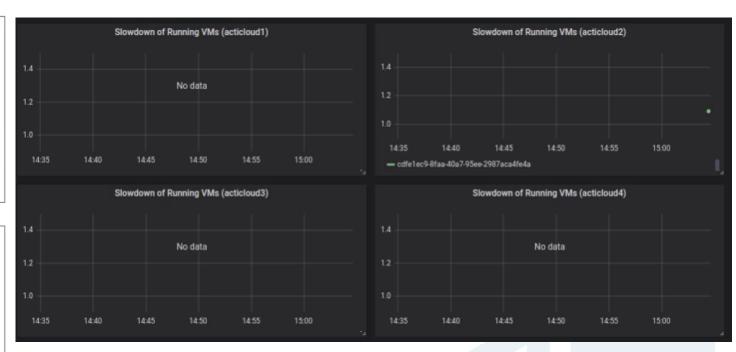


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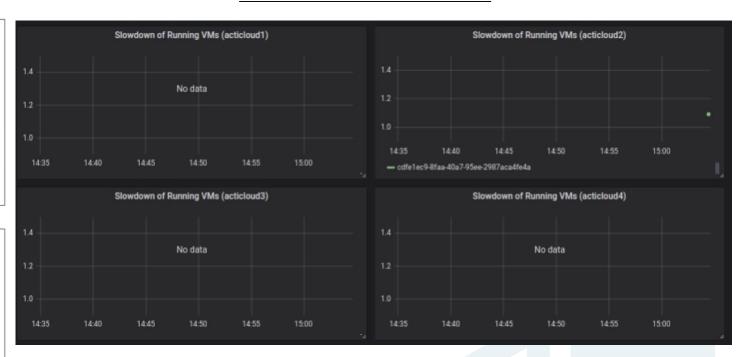


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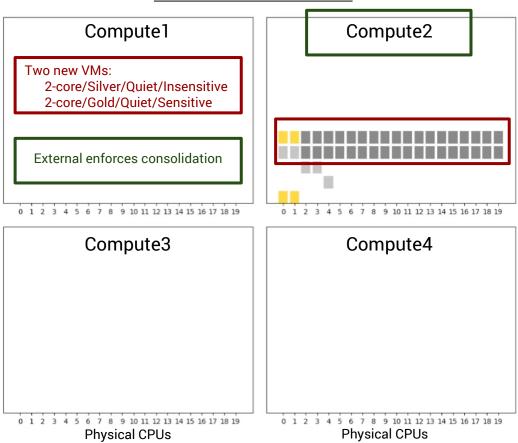
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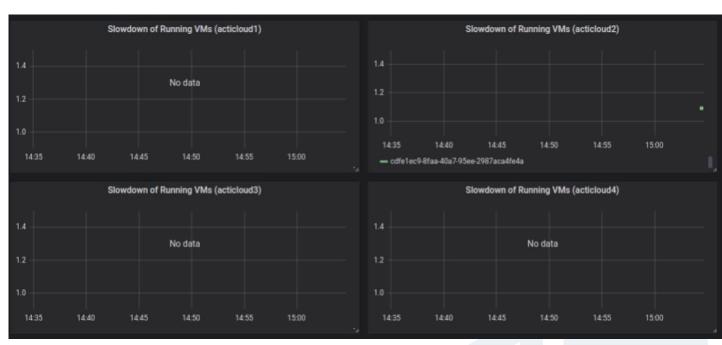
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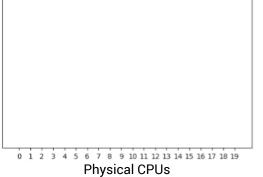
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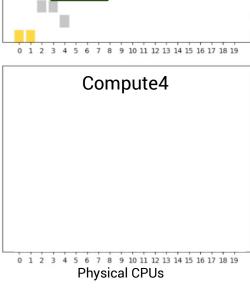
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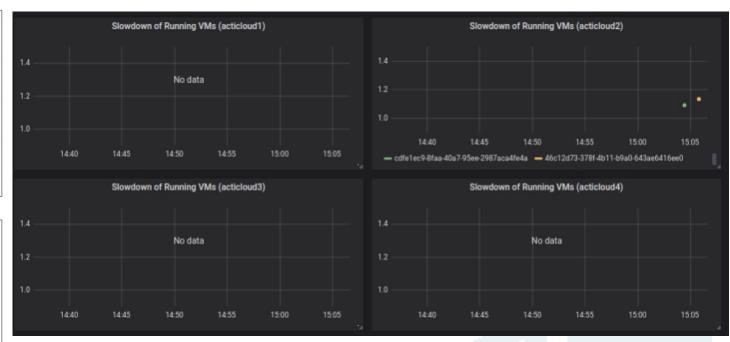


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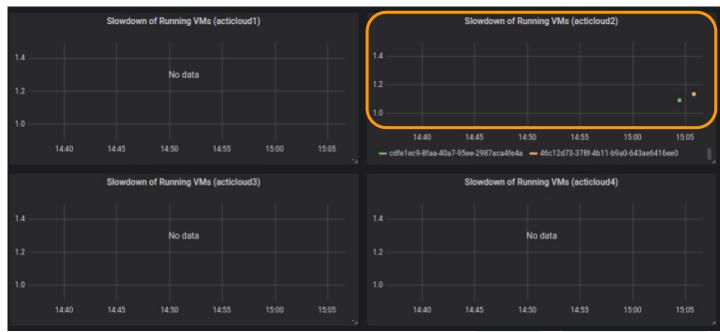


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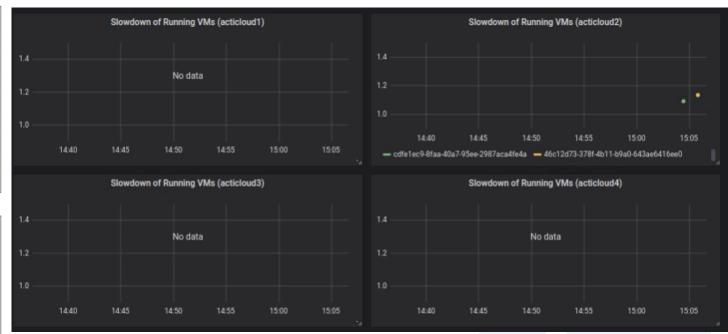


