



ACTiCLOUD

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

Stratos Psomadakis, Stefanos Gerangelos, Dimitrios Siakavaras,  
Ioannis Papadakis, Marina Vemmou, Aspa Skalidi, Vasileios Karakostas,  
Konstantinos Nikas, Nectarios Koziris, Georgios Goumas

*20<sup>th</sup> ACM/IFIP International Middleware Conference 2019*

# 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 from 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

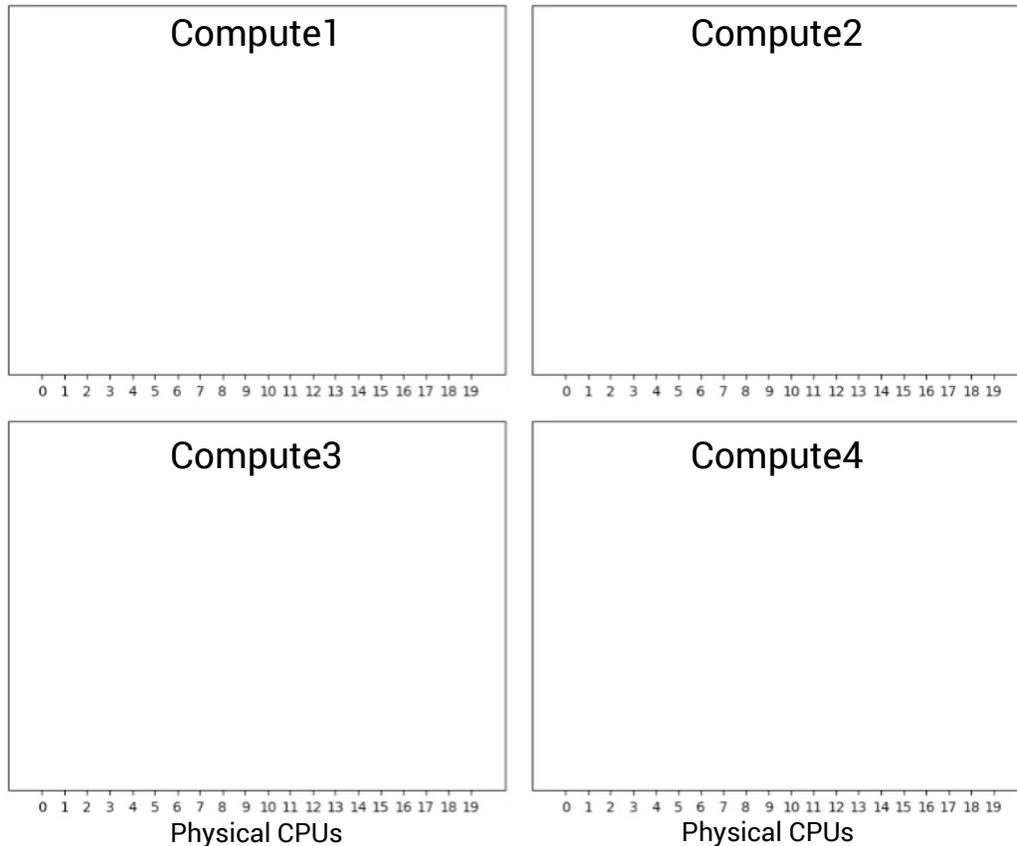
# Demonstration Scenarios

## 1. Full ACTiManager Demo

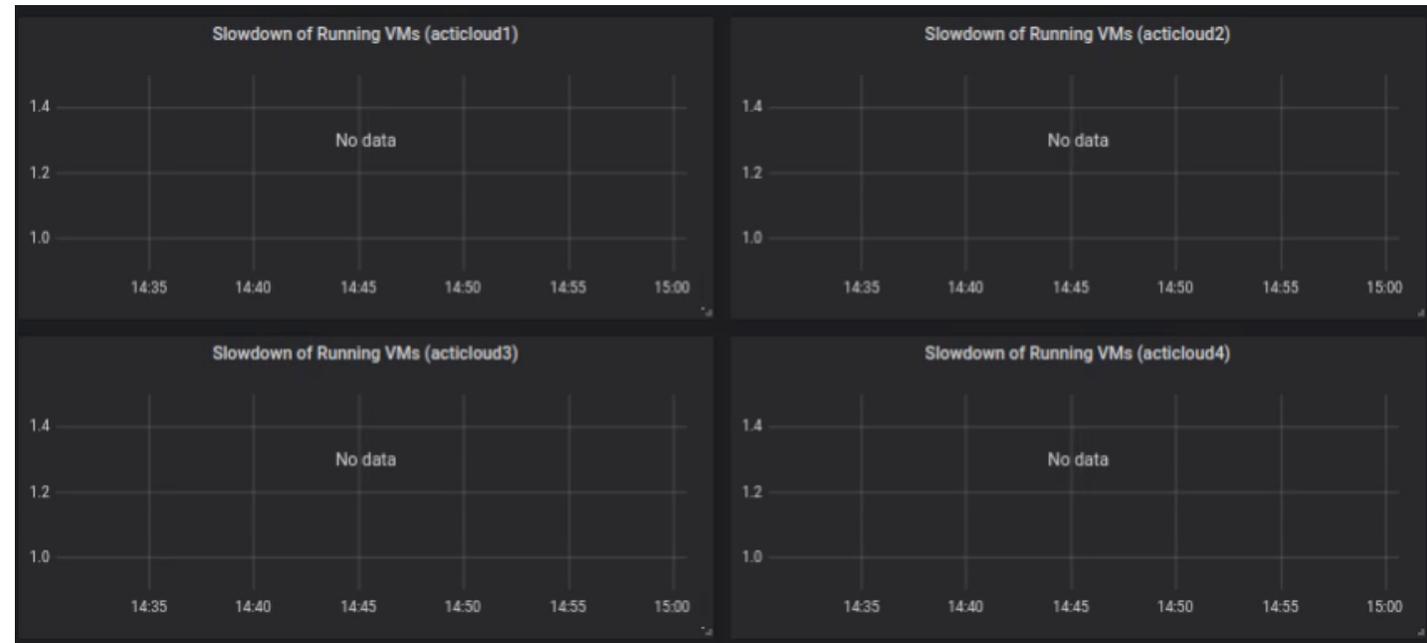
- ACTiManager.External → chooses the appropriate physical server
- ACTiManager.Internal → chooses the appropriate VCPU -> PCPU mapping
- Demonstrates the overall functionality

# ACTiManager Demonstration

## 4 20-core nodes cluster



## 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

### ACTiManager.Internal:

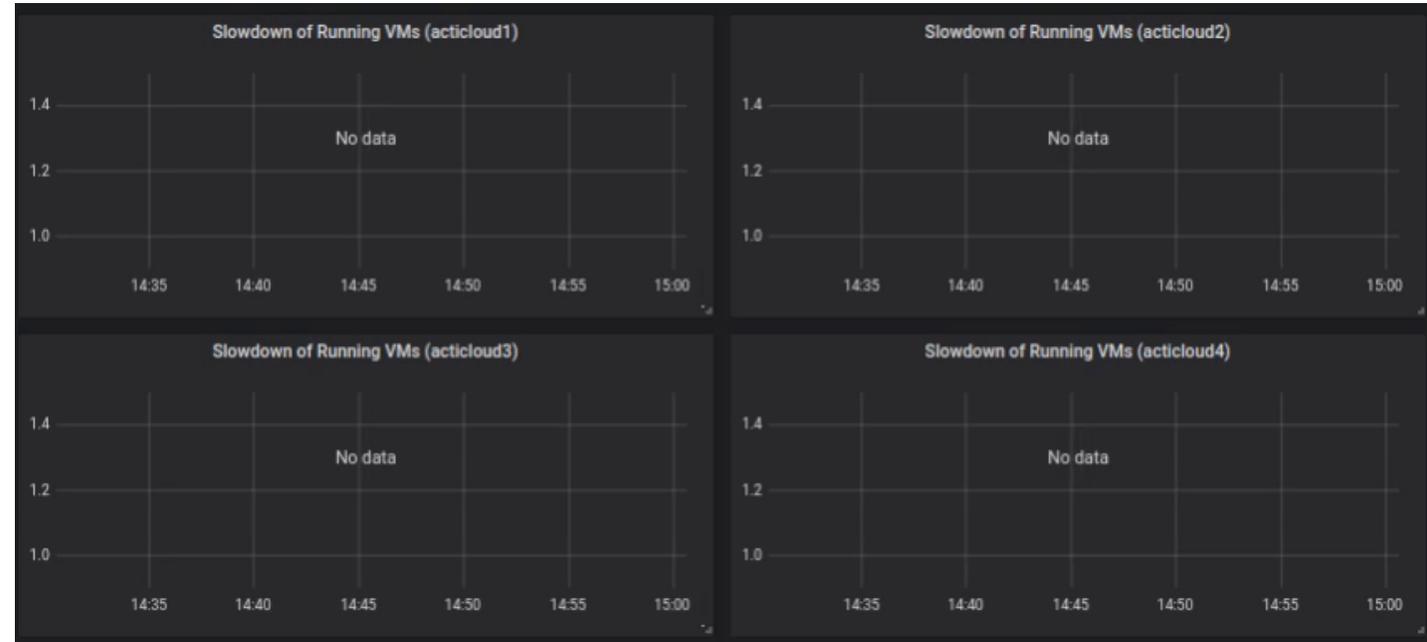
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## 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

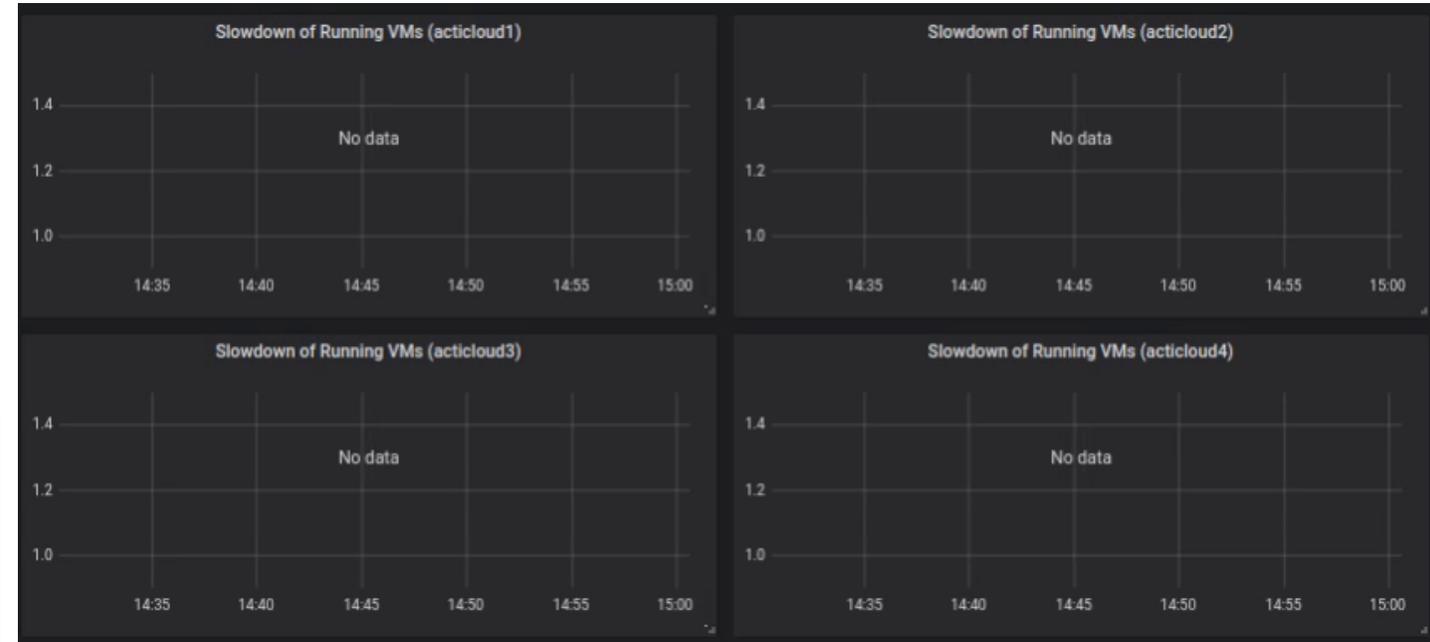
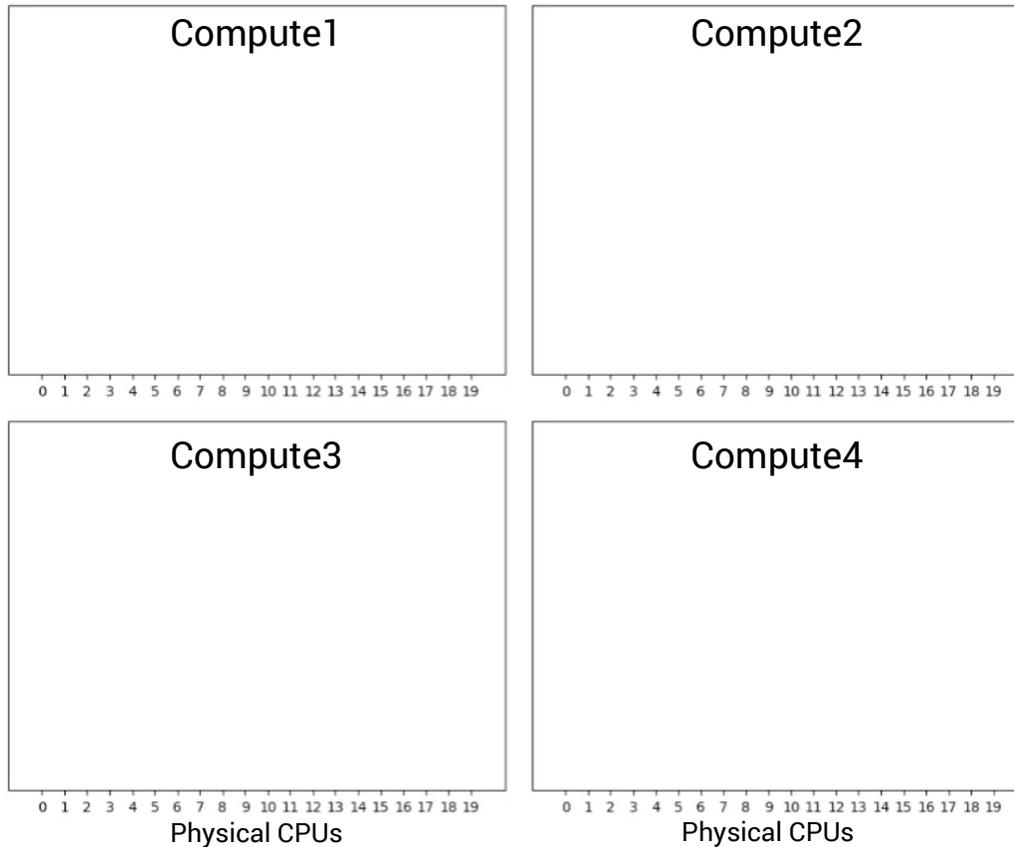
### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster

## Actual Slowdown of Gold VMs



### ACTiManager.External:

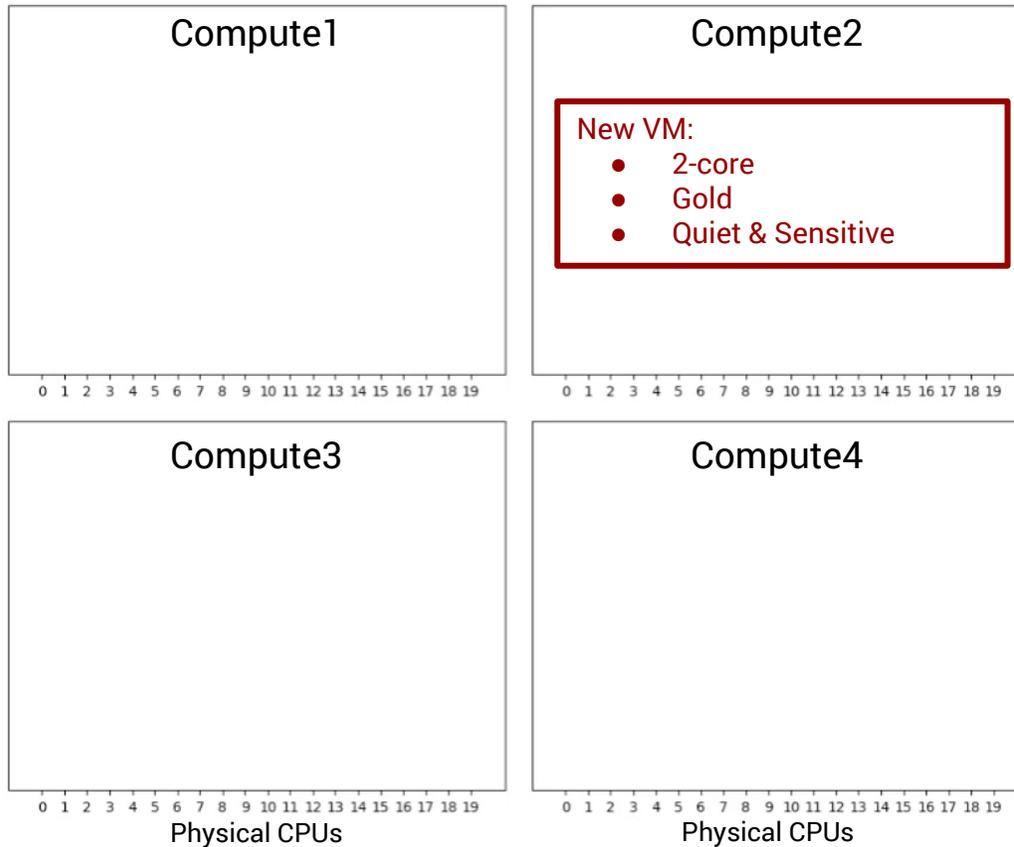
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

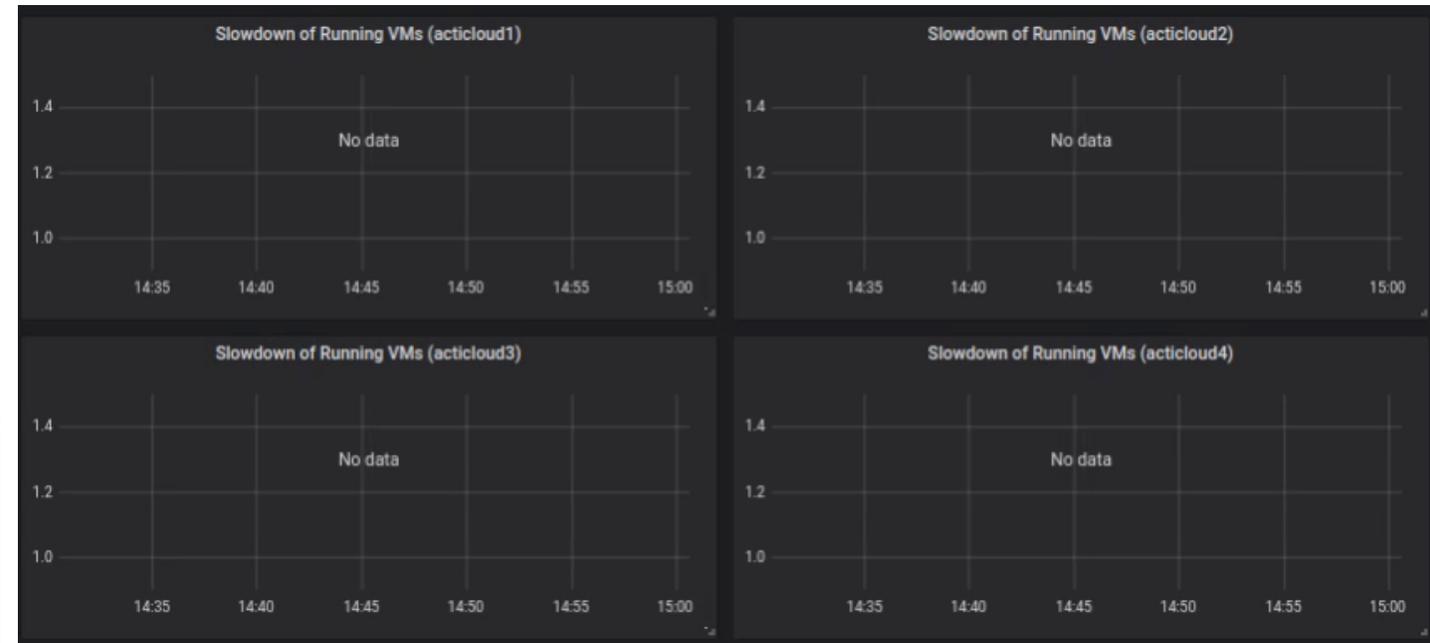
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