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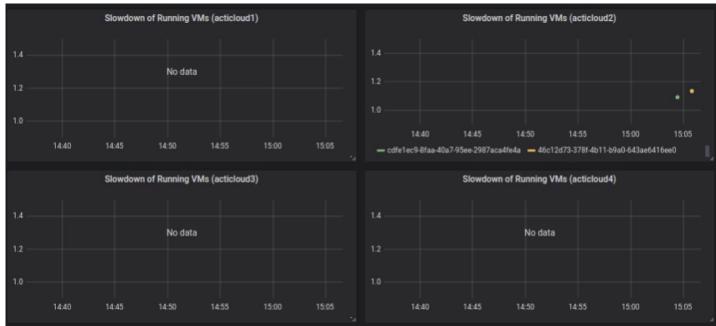
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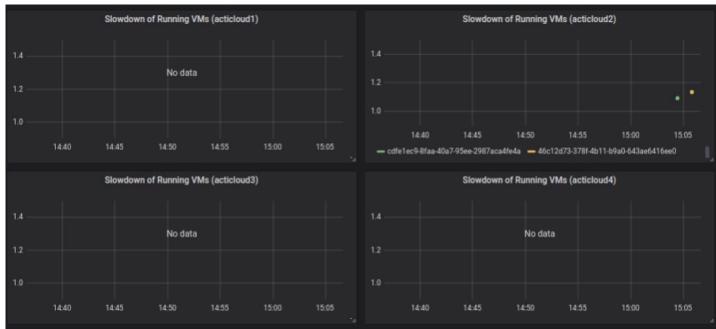
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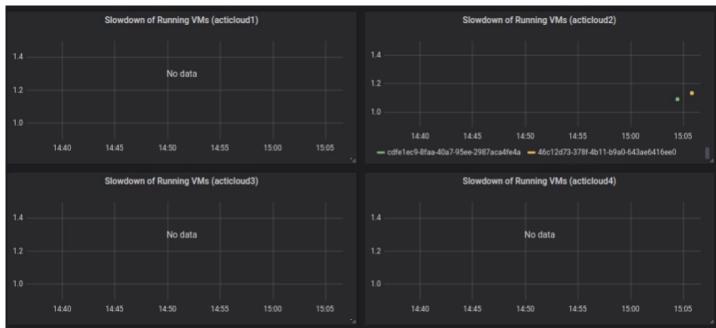
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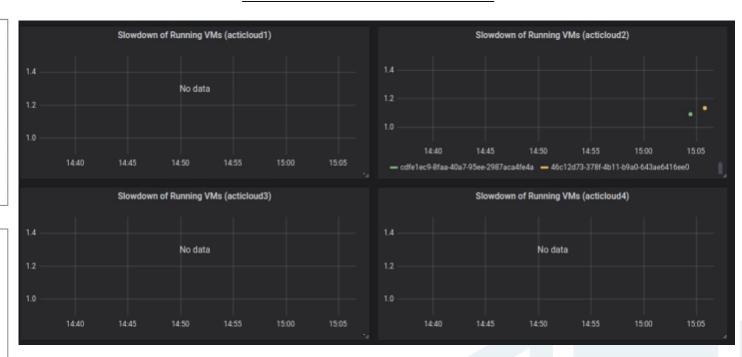
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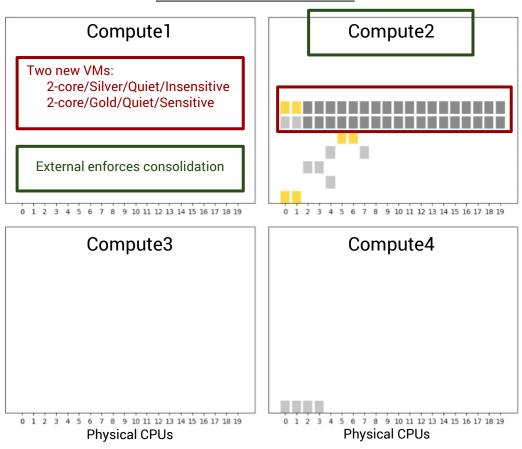
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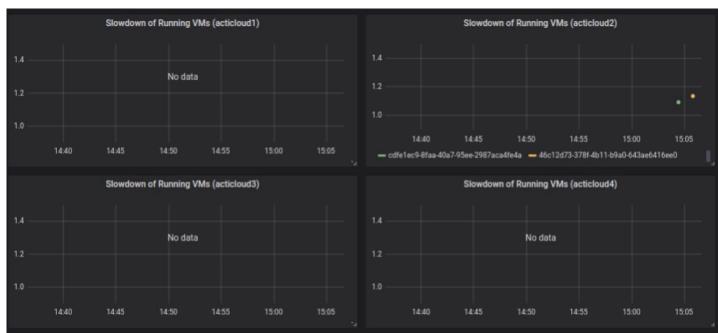
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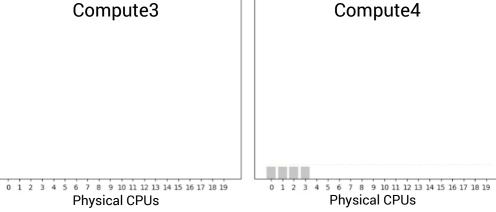
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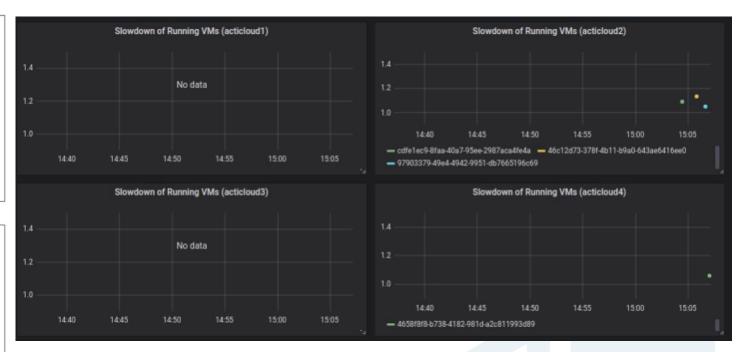


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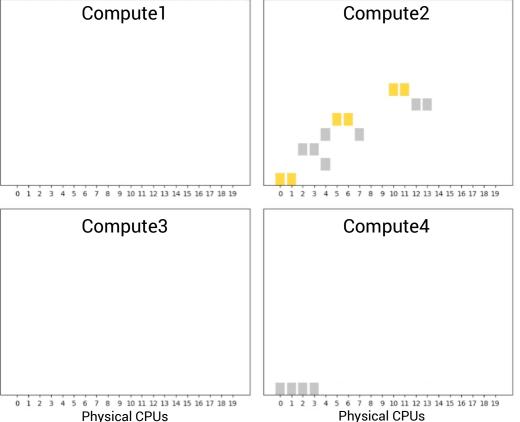
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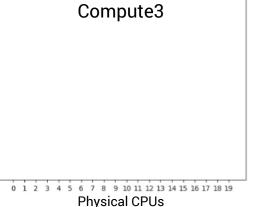
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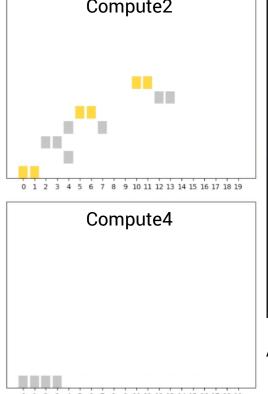
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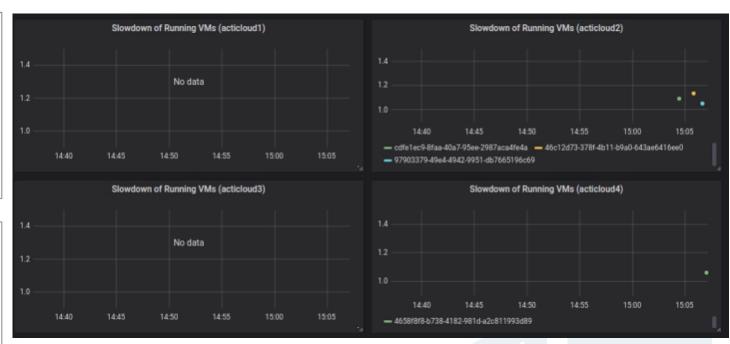
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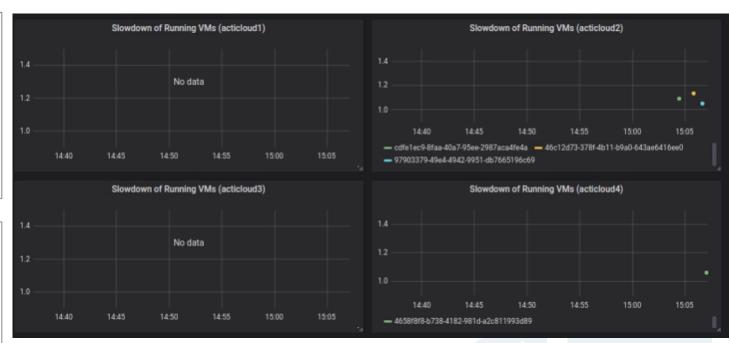
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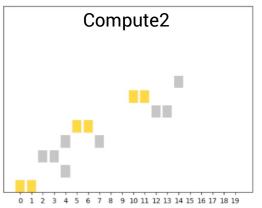
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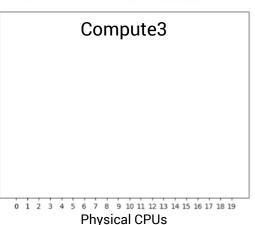
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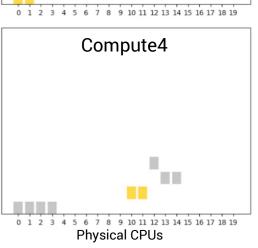