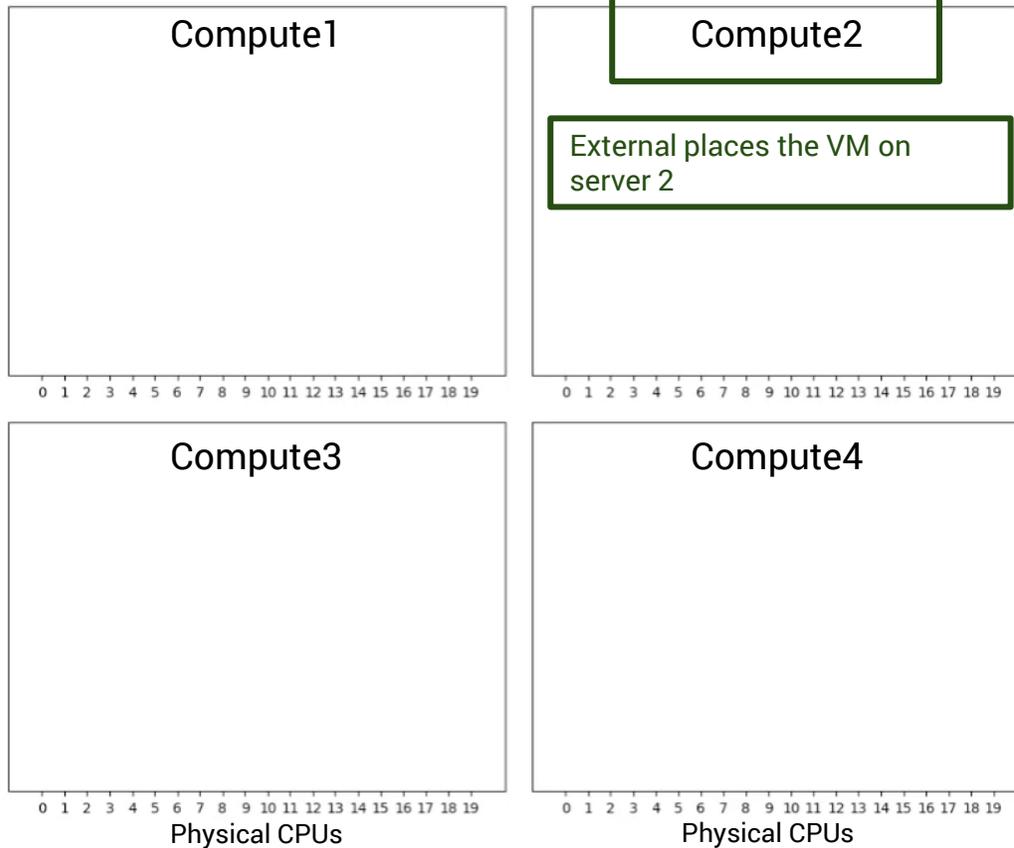
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

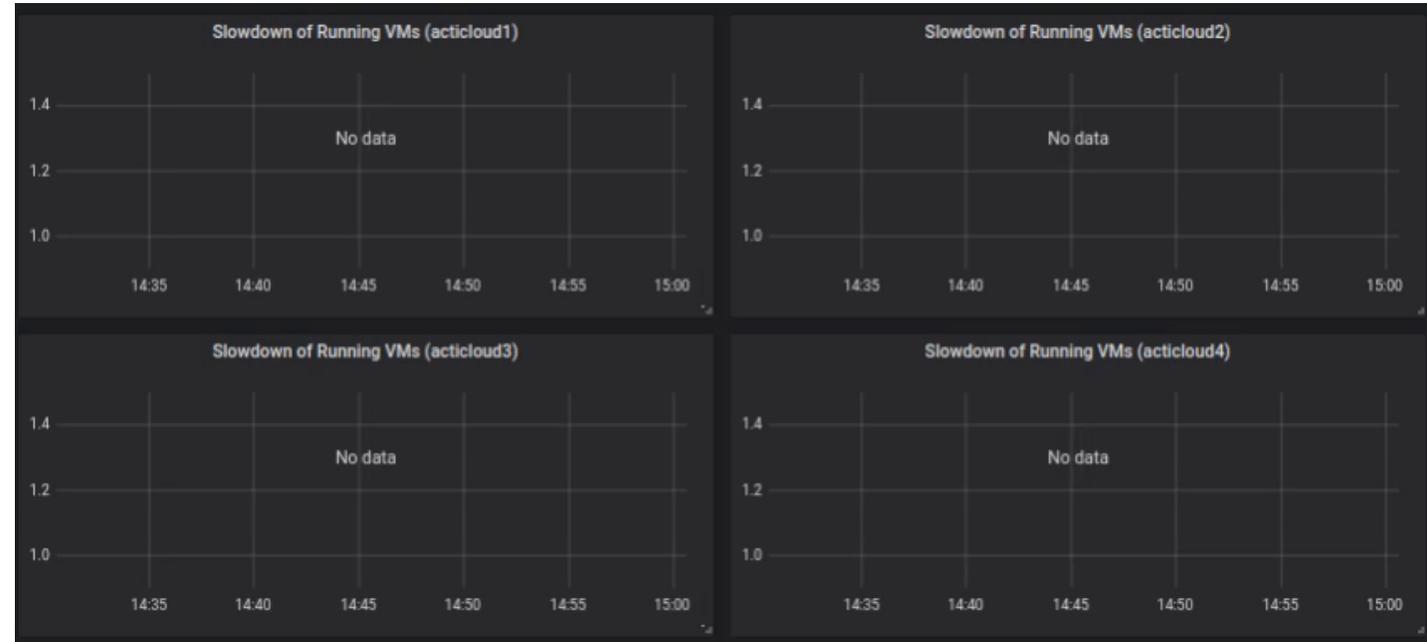
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

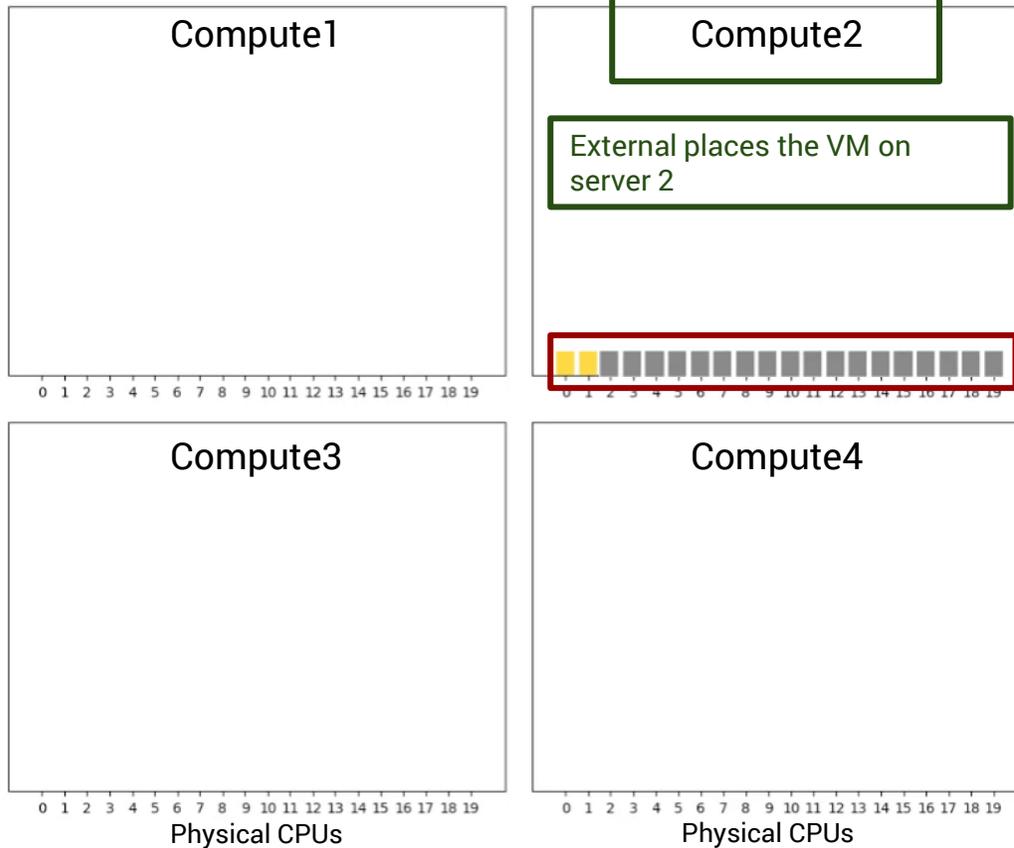
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

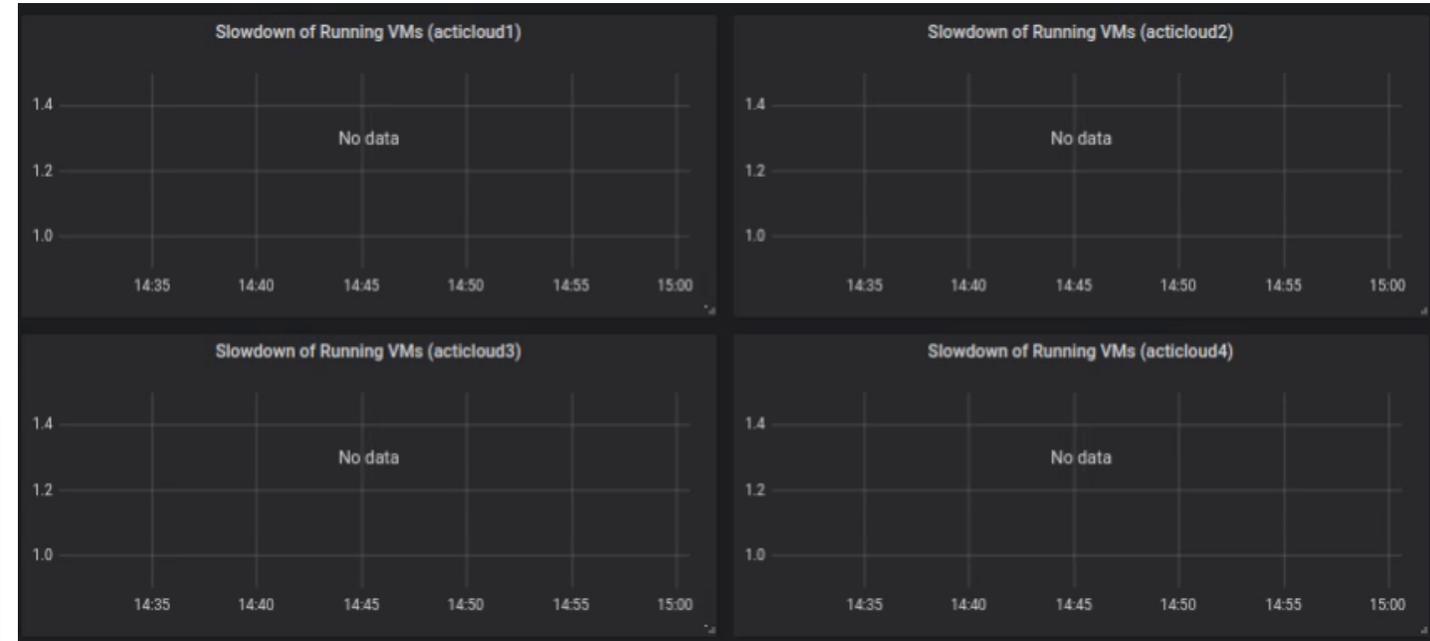
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

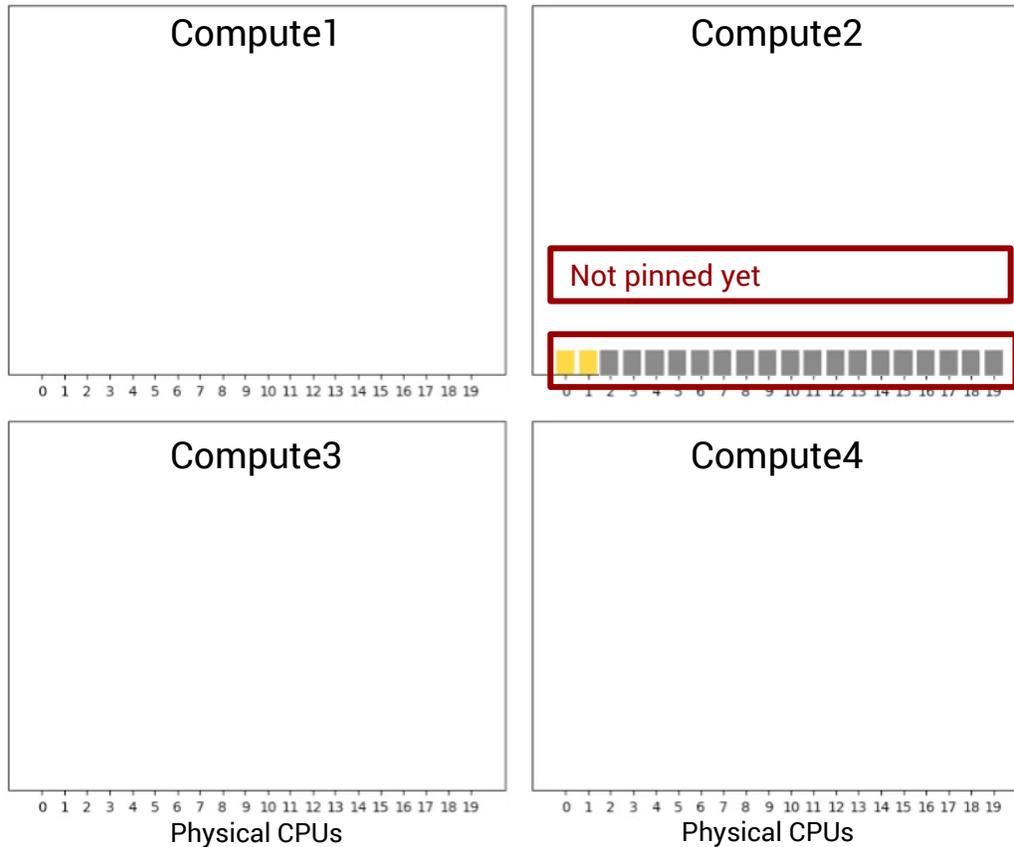
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

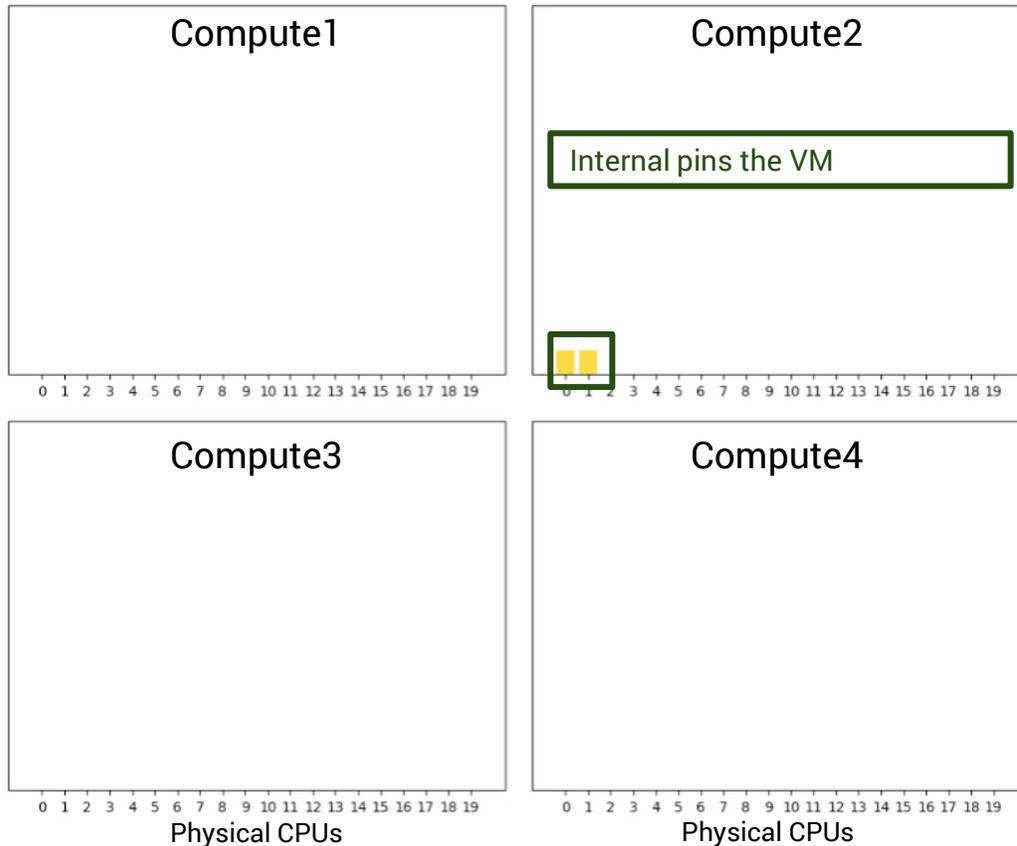
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

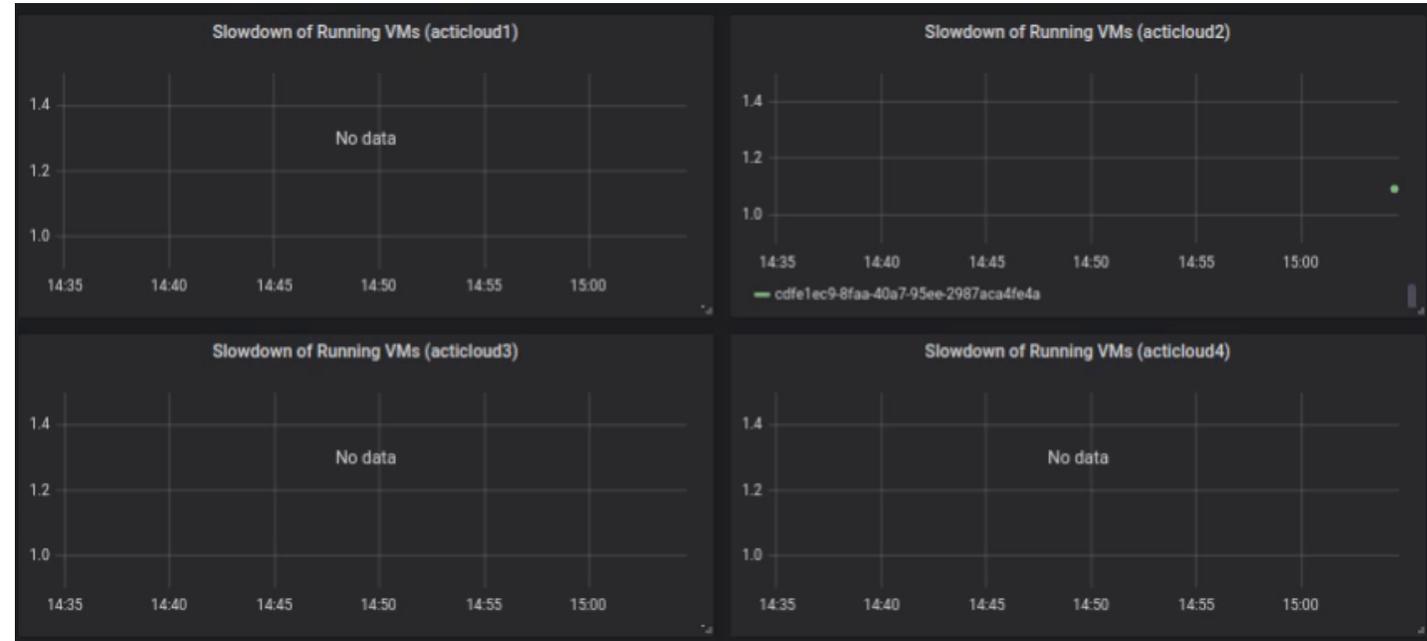
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

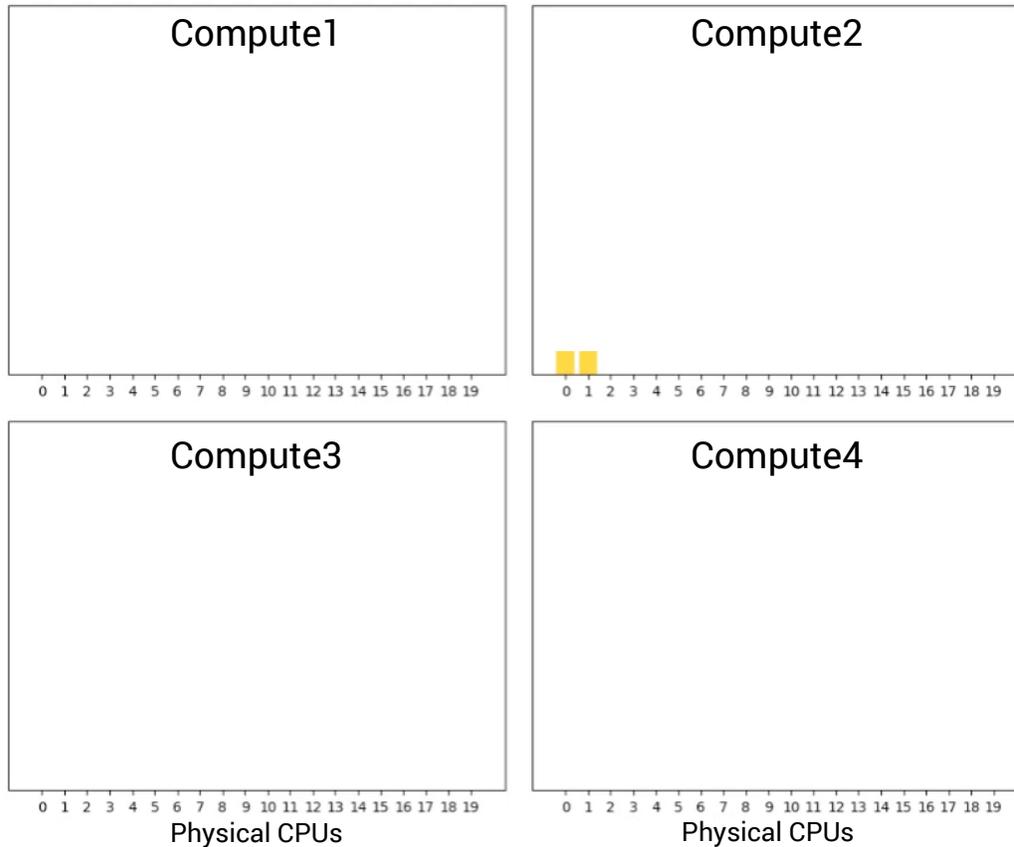
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

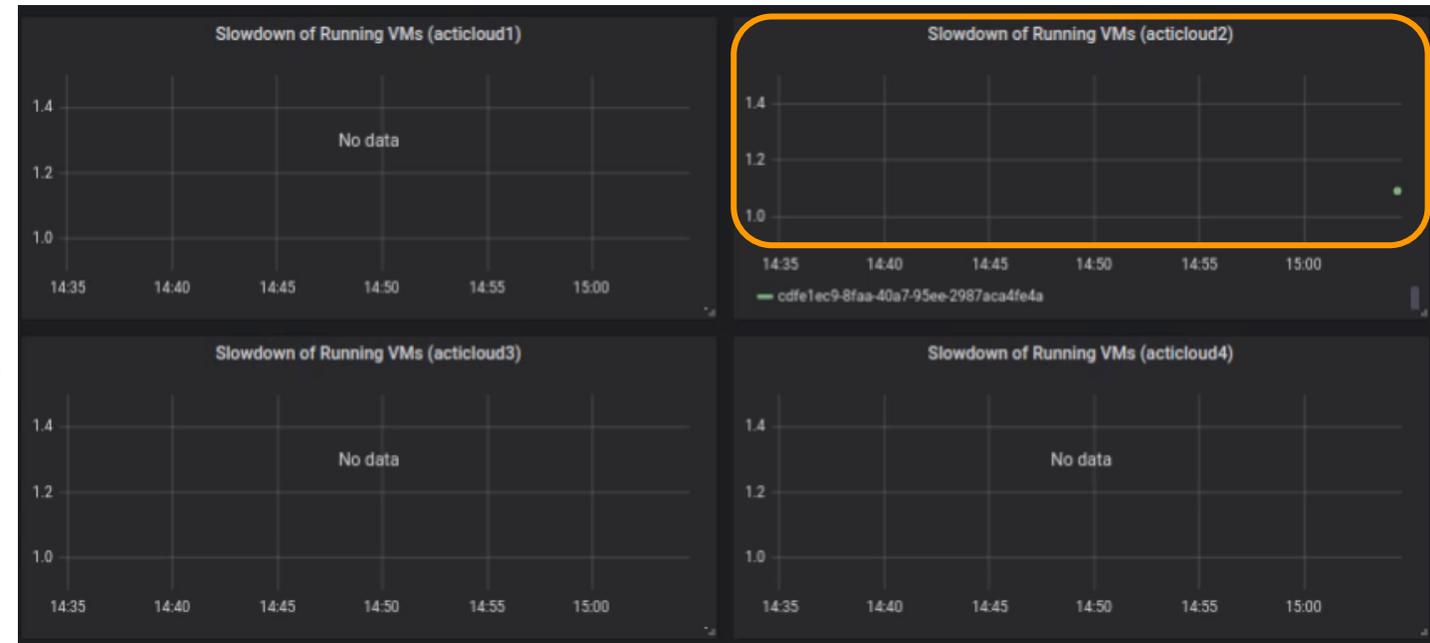
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

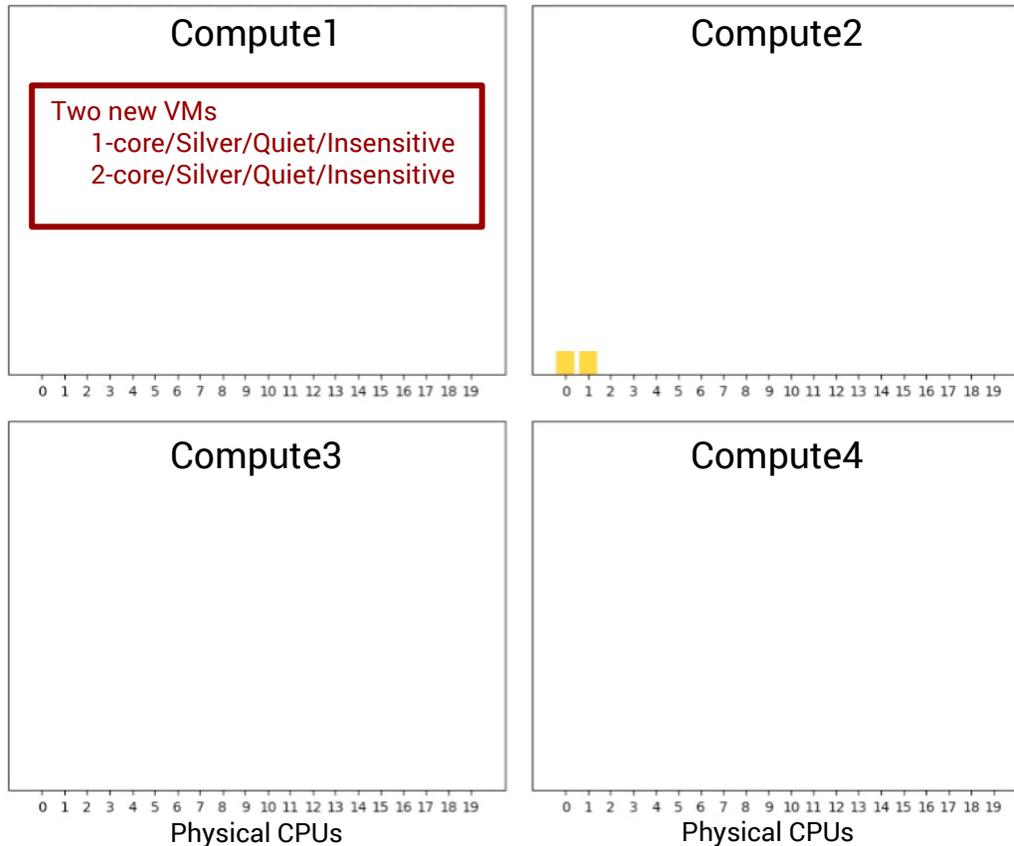
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

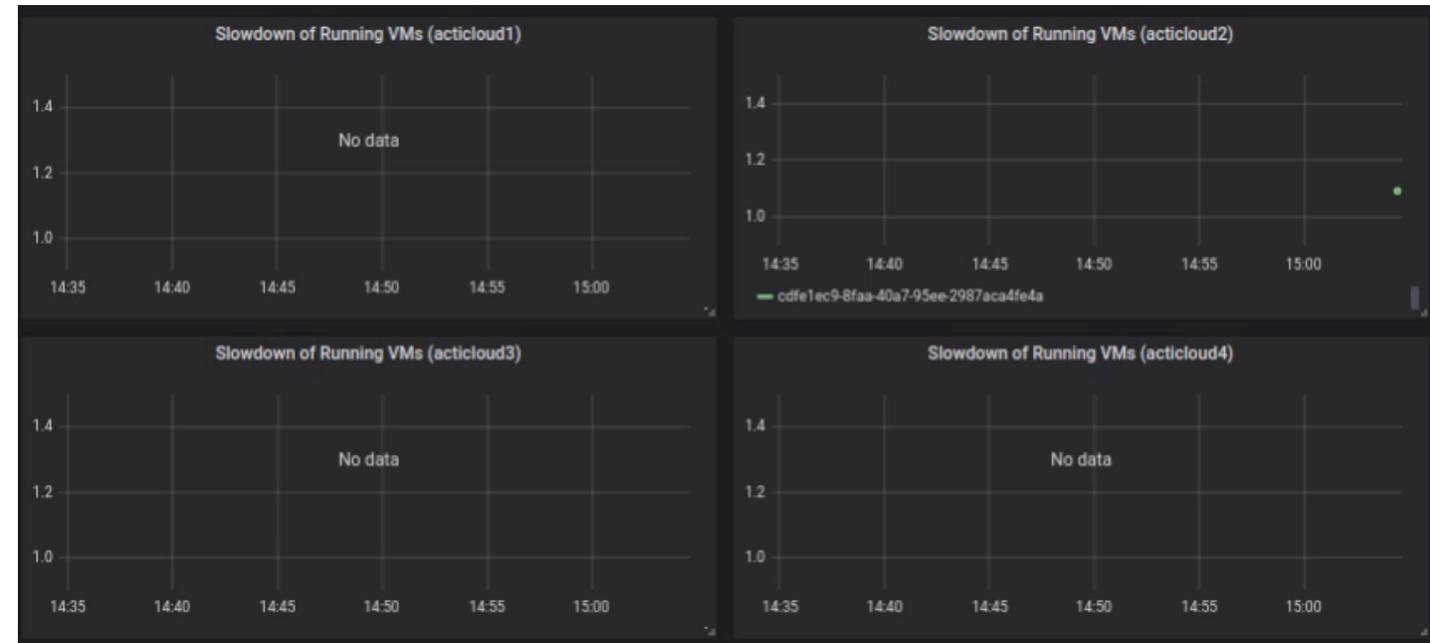
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

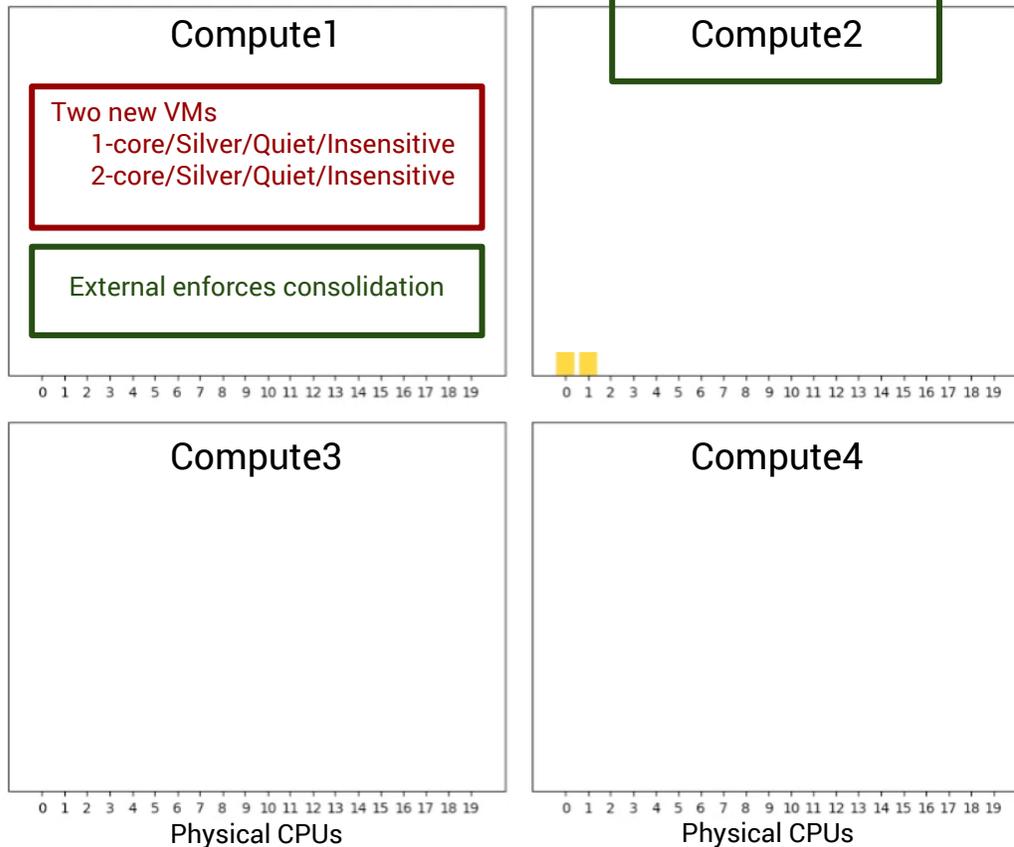
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

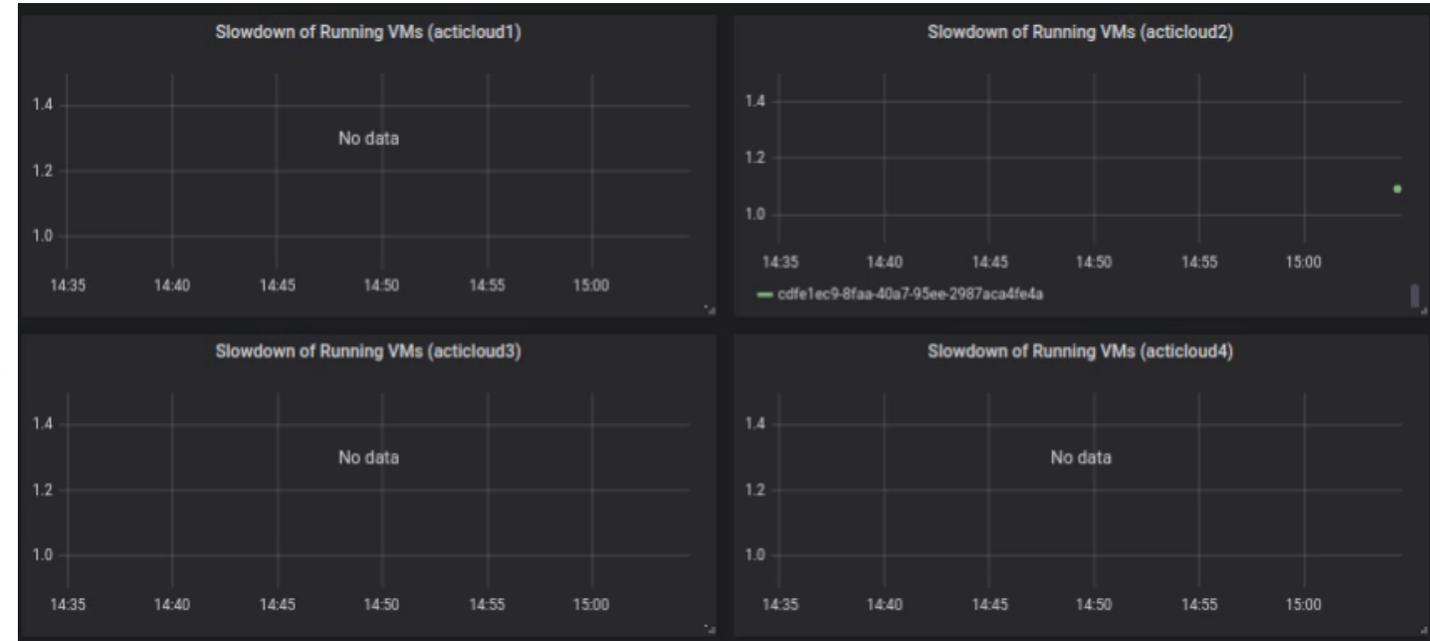
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

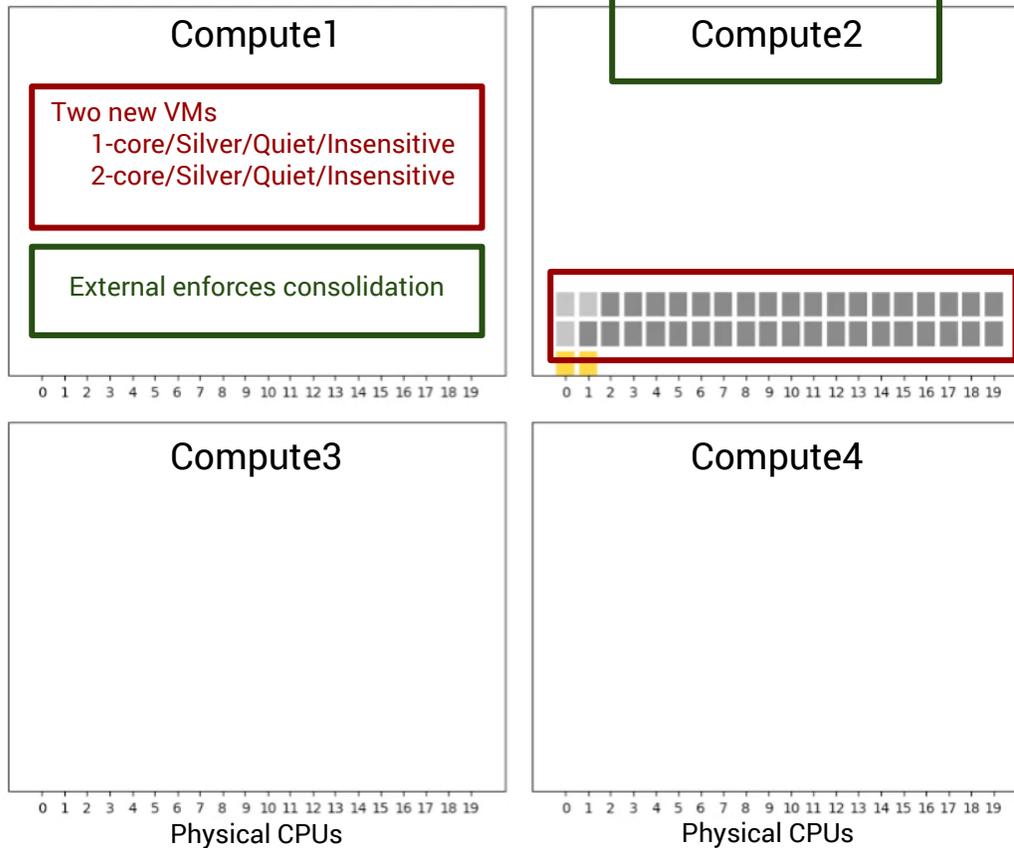
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

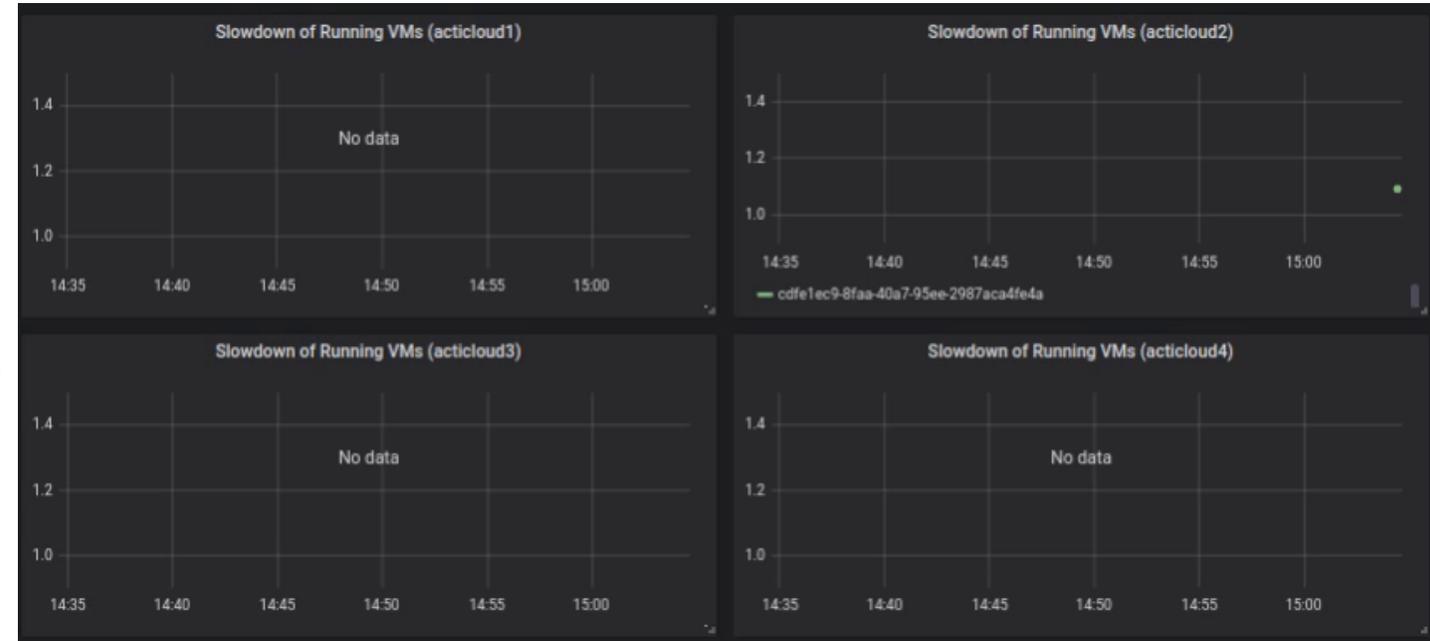
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

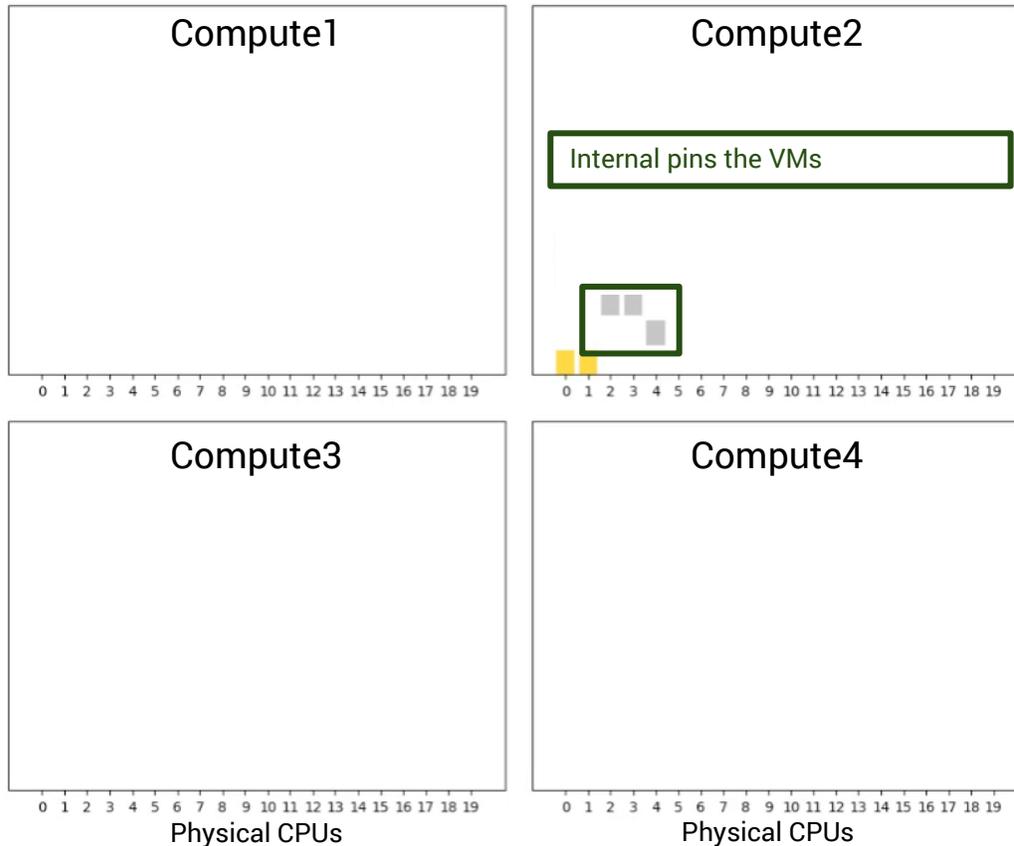
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