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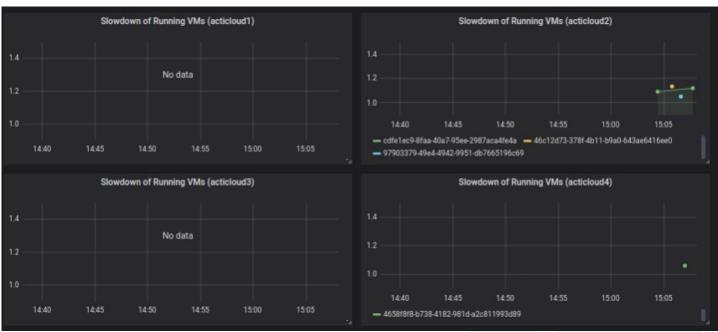
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Actual Slowdown of Gold VMs



ACTiManager.External:

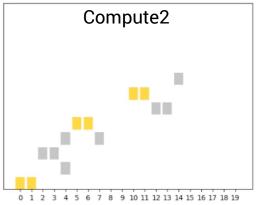
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** Gold/Silver VMs
- Considers VMs' characterization Noisy/Quiet and Sensitive/Insensitive VMs

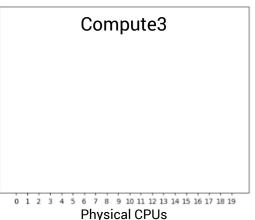
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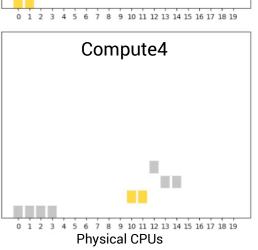


4 20-core nodes cluster

Compute 1 New VM: 8-core/Silver/Quiet/Insensitive External takes into account the VMs' characteristics at coarse granularity







Actual Slowdown of Gold VMs



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ACTiManager.Internal:

Physical CPUs

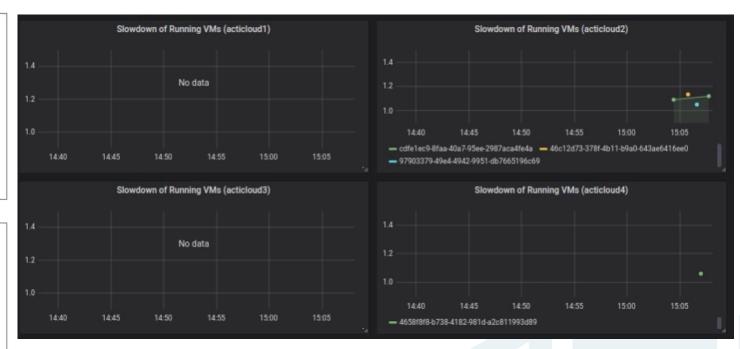


4 20-core nodes cluster

Compute1 Compute2 Internal pins the VM Compute3 Compute4

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 Physical CPUs

Actual Slowdown of Gold VMs



ACTiManager.External:

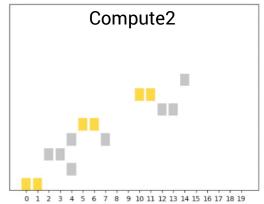
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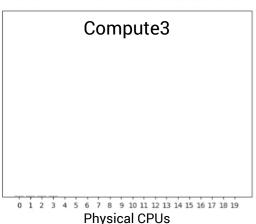
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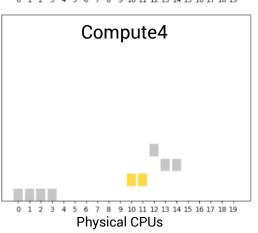


4 20-core nodes cluster

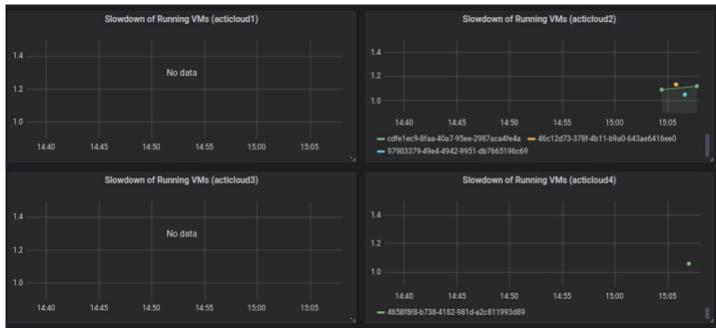
Compute 1







Actual Slowdown of Gold VMs



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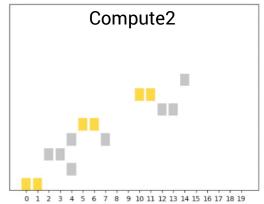
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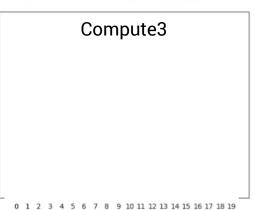
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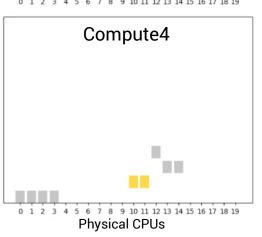
4 20-core nodes cluster

Compute 1





Physical CPUs



Actual Slowdown of Gold VMs



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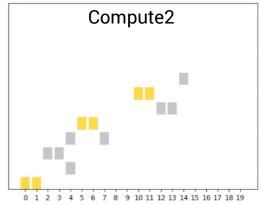
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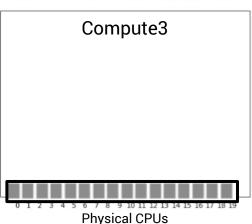
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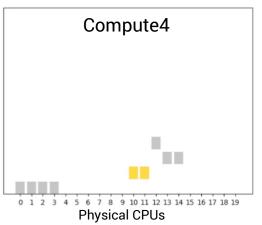


4 20-core nodes cluster

Compute 1







Actual Slowdown of Gold VMs



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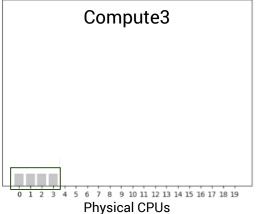
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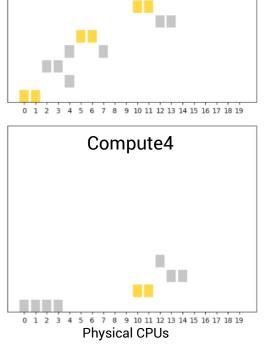
ACTiManager.Internal:



4 20-core nodes cluster

Compute1 Compute2





Actual Slowdown of Gold VMs



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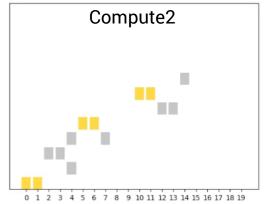
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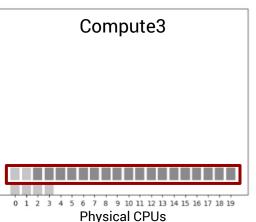
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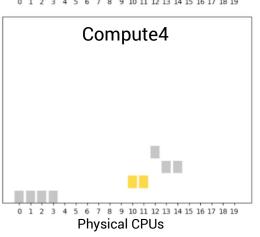


4 20-core nodes cluster

Compute 1







Actual Slowdown of Gold VMs



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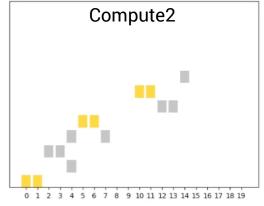
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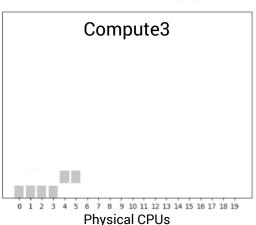
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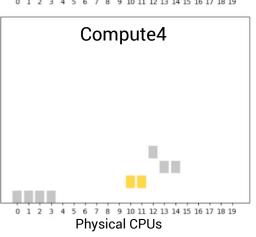