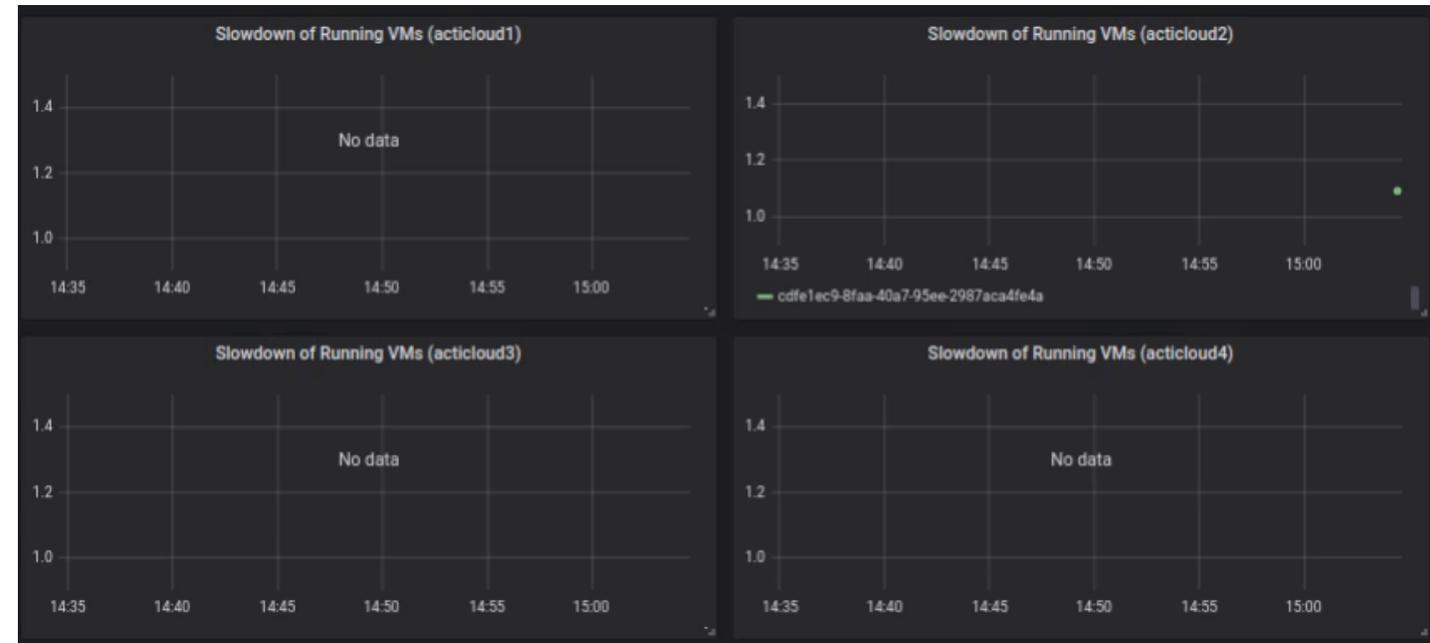
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

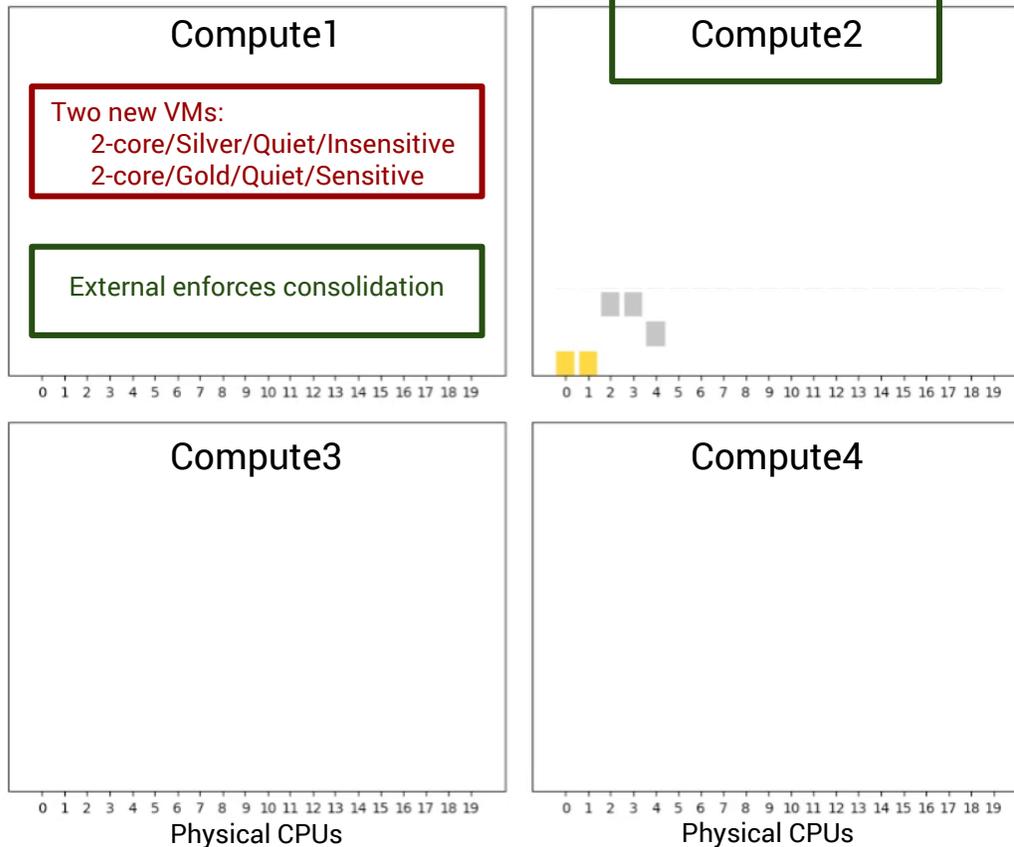
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

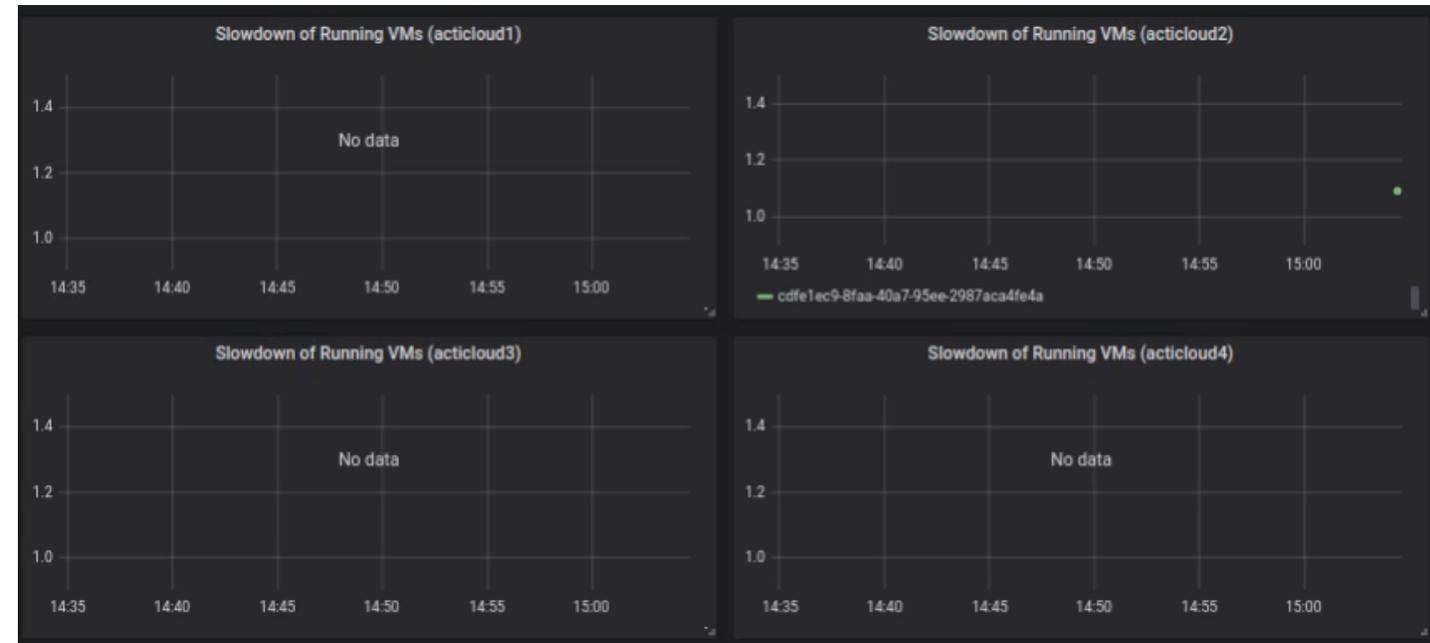
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

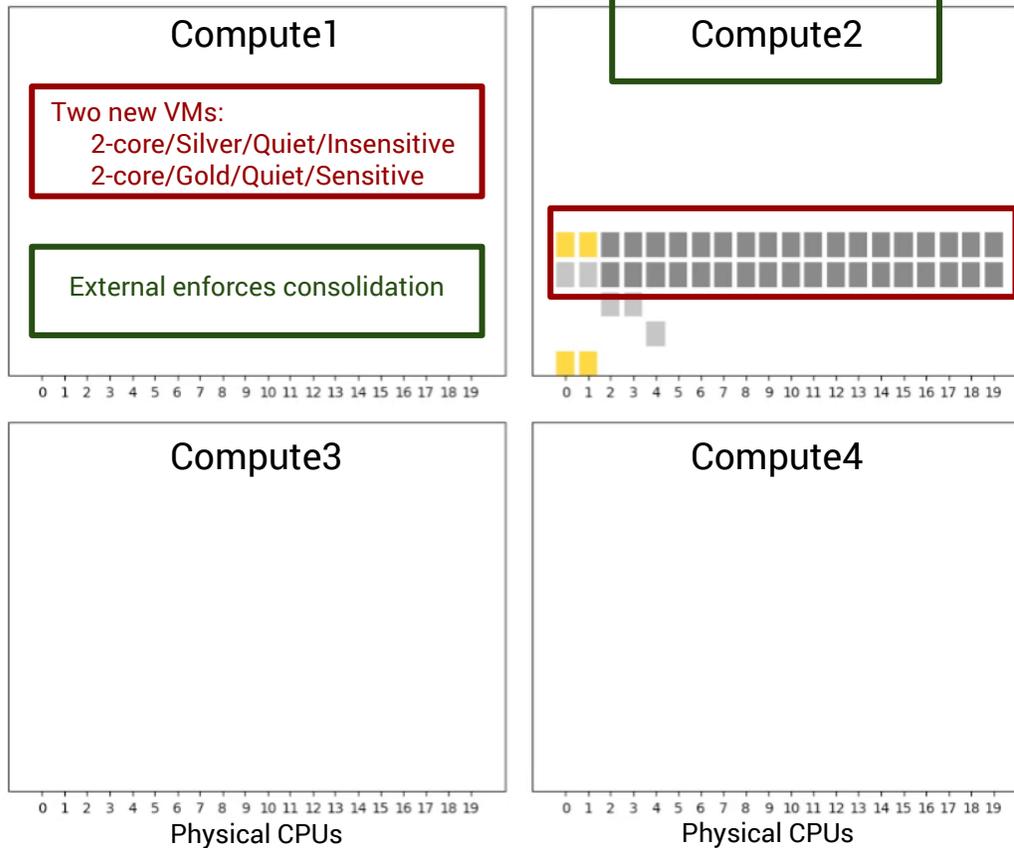
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

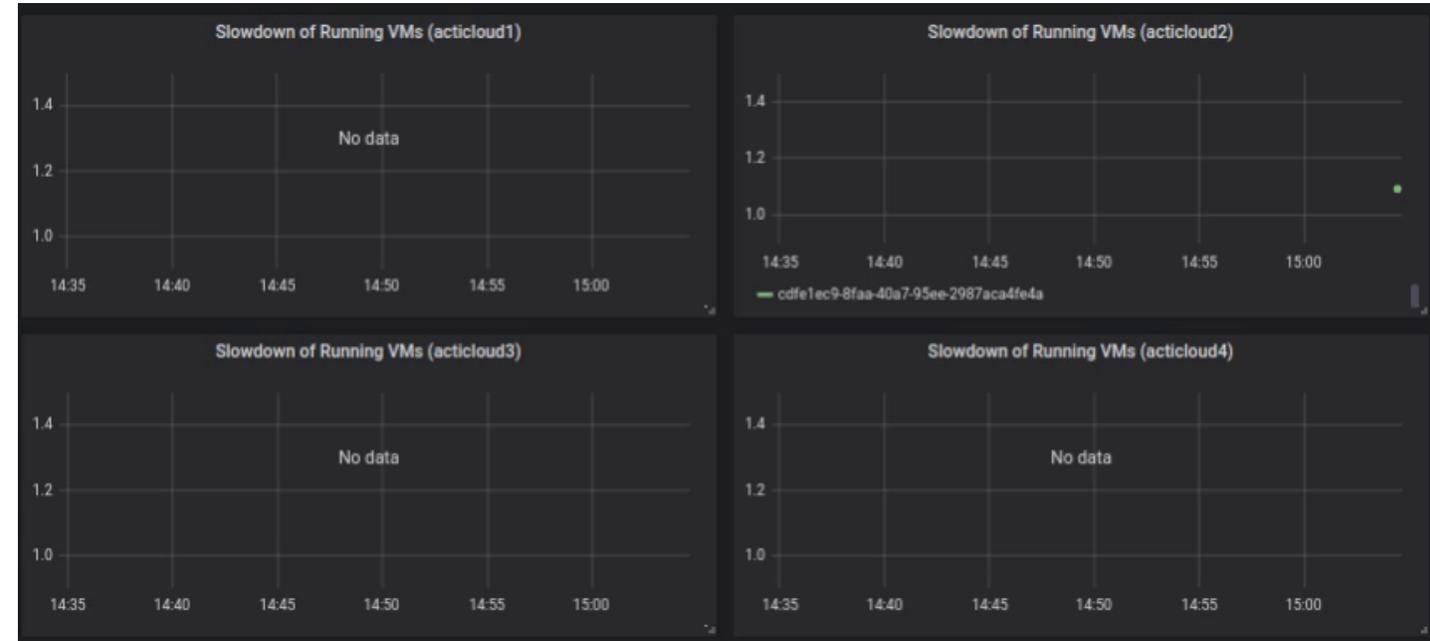
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

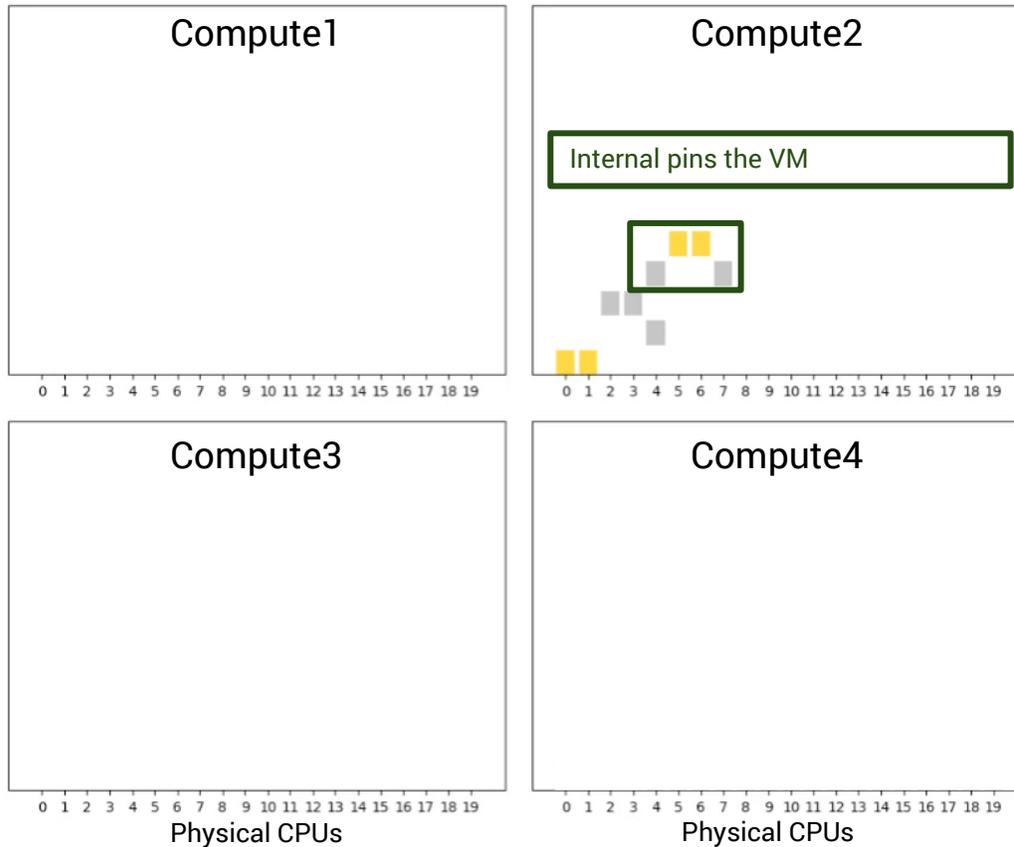
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

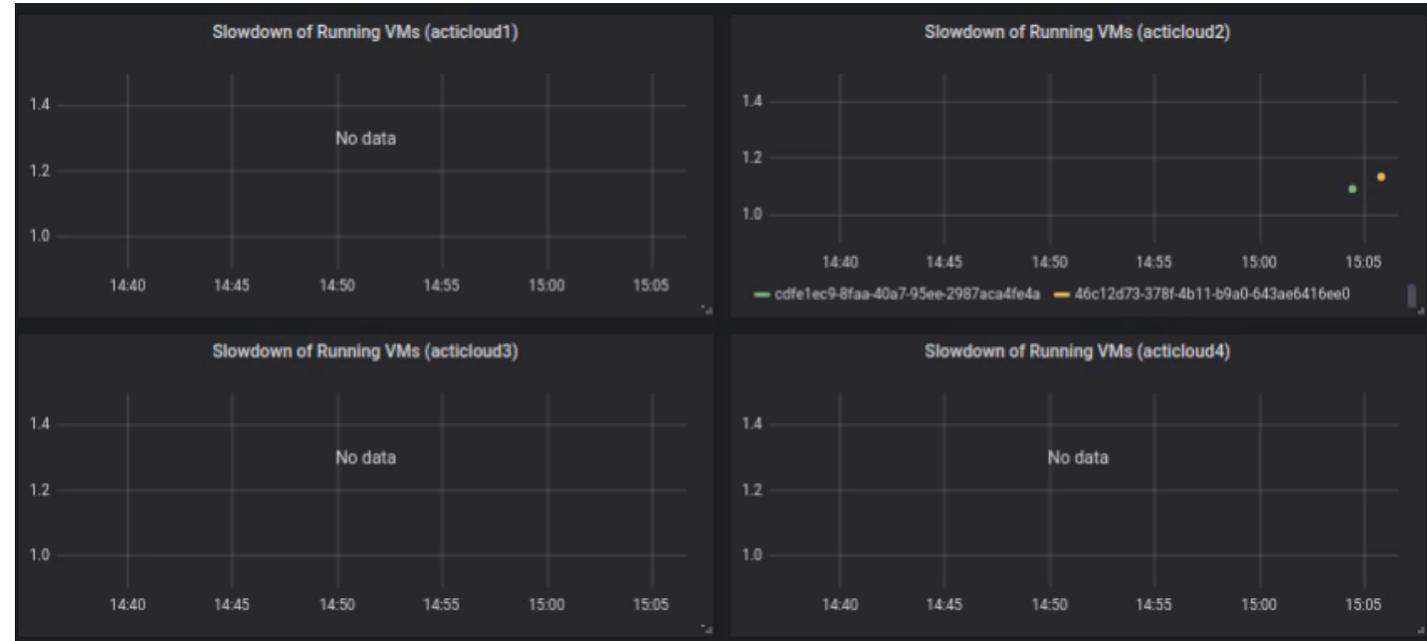
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