4 20-core nodes cluster

Compute 1







Actual Slowdown of Gold VMs



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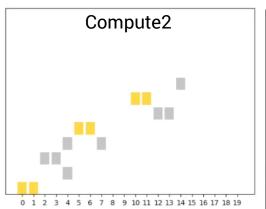
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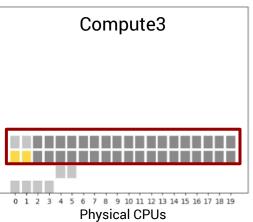
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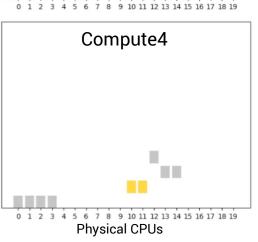


4 20-core nodes cluster

Compute 1







Actual Slowdown of Gold VMs



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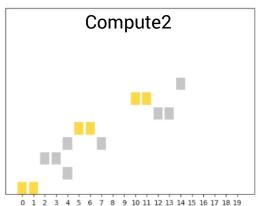
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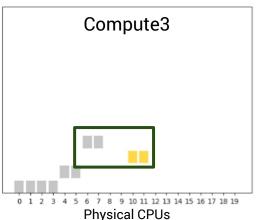
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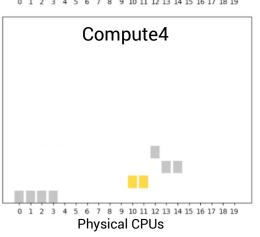


4 20-core nodes cluster

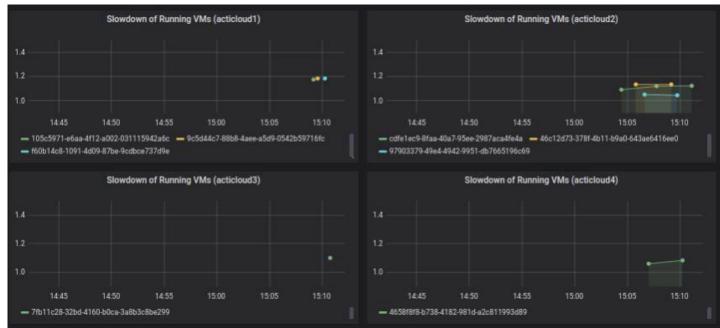
Compute 1







Actual Slowdown of Gold VMs



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ACTiManager.Internal:

Physical CPUs

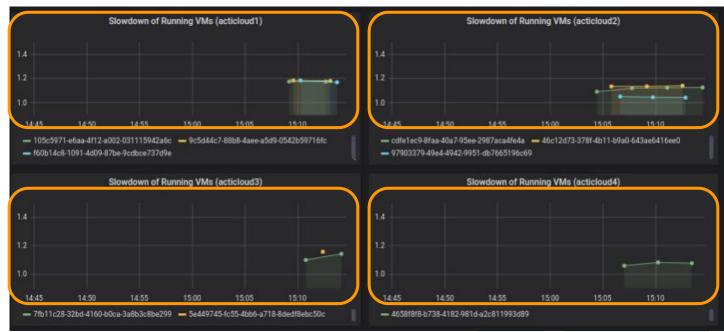


4 20-core nodes cluster

Compute1 Compute2 Compute3 Compute4

Physical CPUs

Actual Slowdown of Gold VMs



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Physical CPUs



4 20-core nodes cluster

Compute1 Compute2 Compute3 Compute4

Physical CPUs

Actual Slowdown of Gold VMs



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ACTiManager.Internal:

Physical CPUs



4 20-core nodes cluster

Compute1 Compute2 Compute3 Compute4

Physical CPUs

Actual Slowdown of Gold VMs



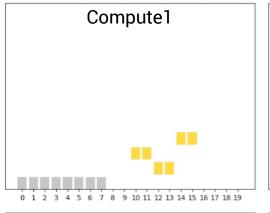
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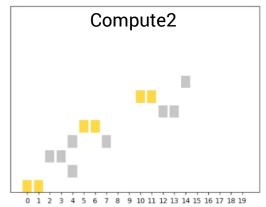
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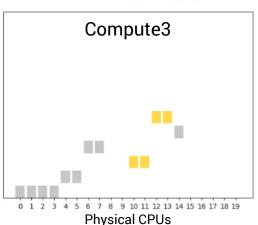
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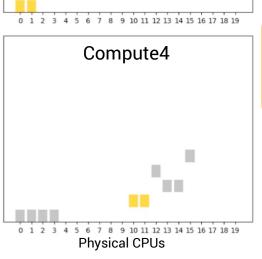


4 20-core nodes cluster









Actual Slowdown of Gold VMs



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ACTiManager.Internal:

Demonstration Scenarios

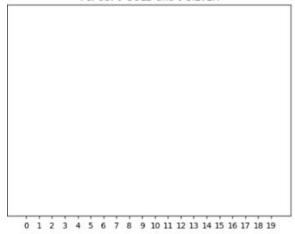


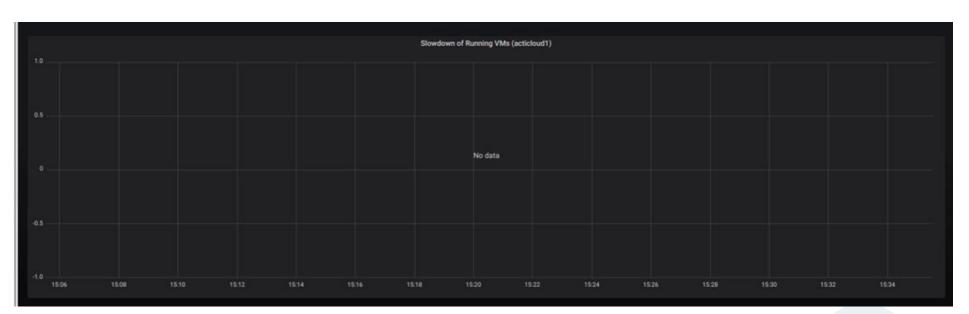
- 2. Internal component (vs. Linux scheduler)
 - Server level
 - Pinning of VMs to cores
 - Detects interference