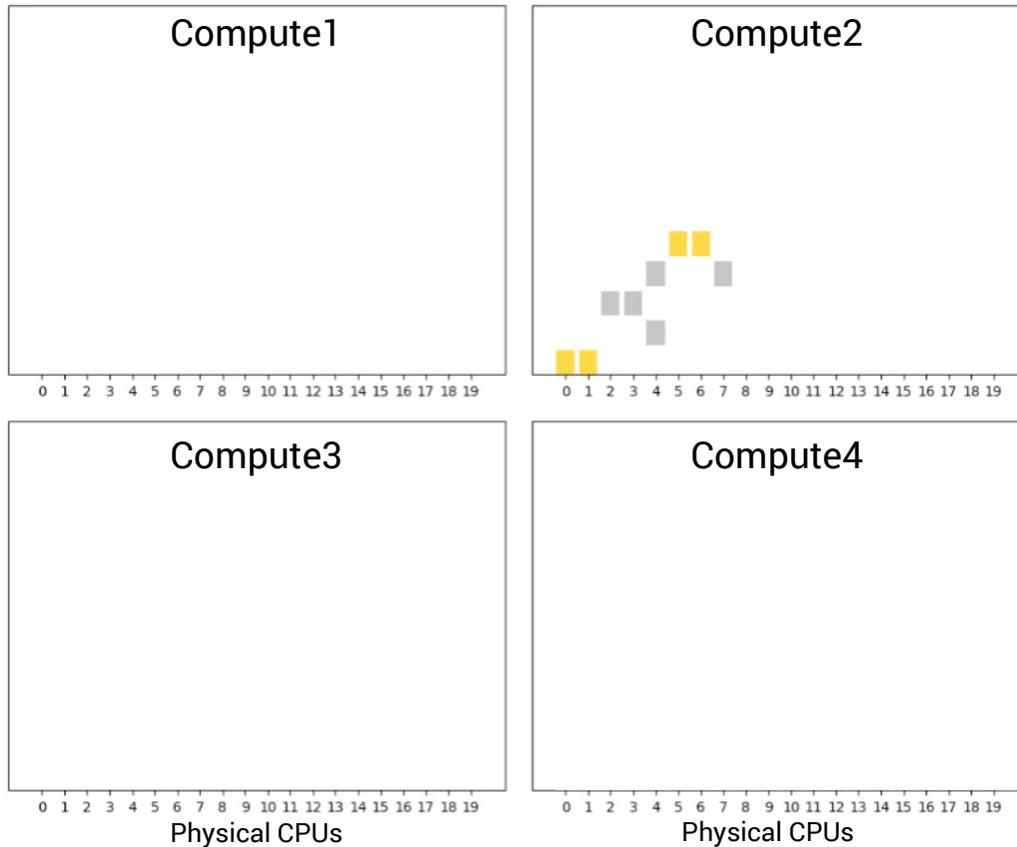
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

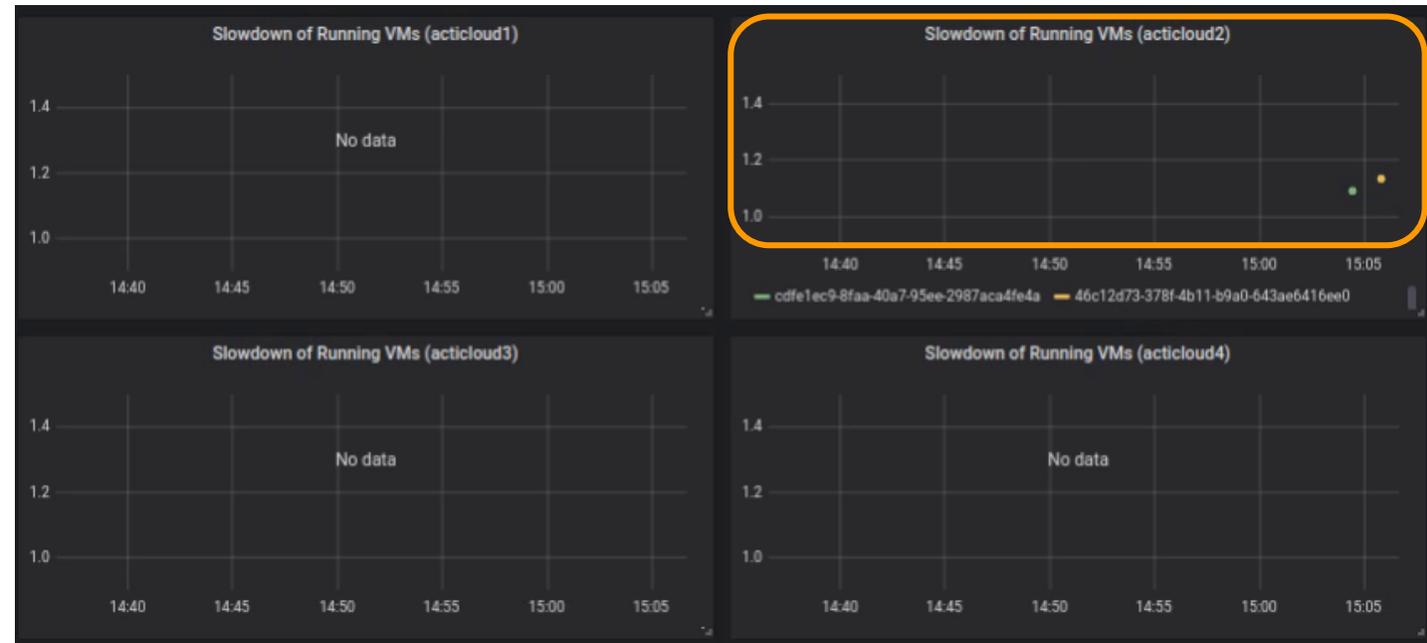
- Pins the VMs' virtual cpus to servers' physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

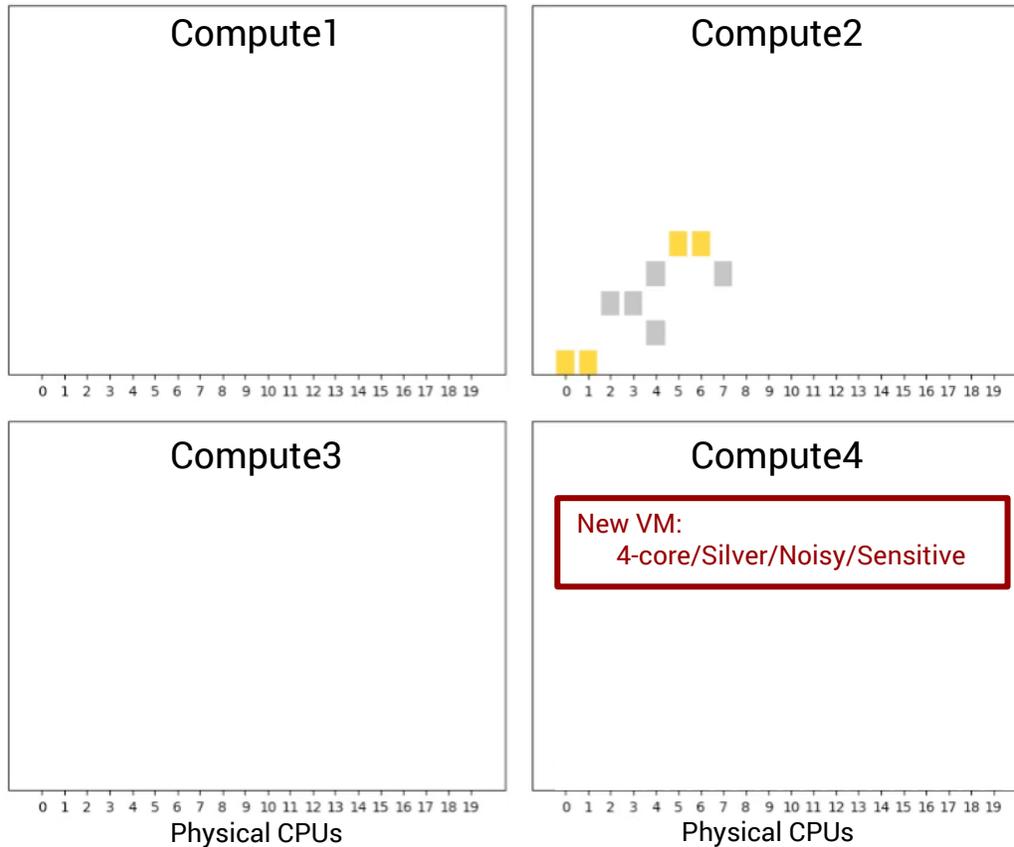
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

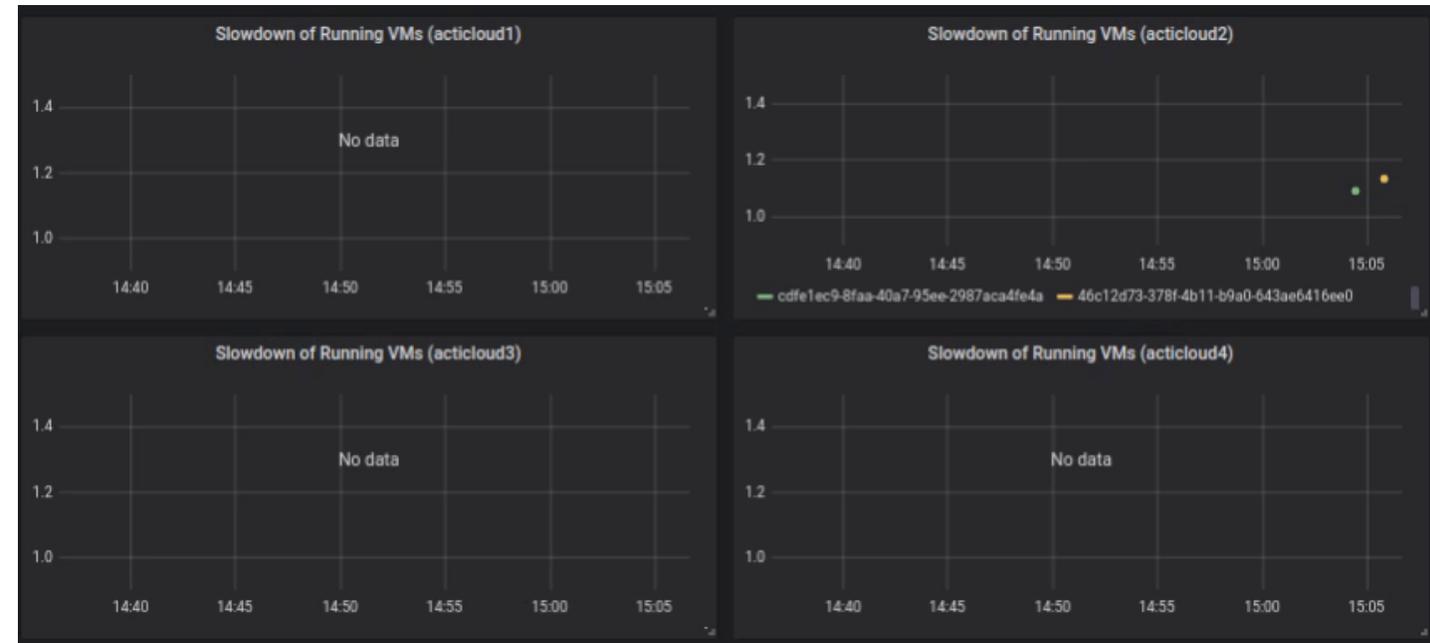
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

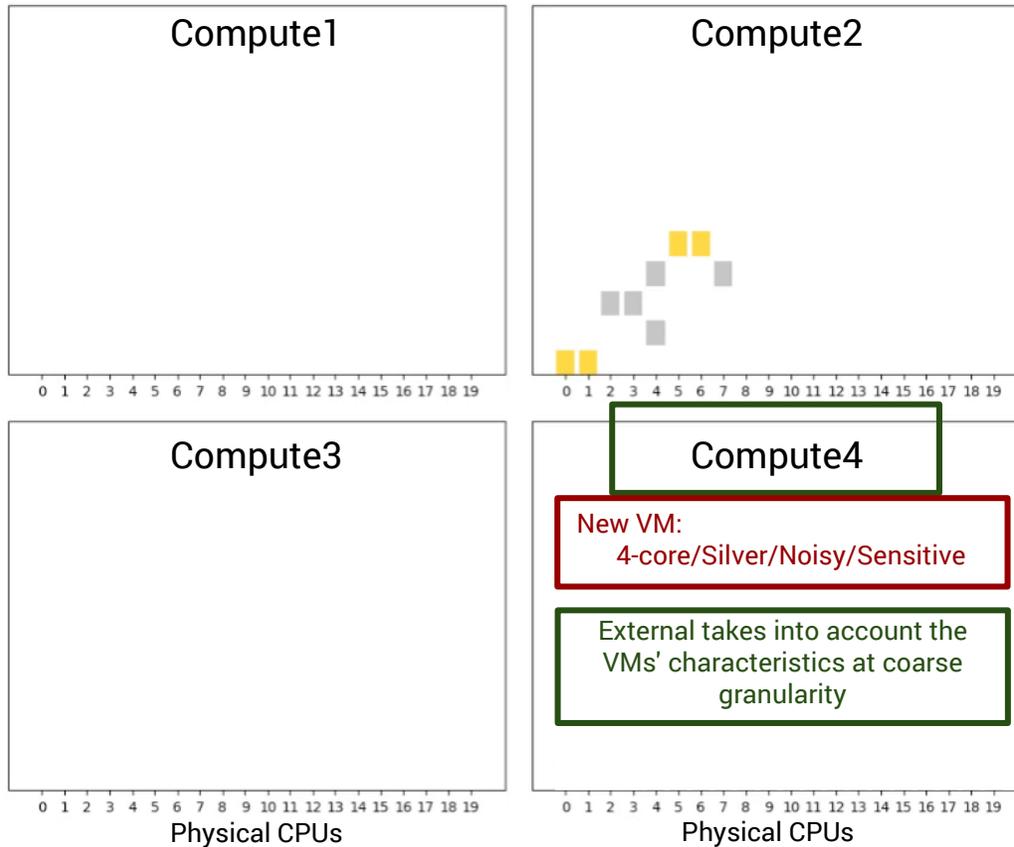
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

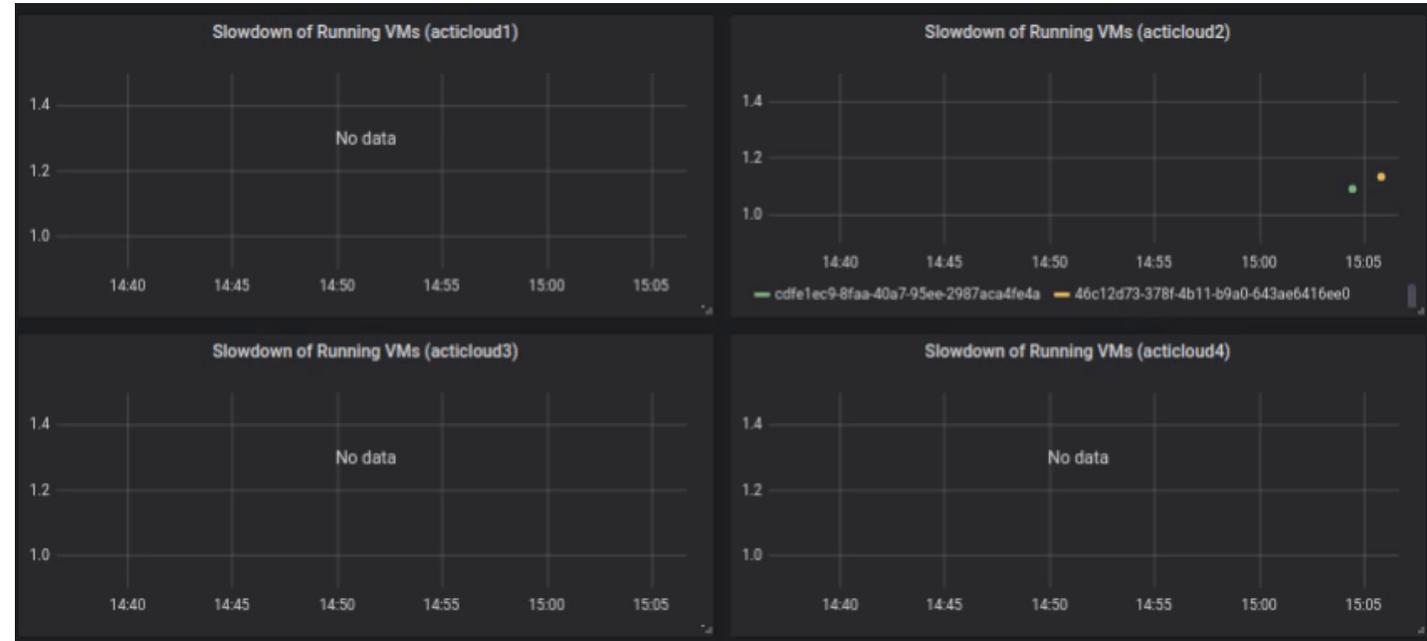
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

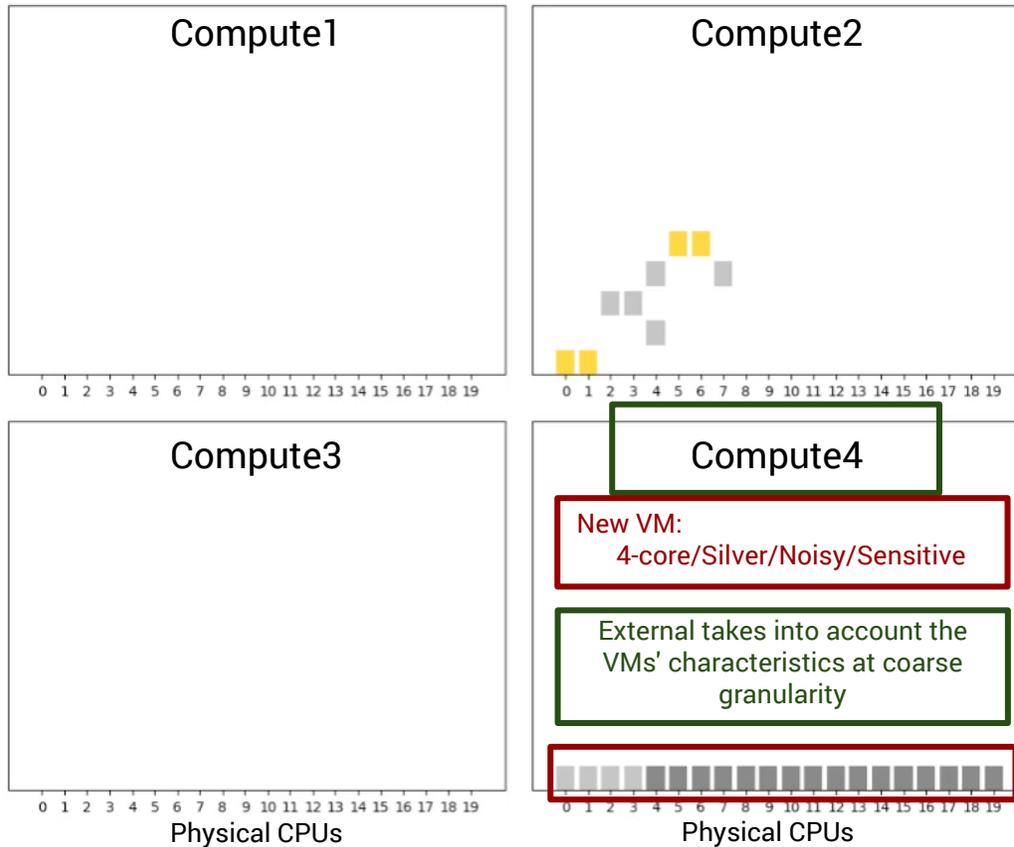
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster

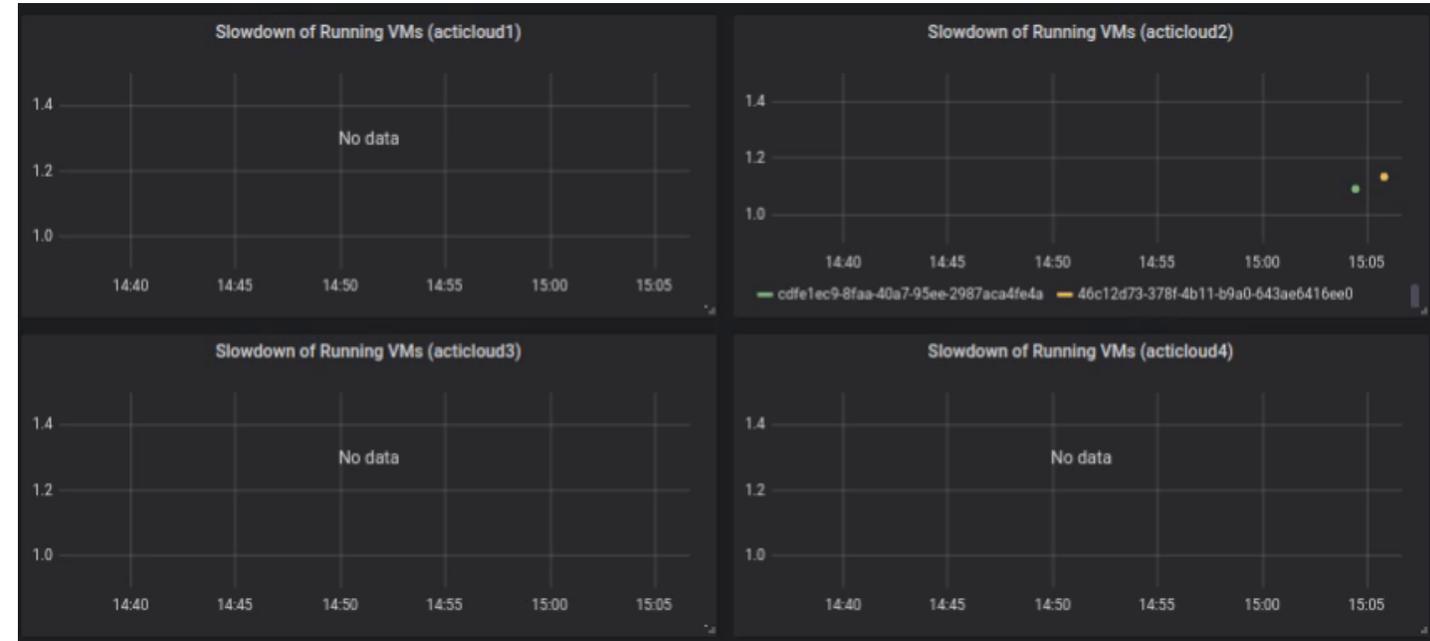


New VM:  
4-core/Silver/Noisy/Sensitive

External takes into account the  
VMs' characteristics at coarse  
granularity



## Actual Slowdown of Gold VMs



### ACTiManager.External:

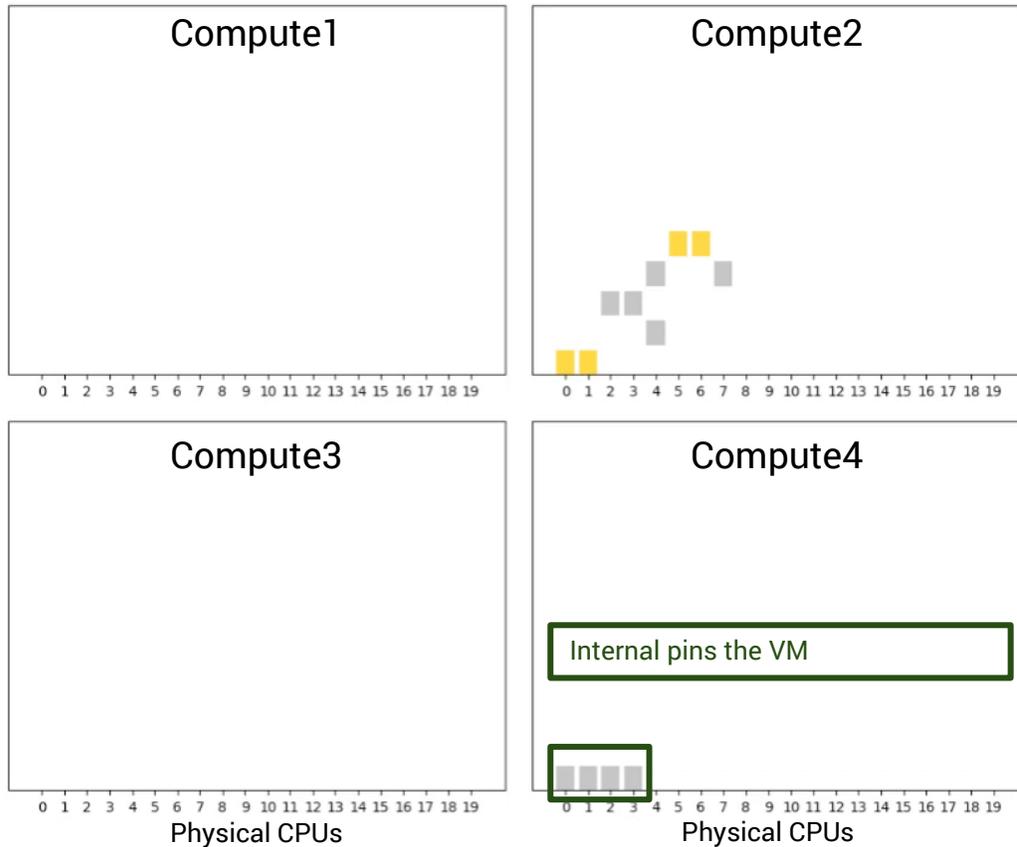
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

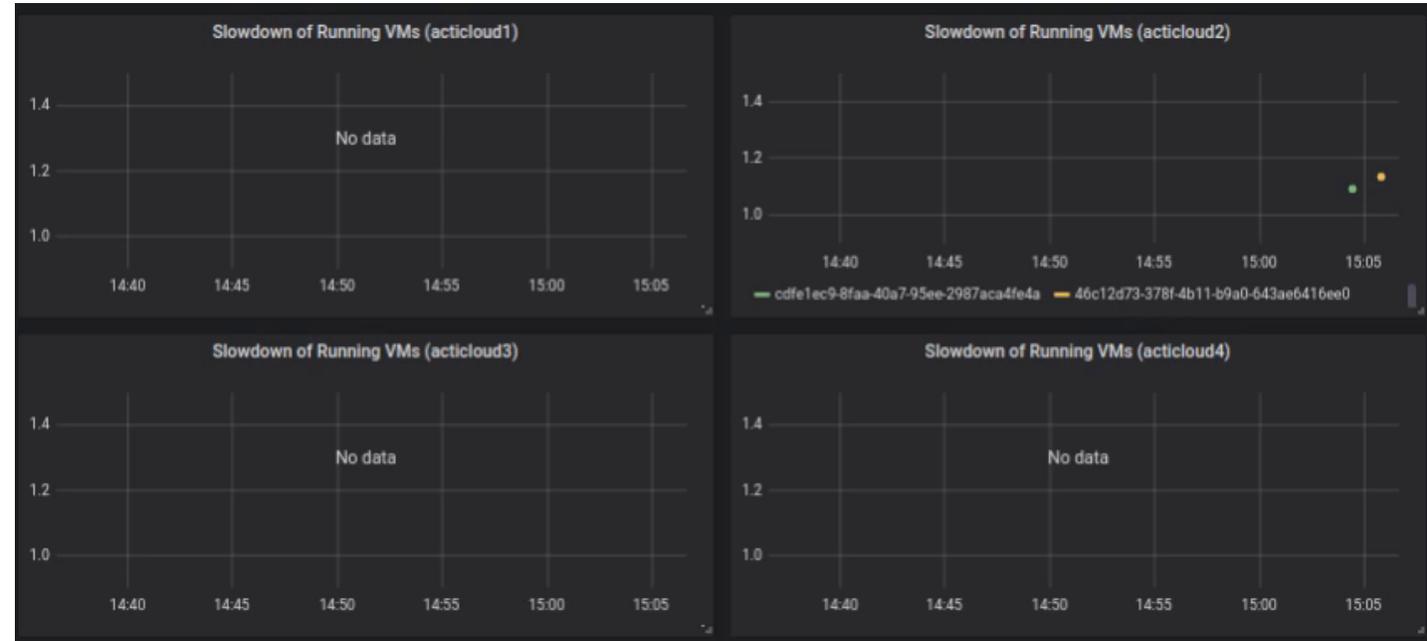
- Pins the VMs' virtual cpus to servers' physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

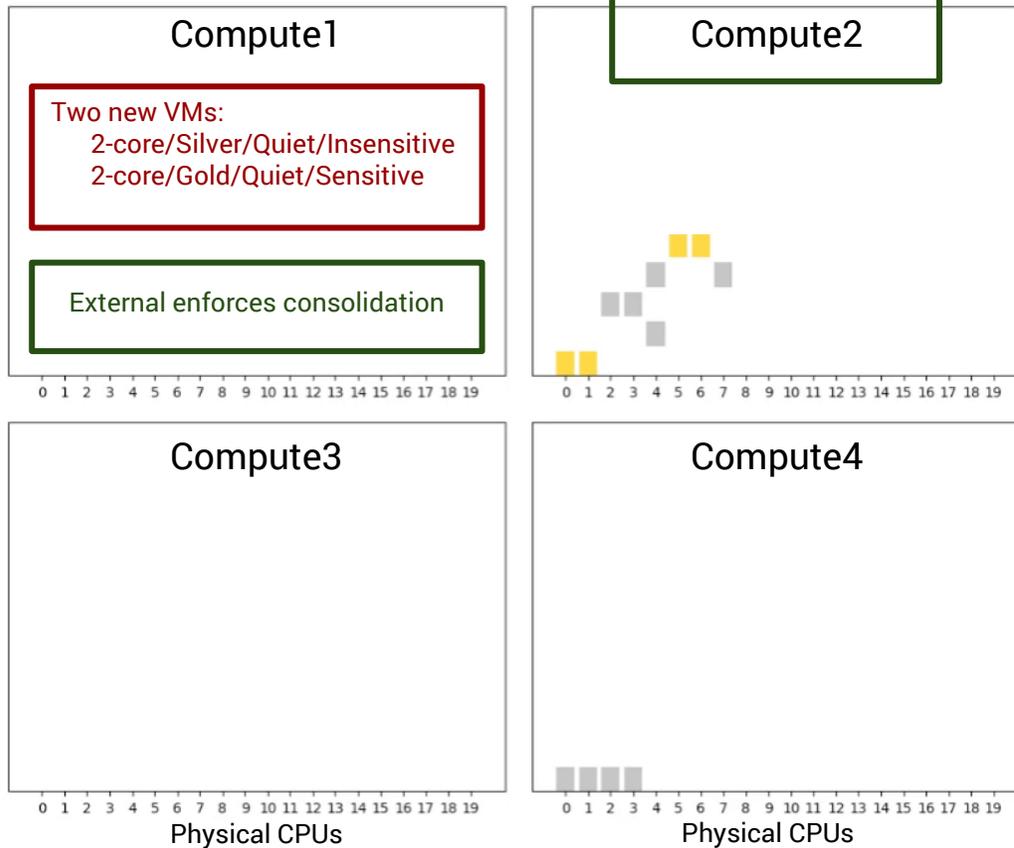
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

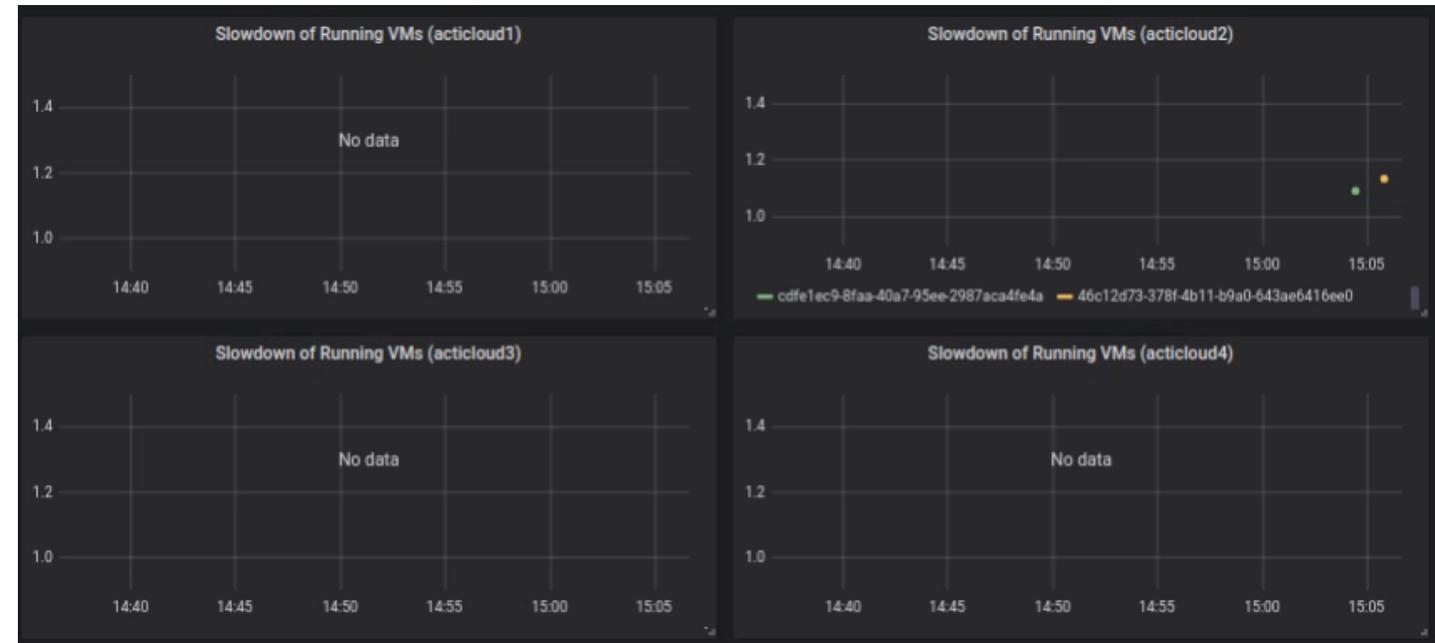
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

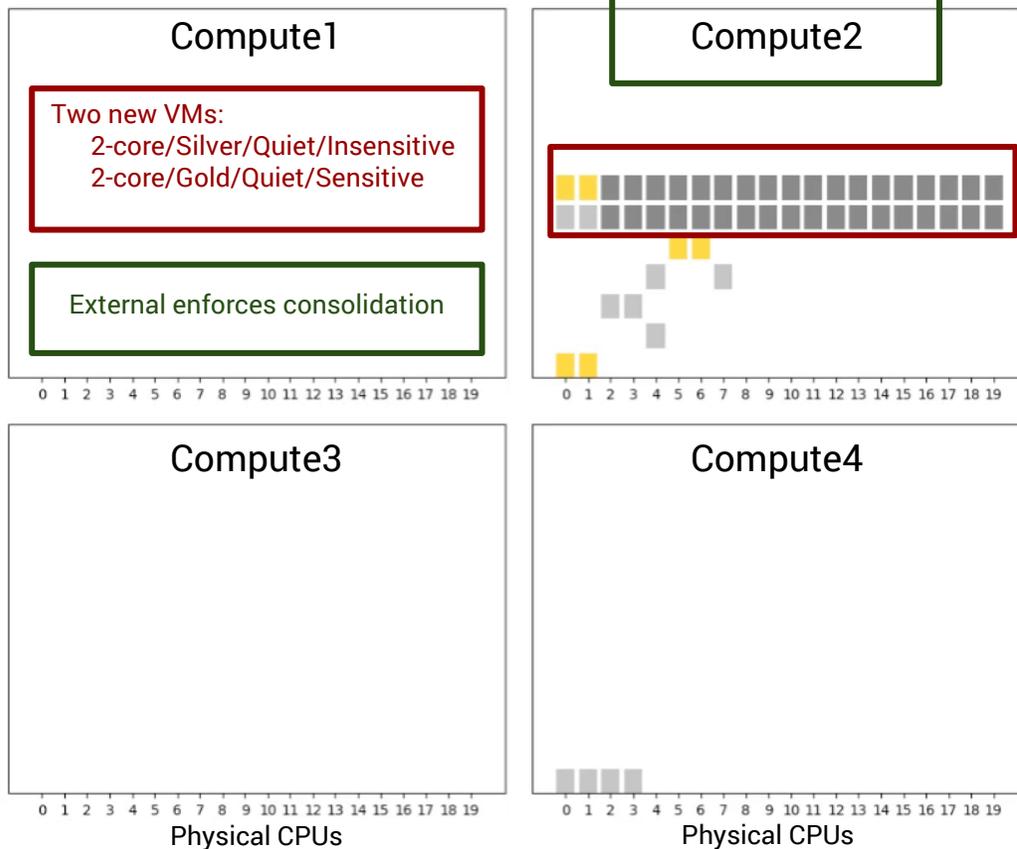
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

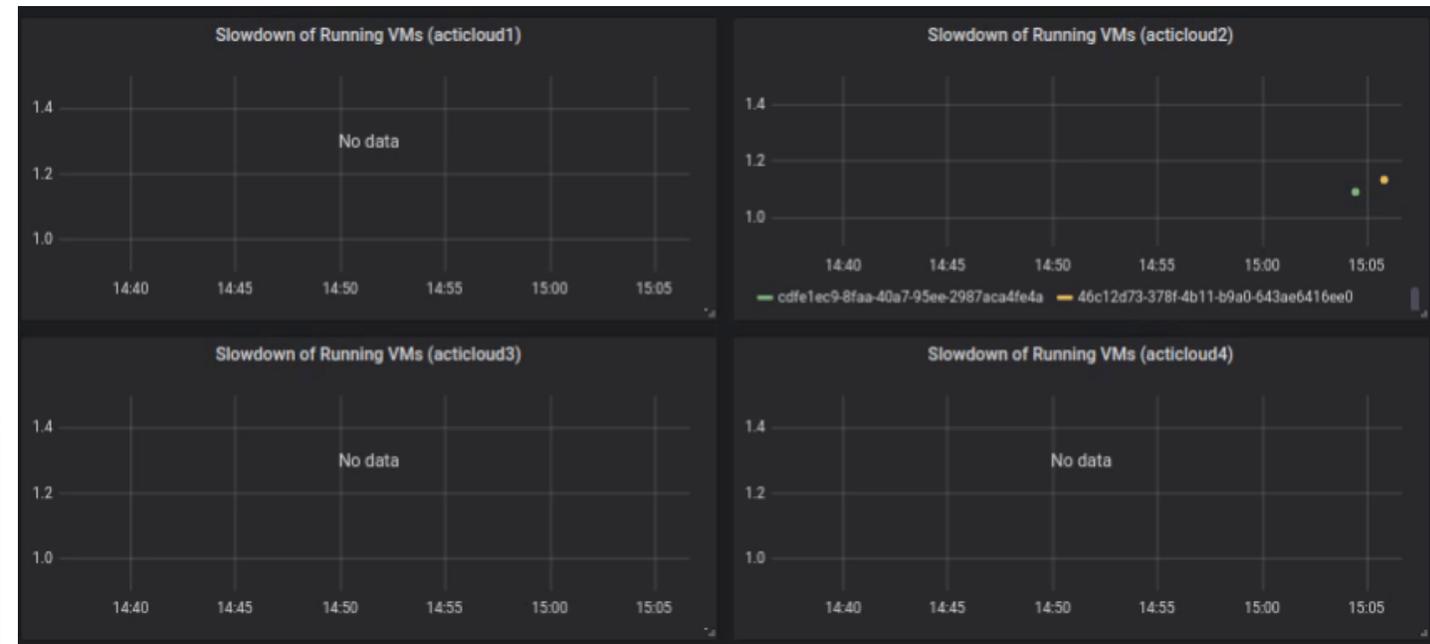
- Pins the VMs' virtual cpus to servers' physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

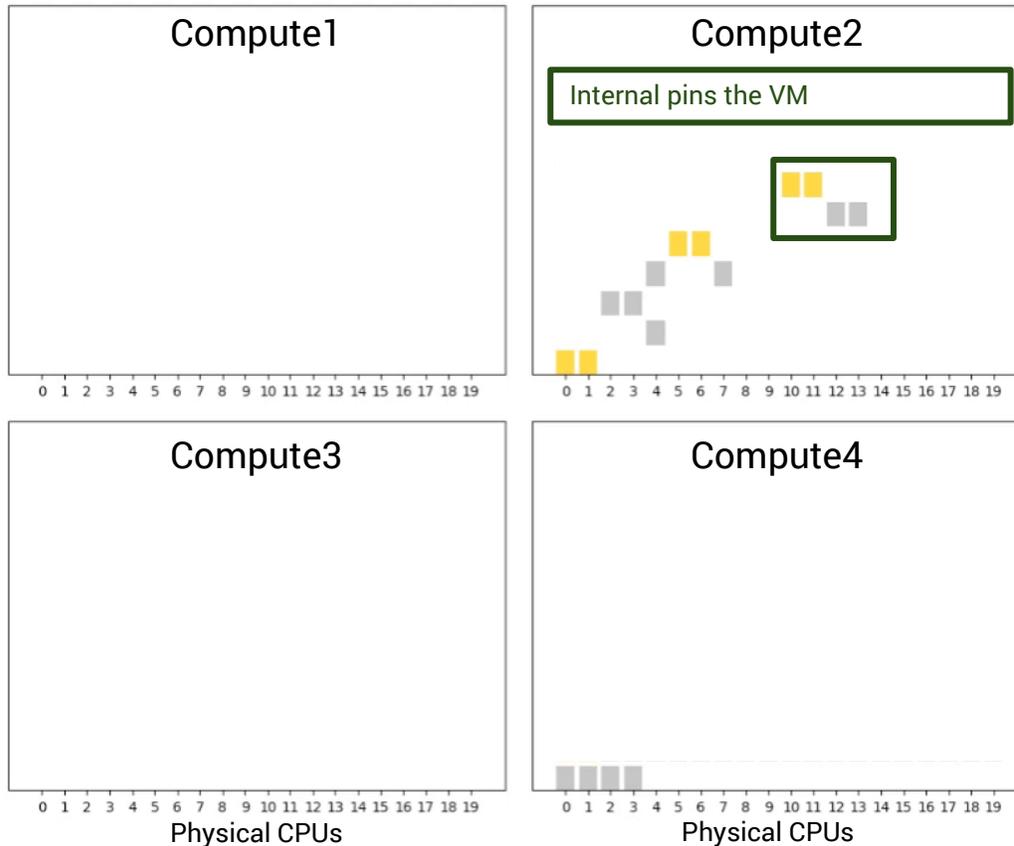
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

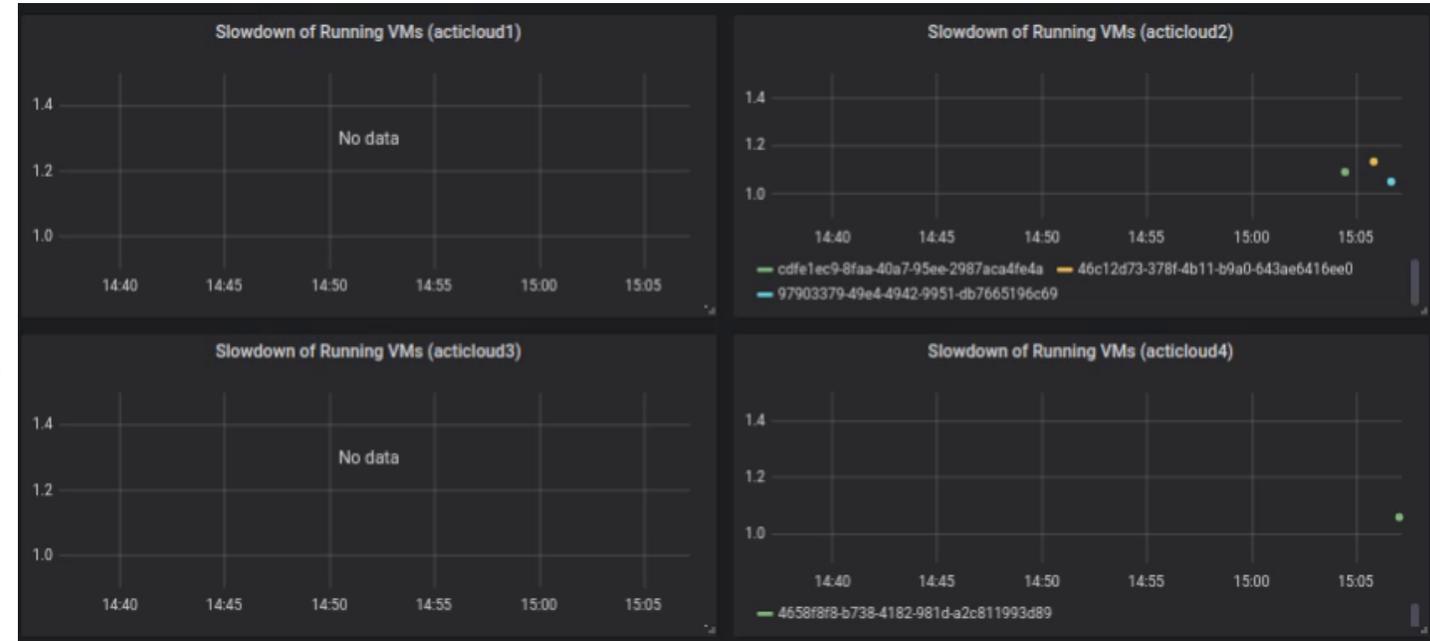
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