Compute-1

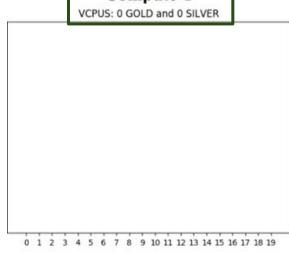
VCPUS: 0 GOLD and 0 SILVER

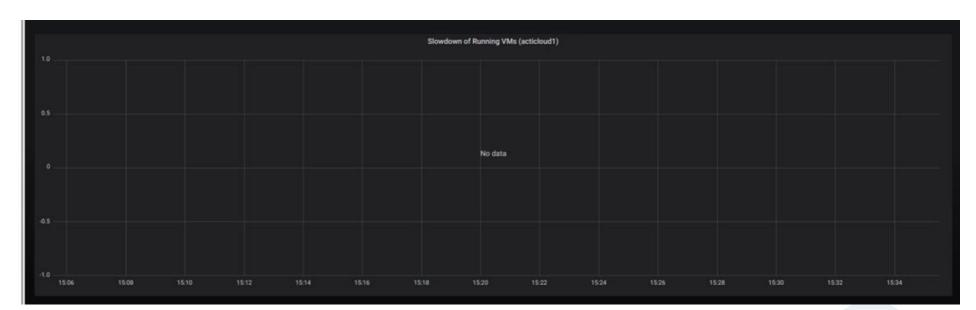






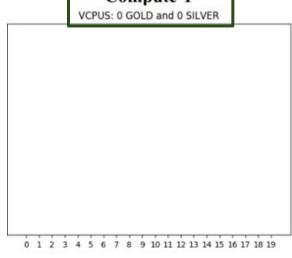
Compute-1

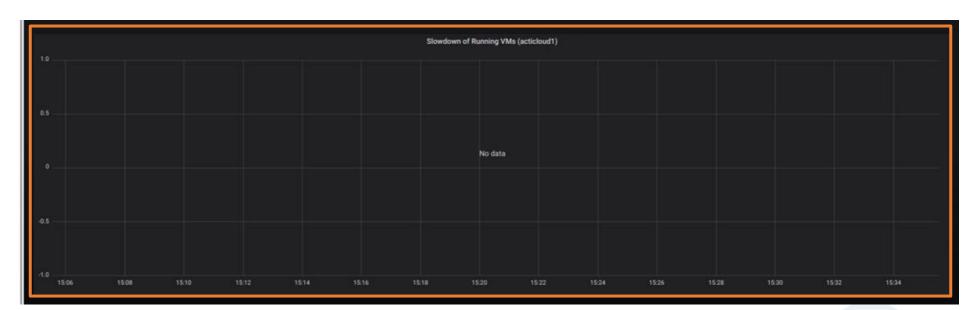




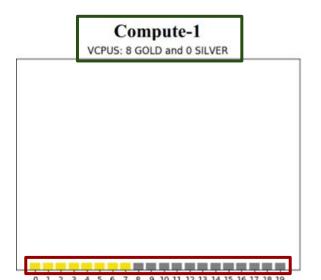


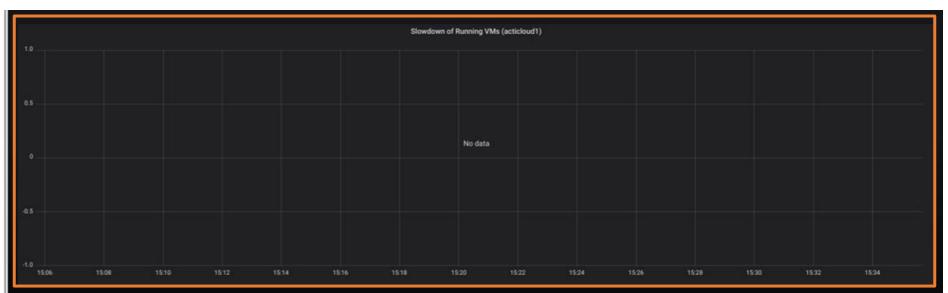
Compute-1



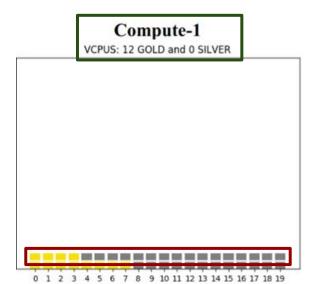


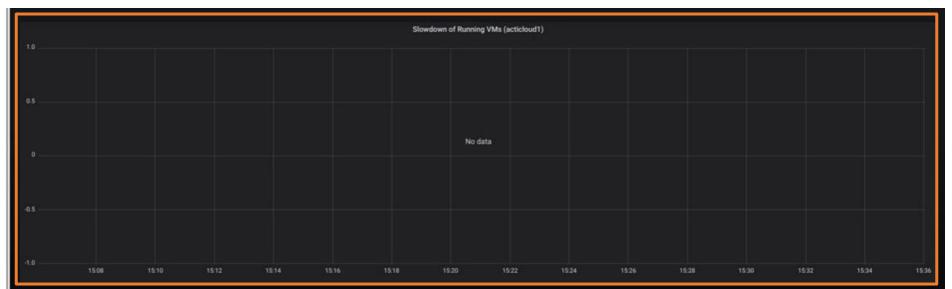




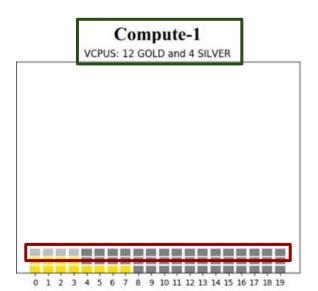


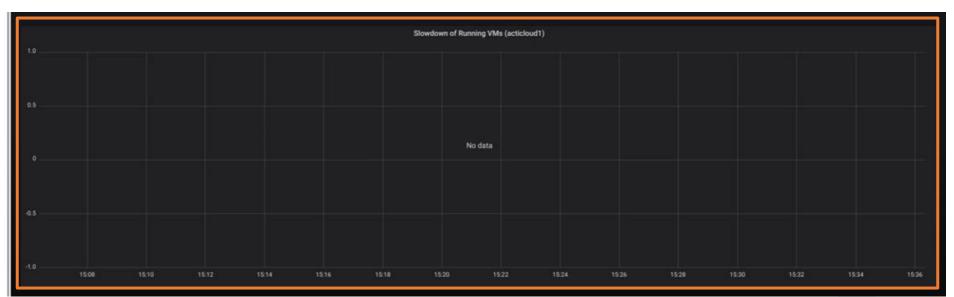




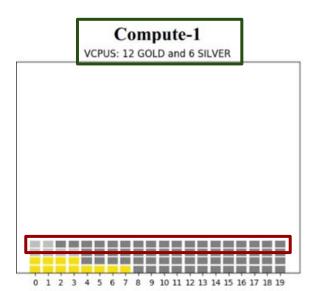


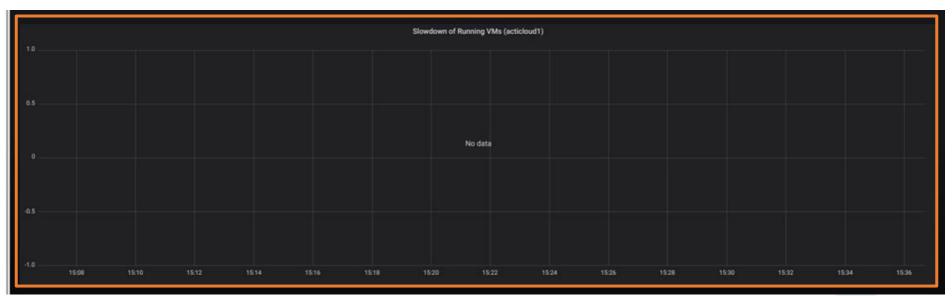




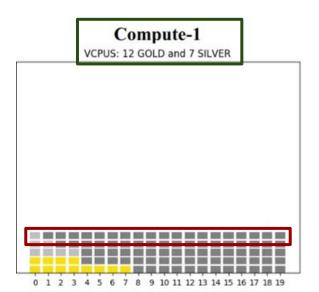


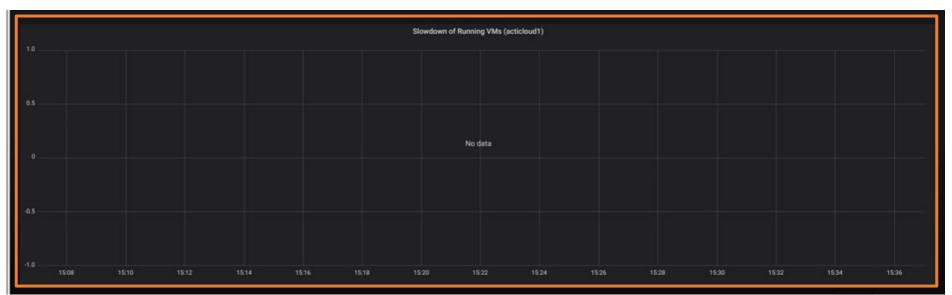