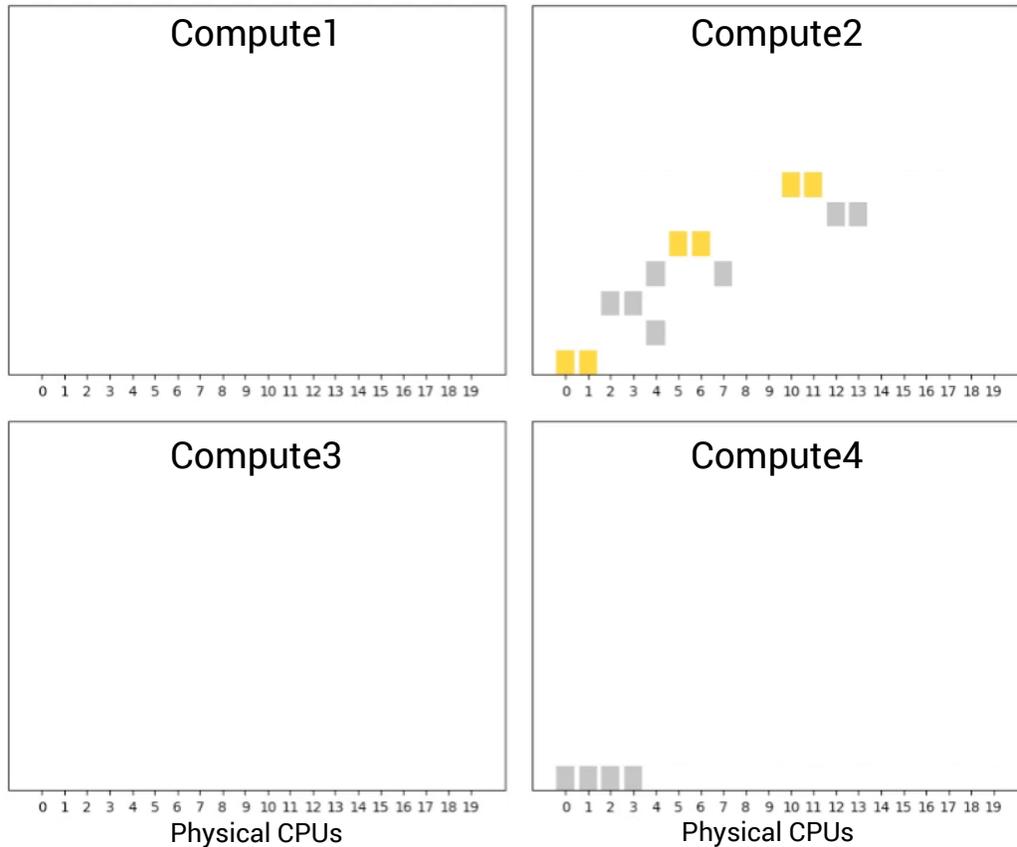
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

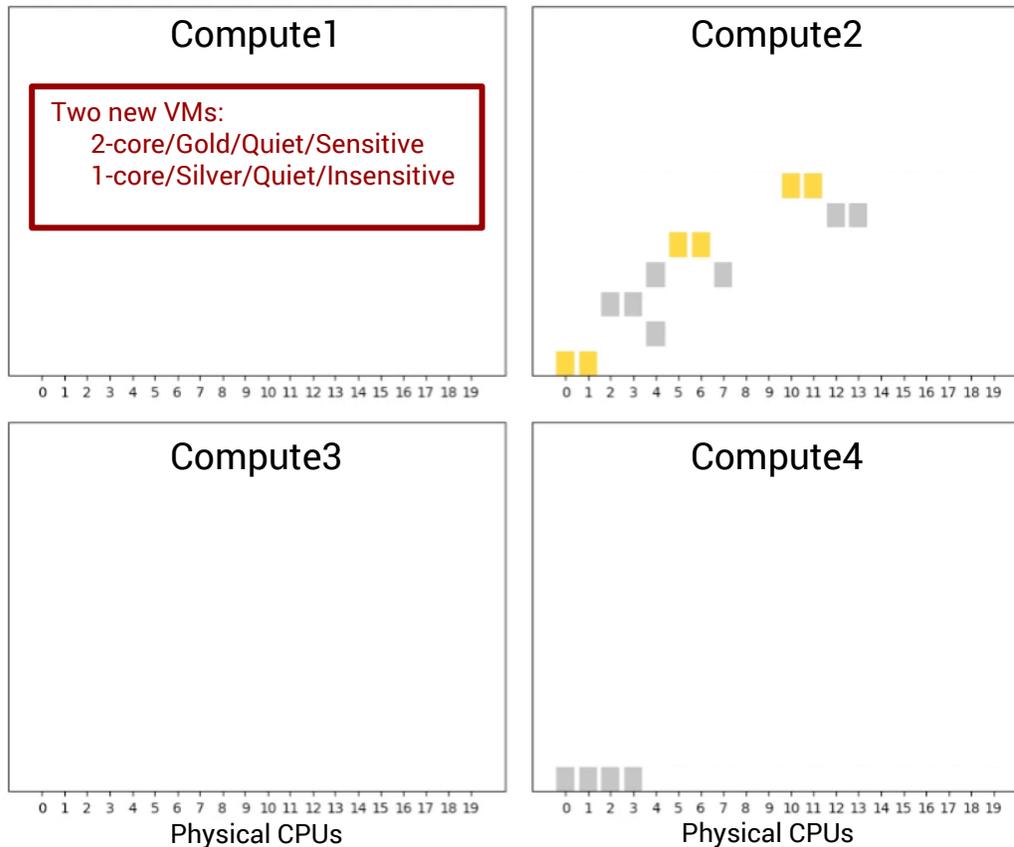
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

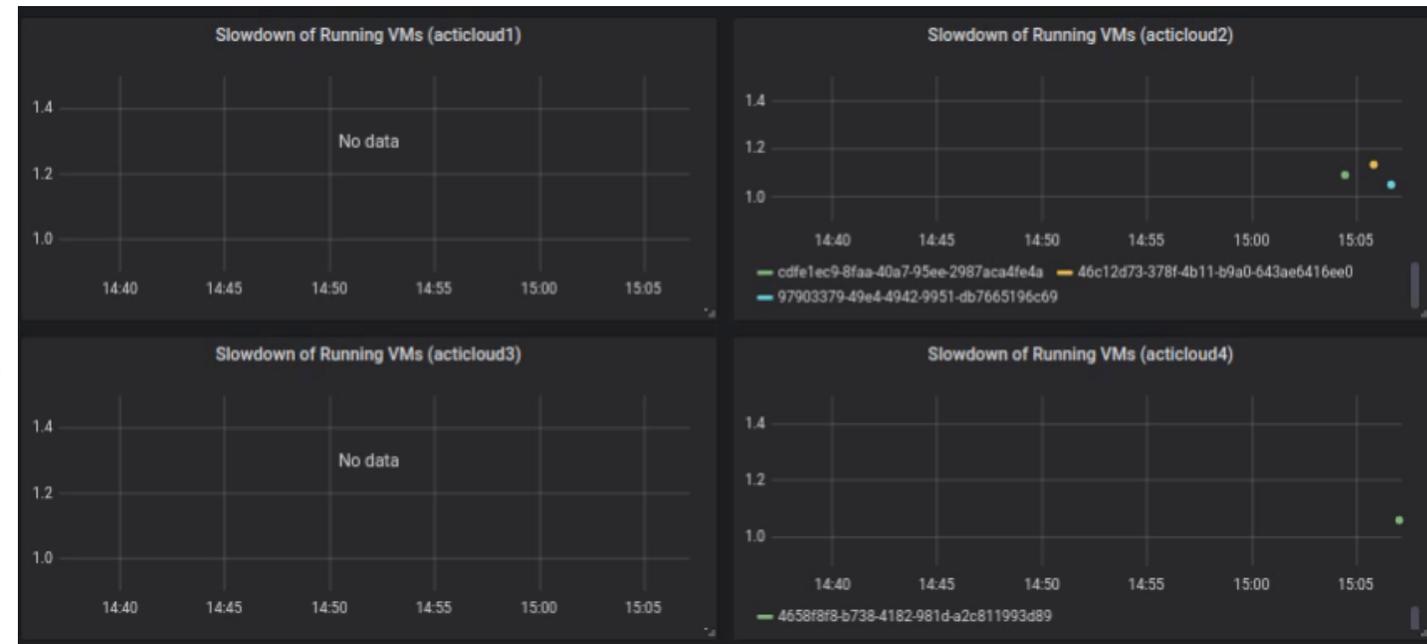
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

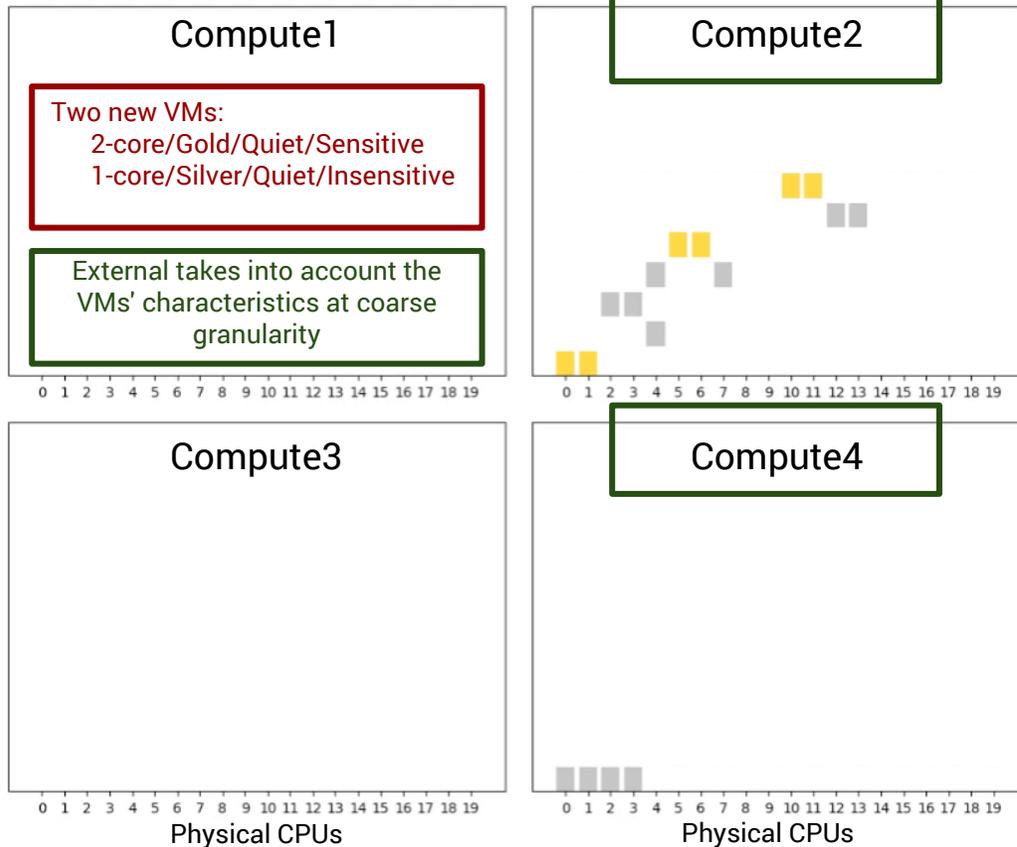
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

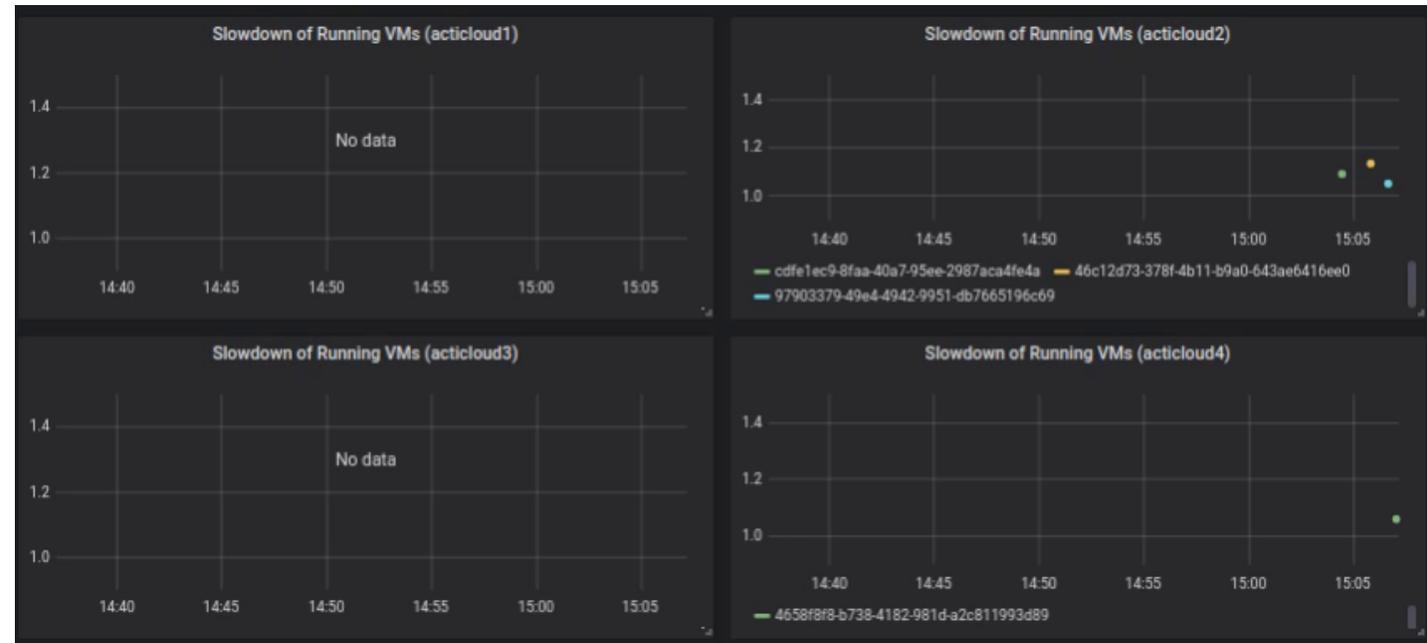
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

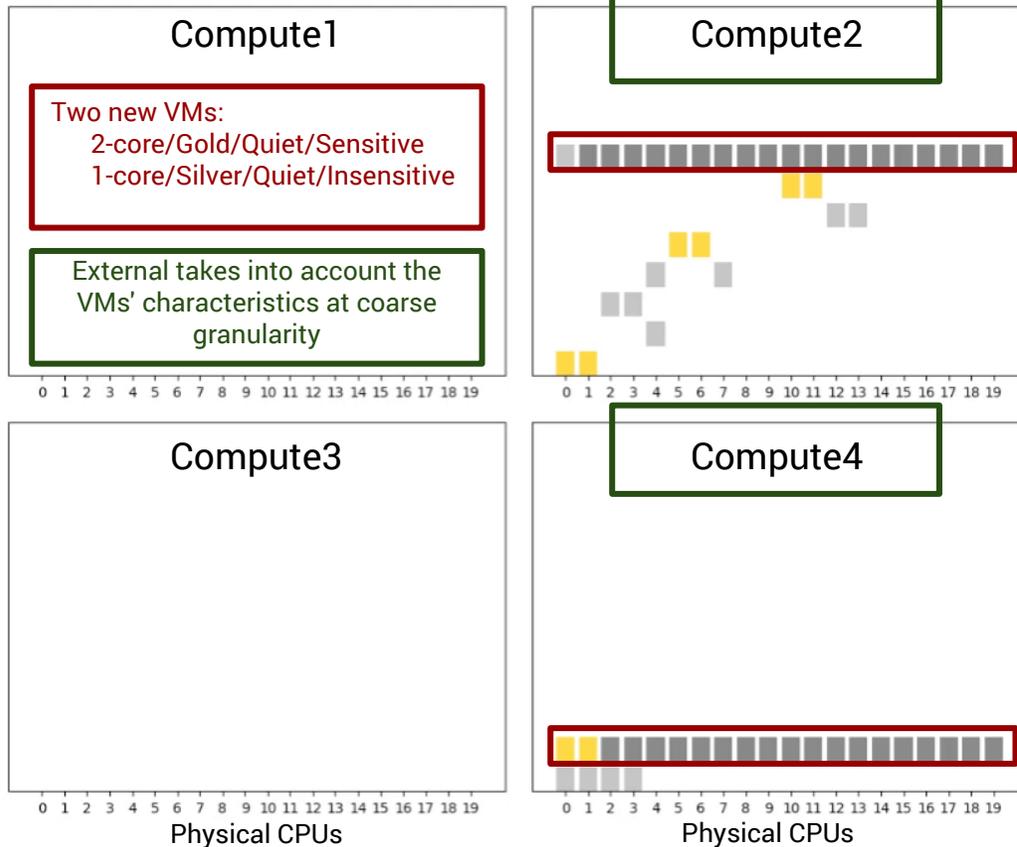
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

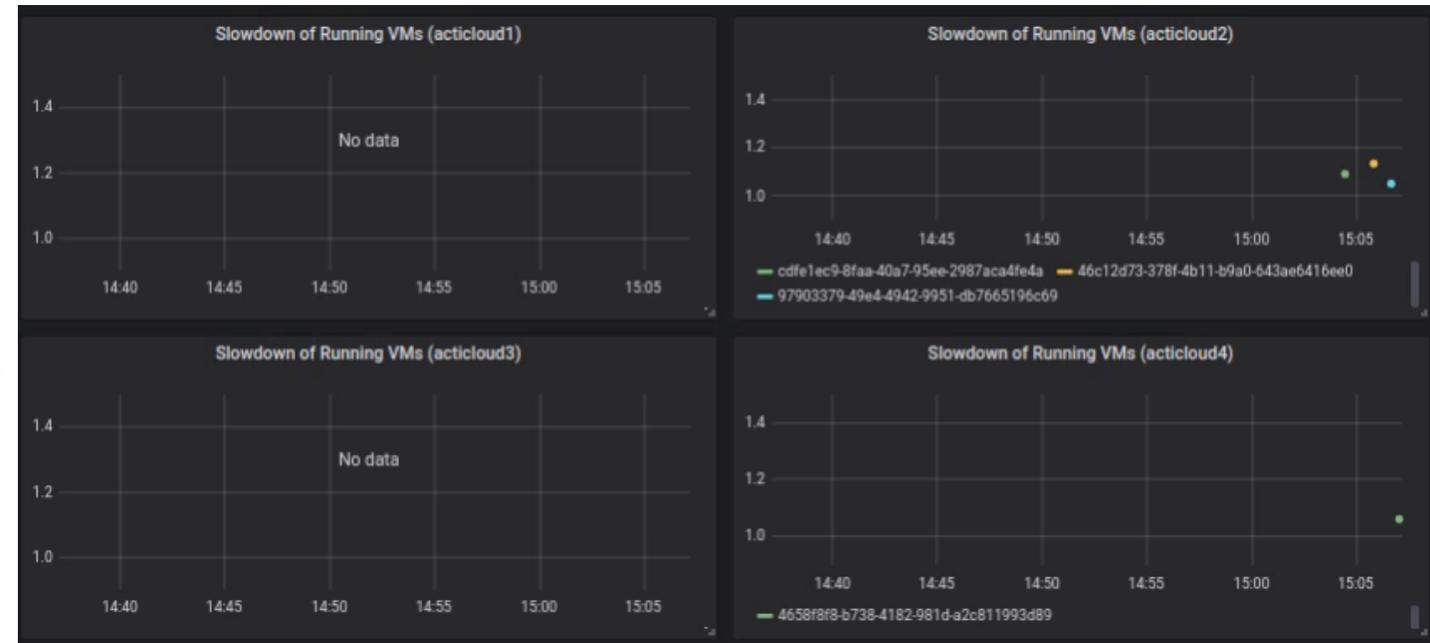
- Pins the VMs' virtual cpus to servers' physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