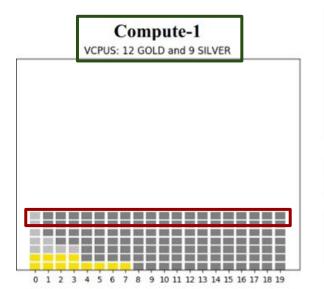


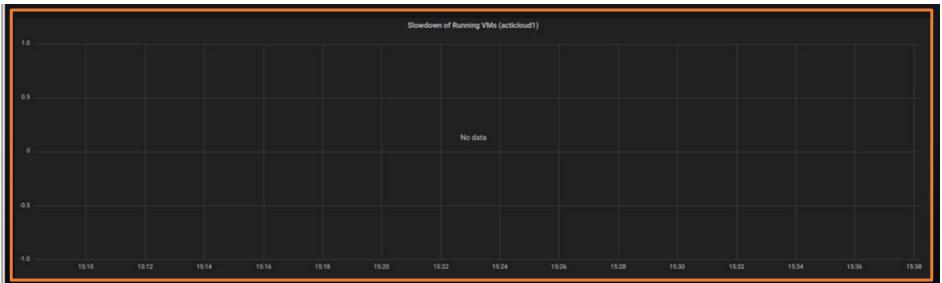






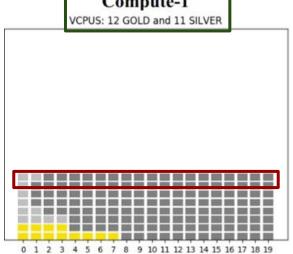


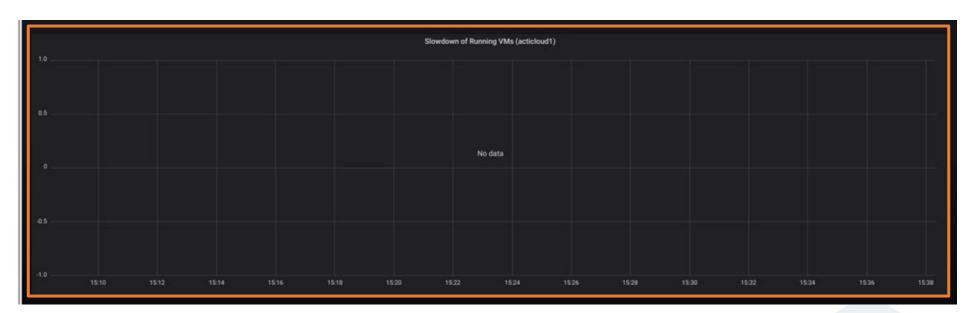






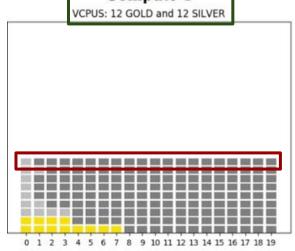


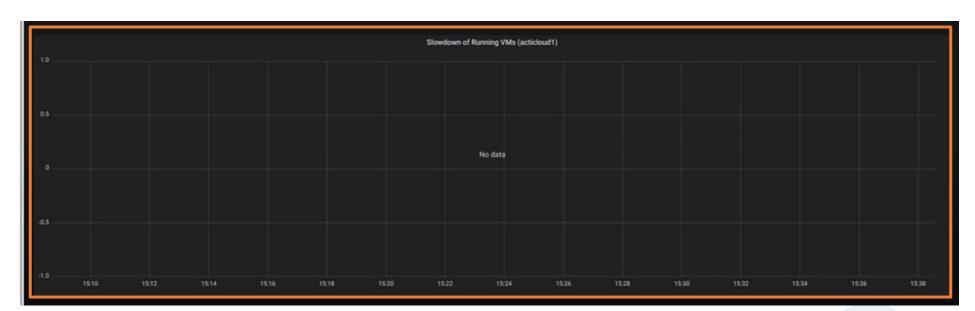




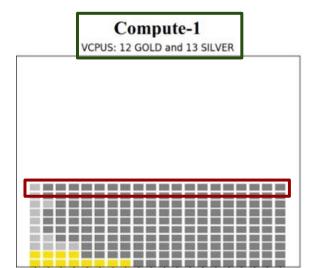


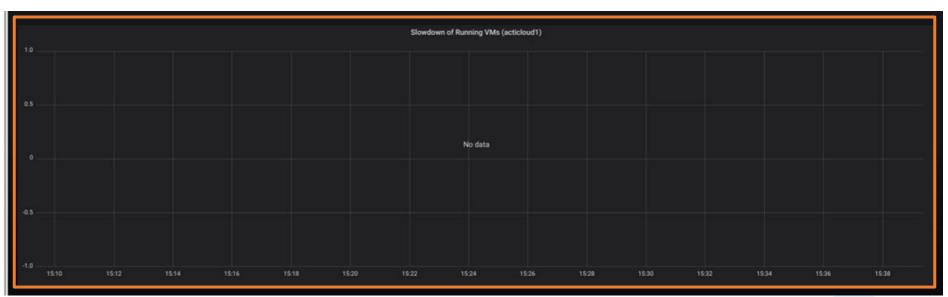






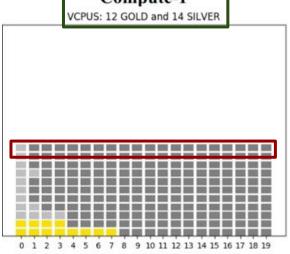


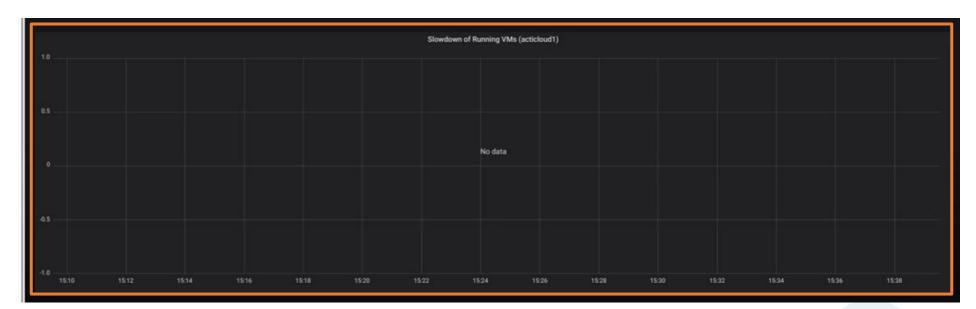




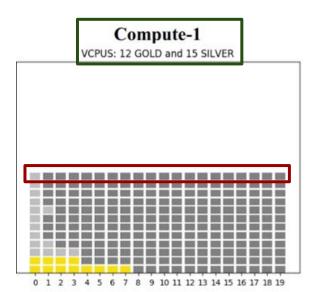


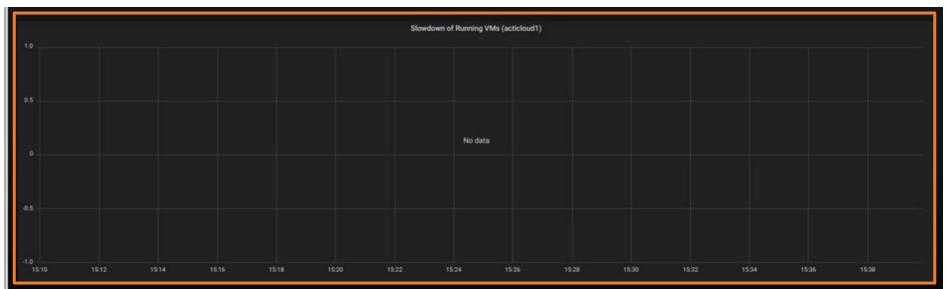




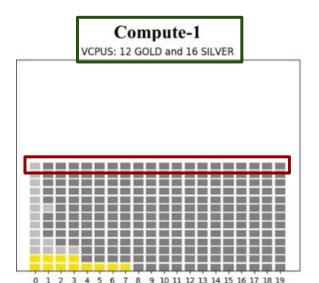


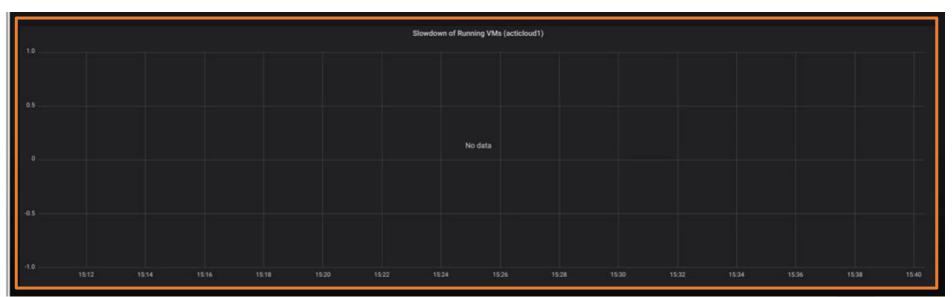




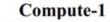


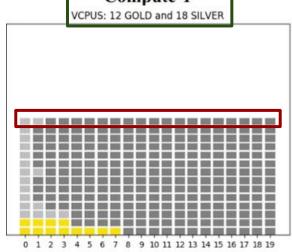


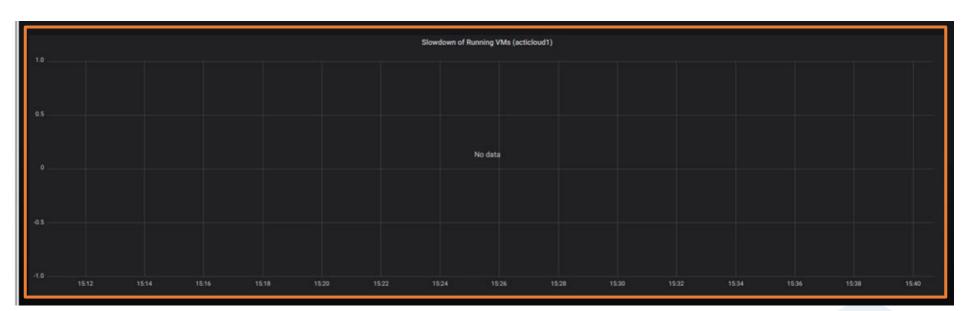






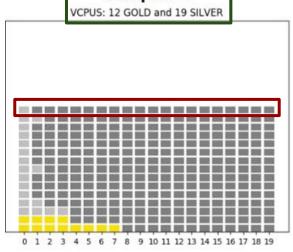


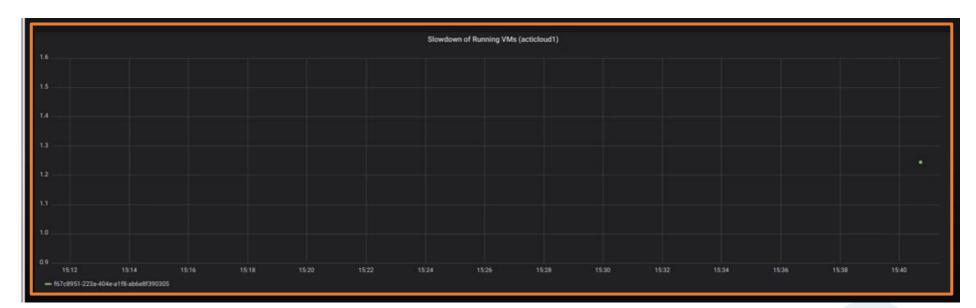




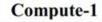


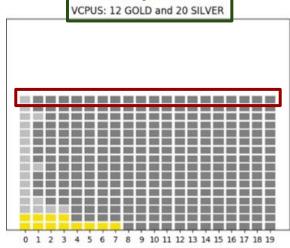


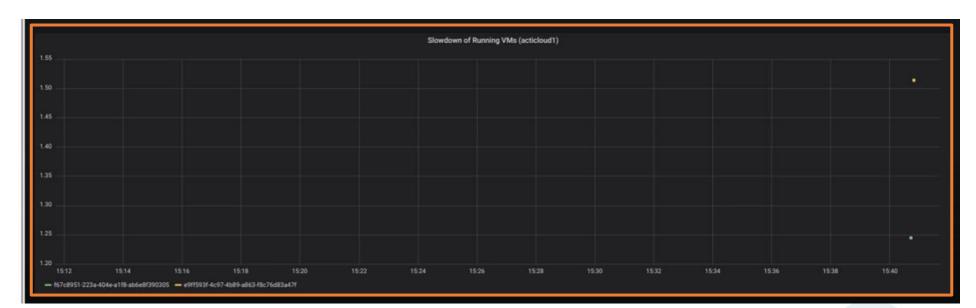








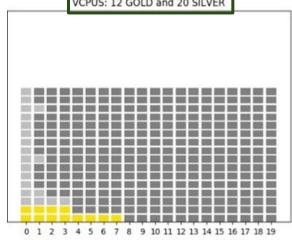


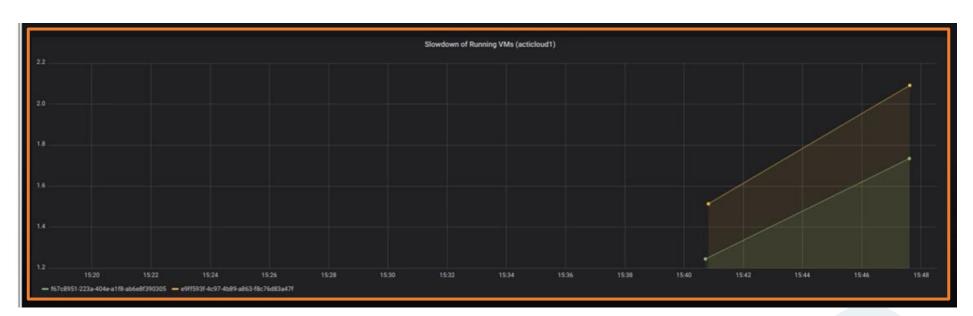




Compute-1

VCPUS: 12 GOLD and 20 SILVER

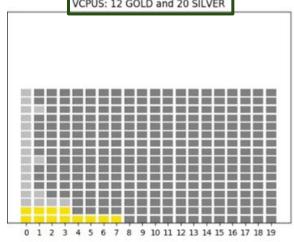


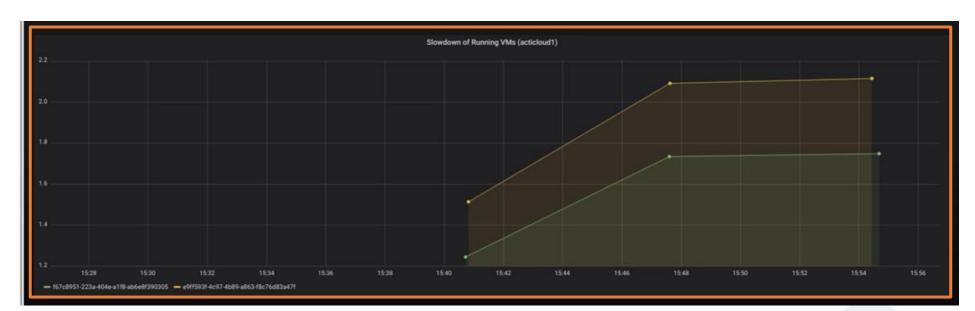




Compute-1

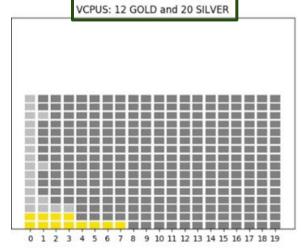
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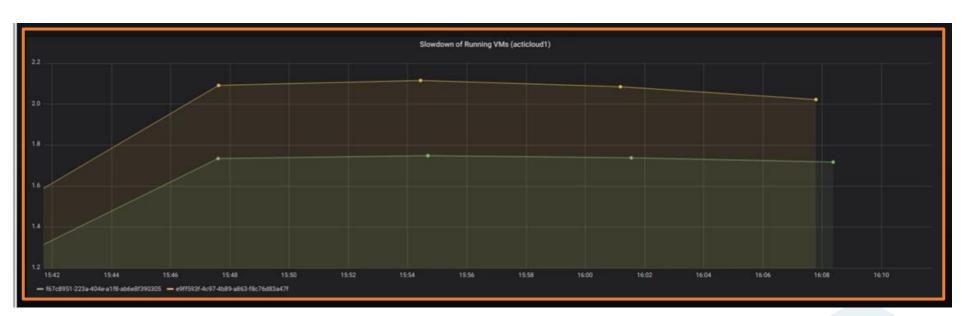




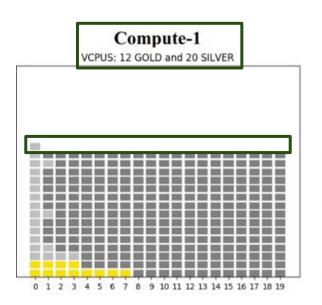


Compute-1





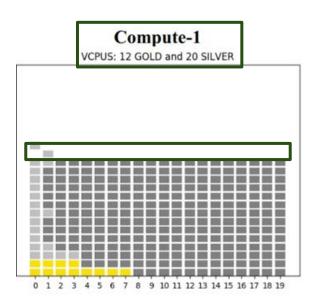


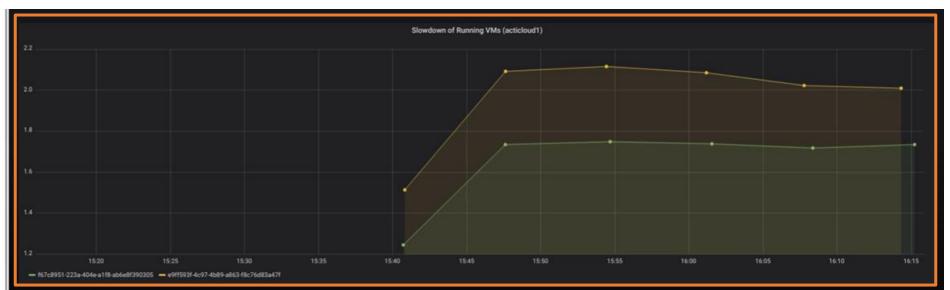




- Pins the VMs' virtual cpus to servers' physical cpus
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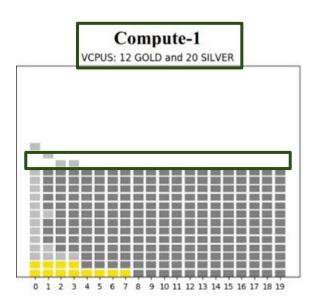


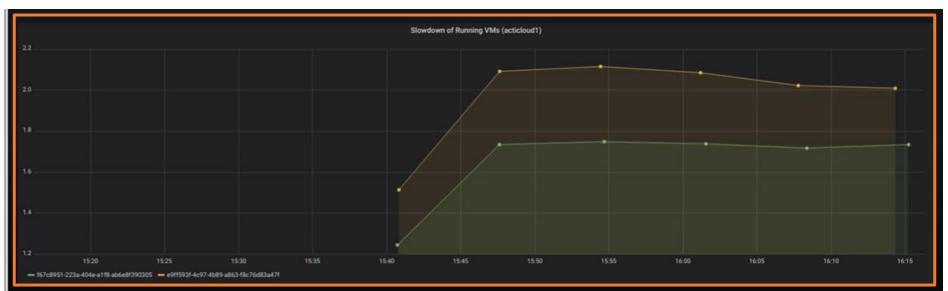




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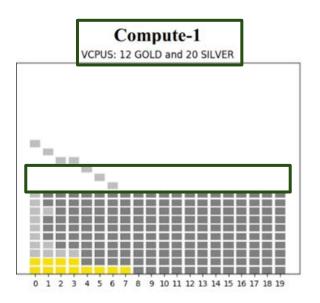






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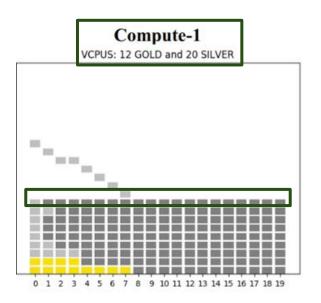






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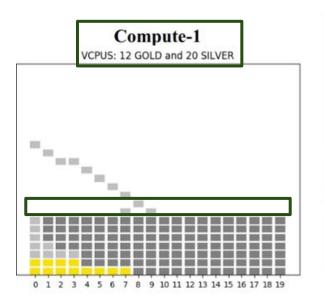






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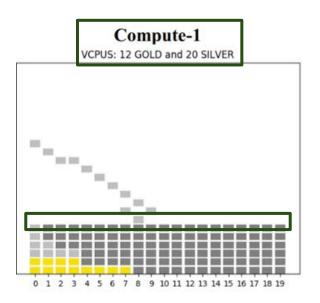






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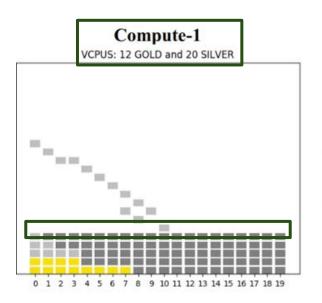






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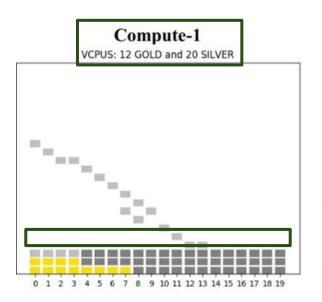






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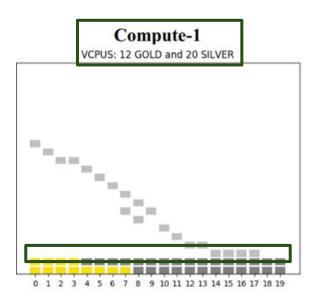






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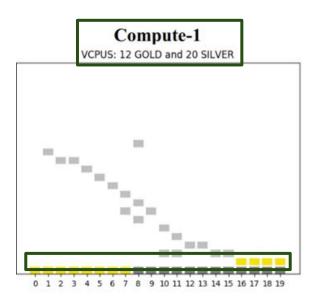






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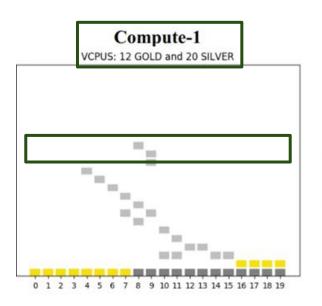






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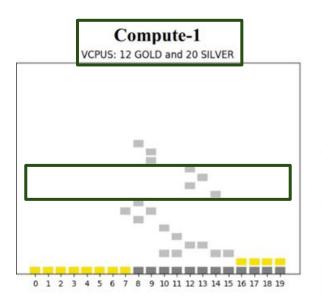






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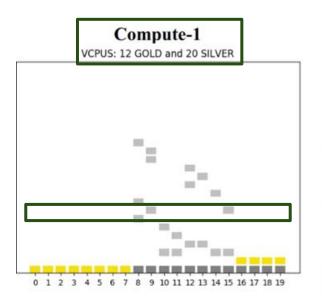






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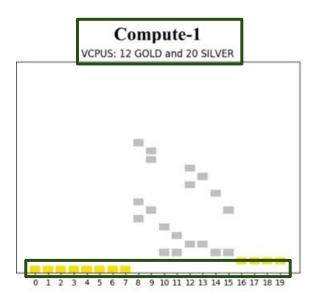






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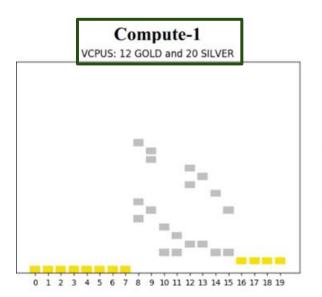






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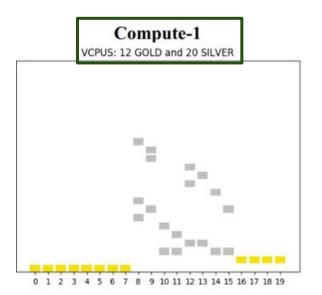






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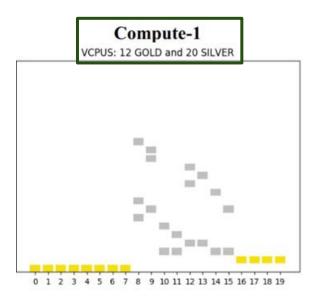






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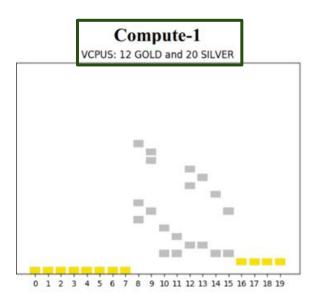






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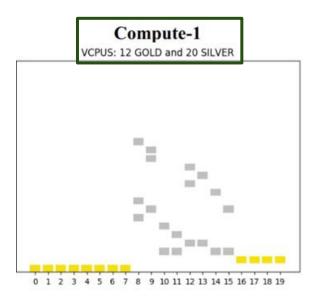






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