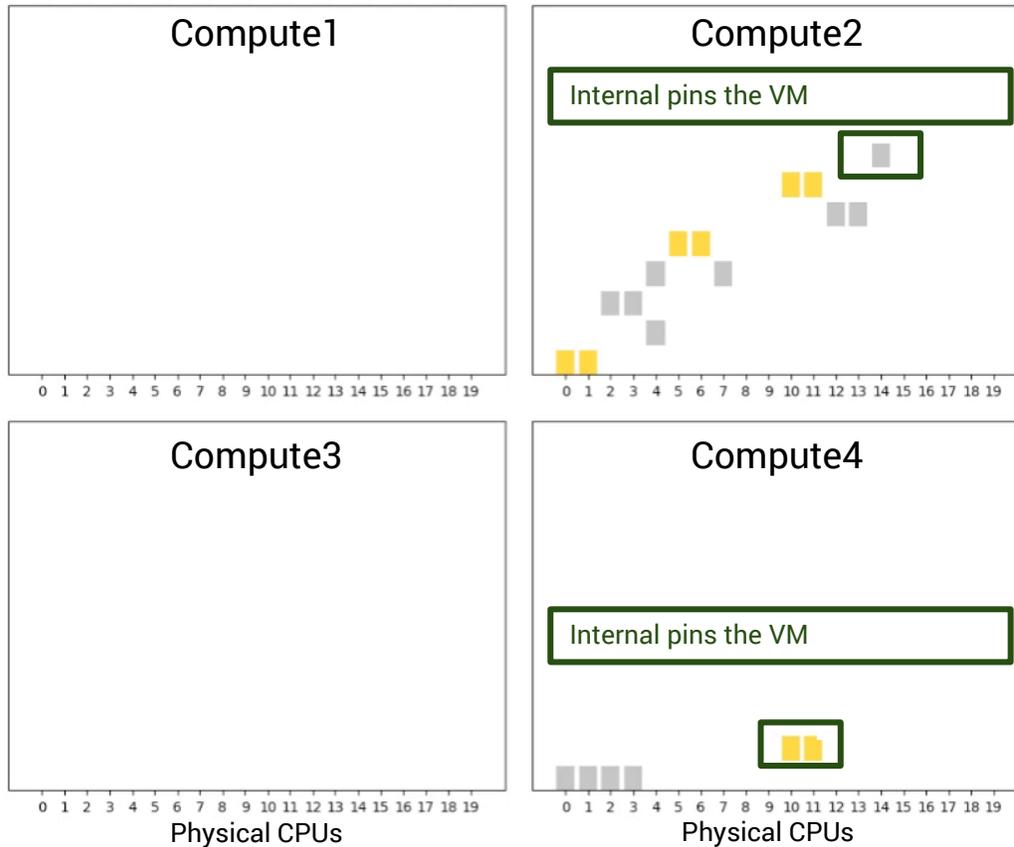
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

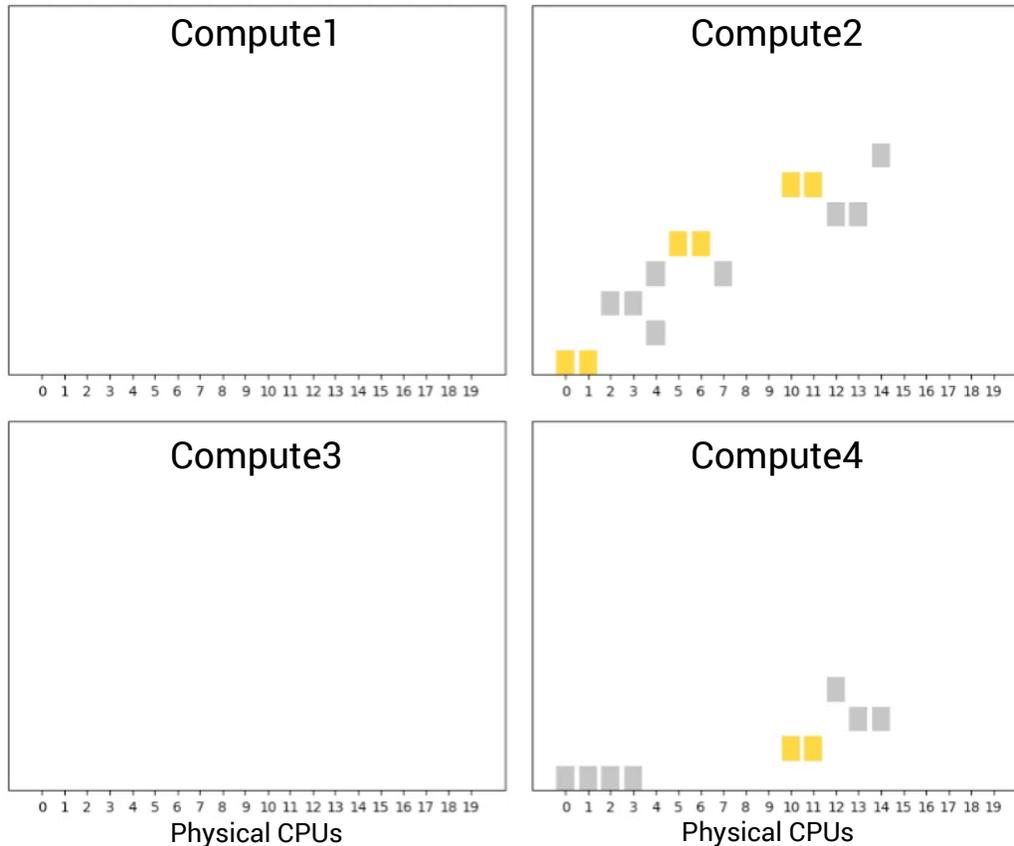
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

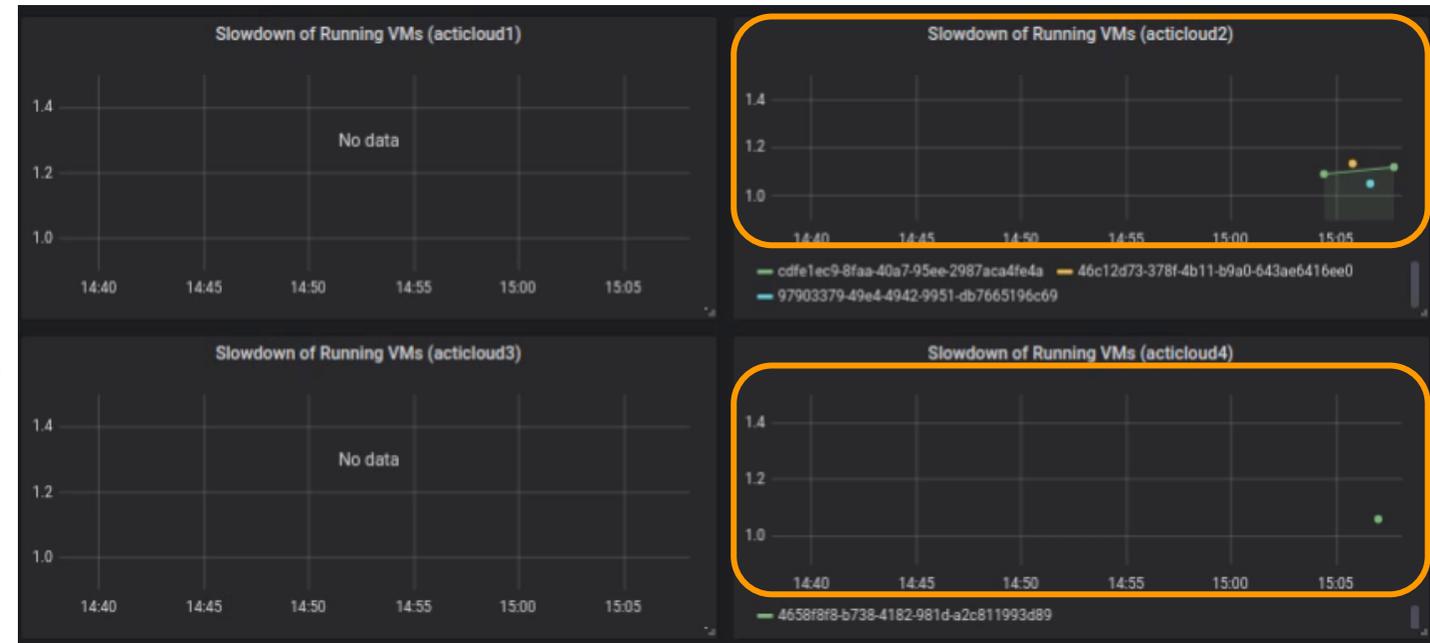
- Pins the VMs' virtual cpus to servers' physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

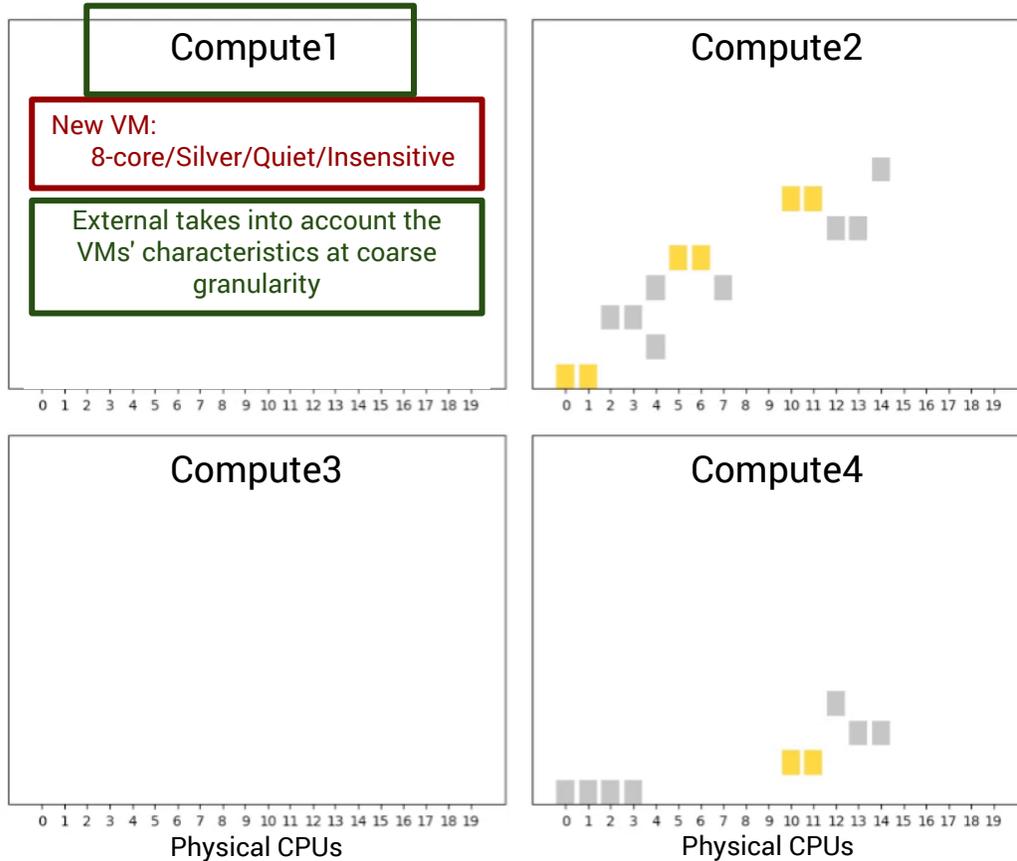
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

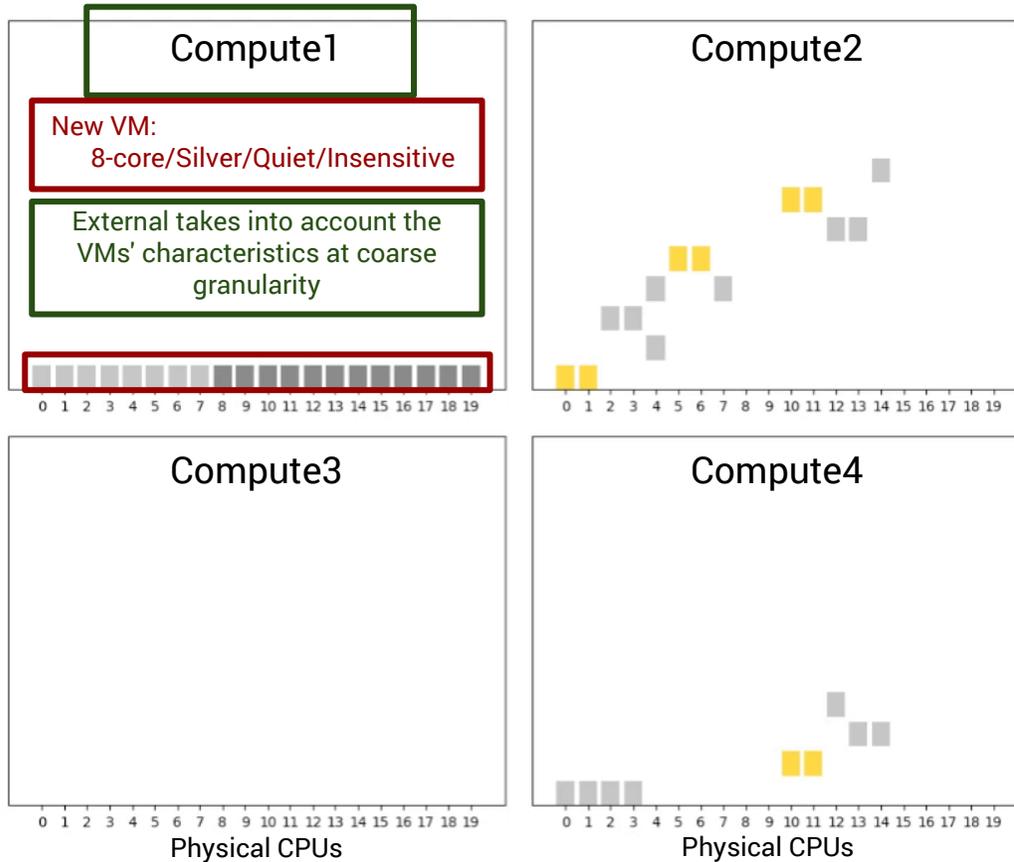
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

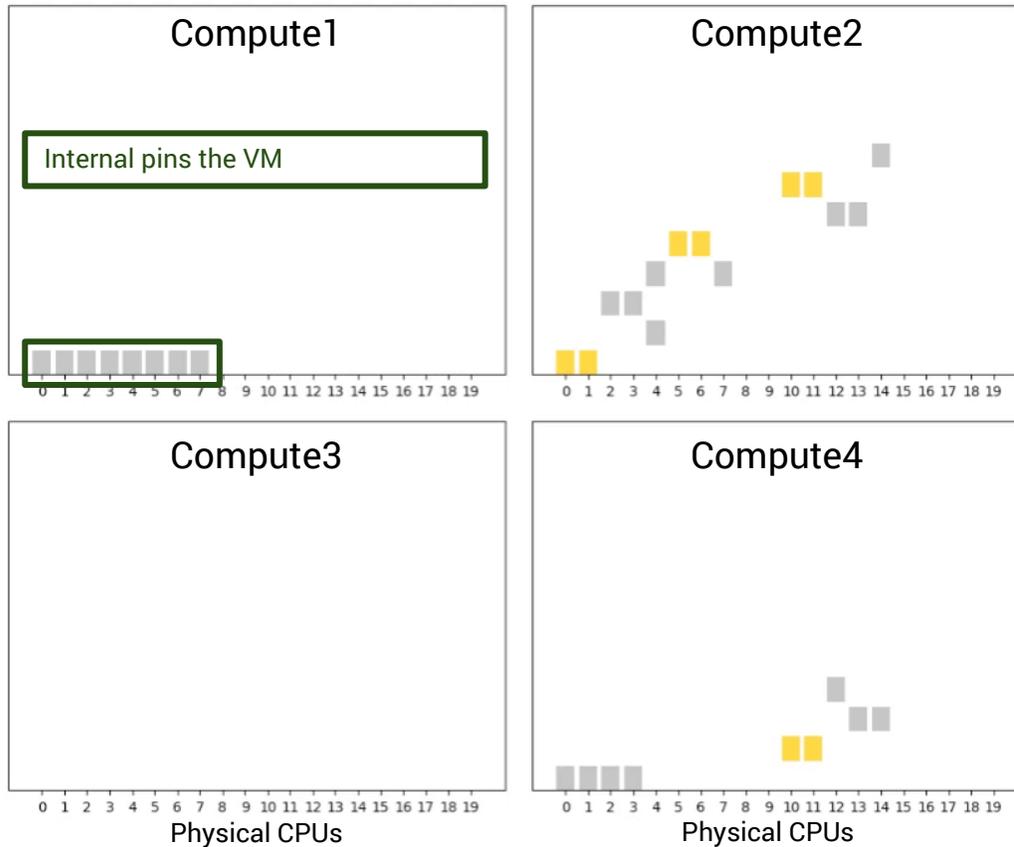
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

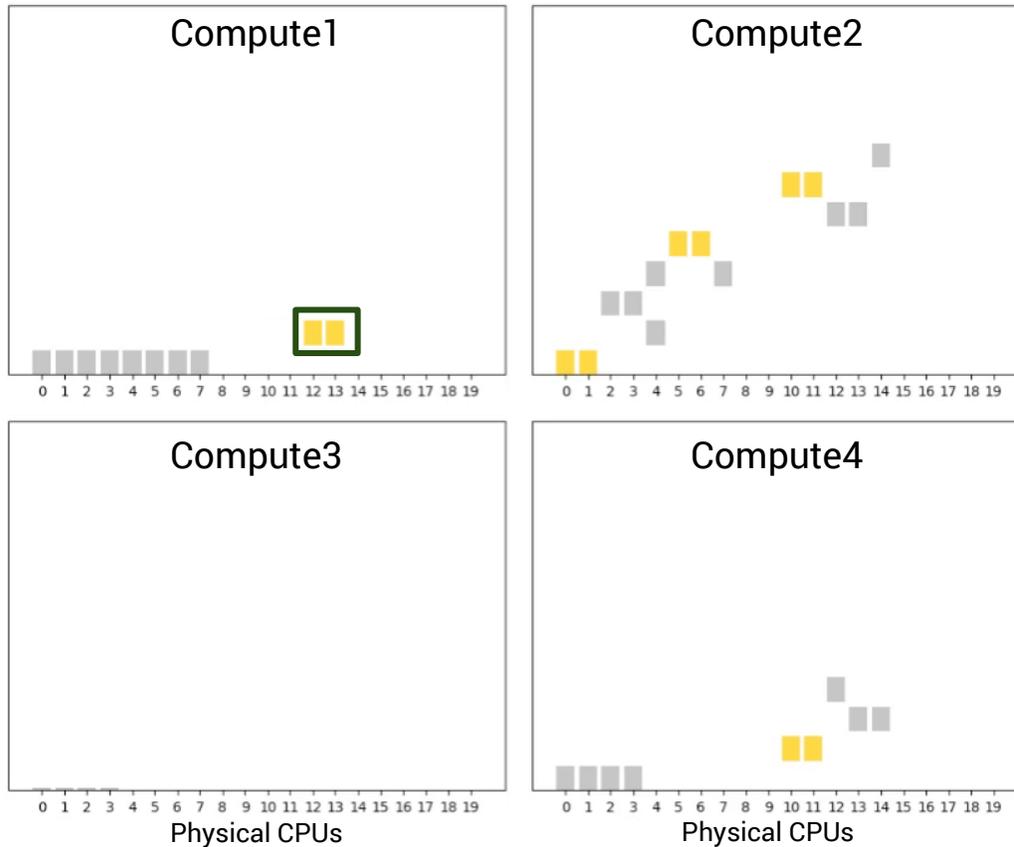
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

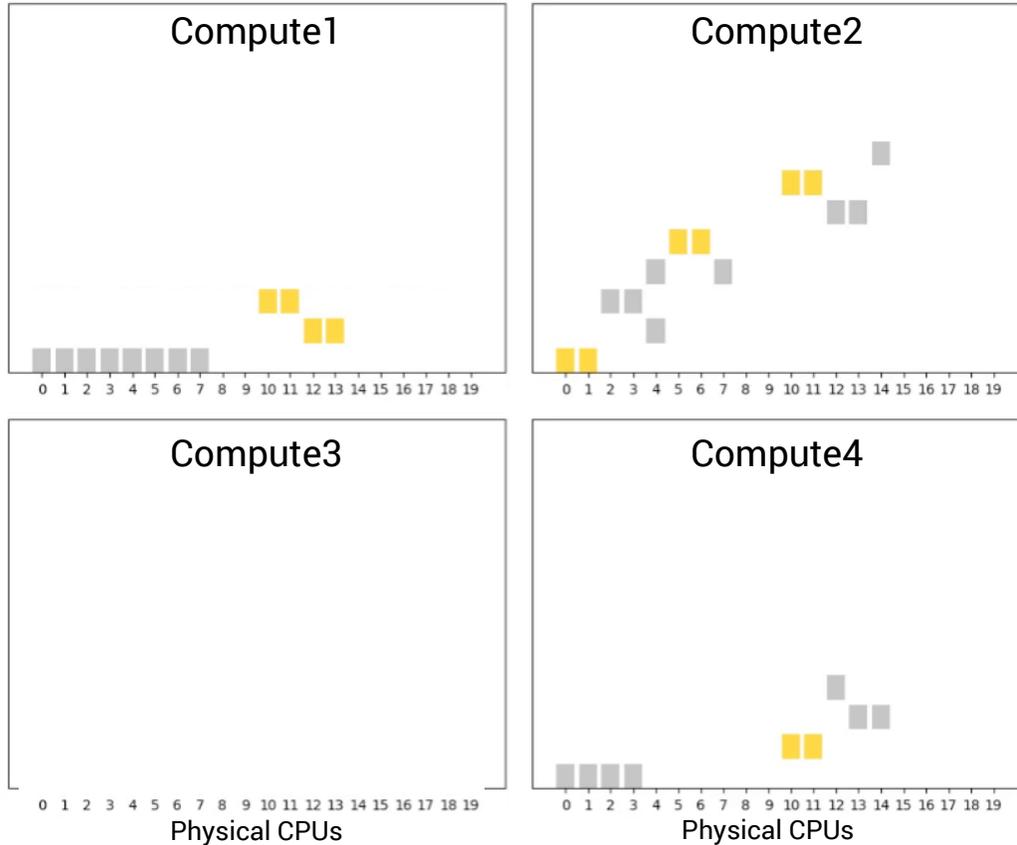
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

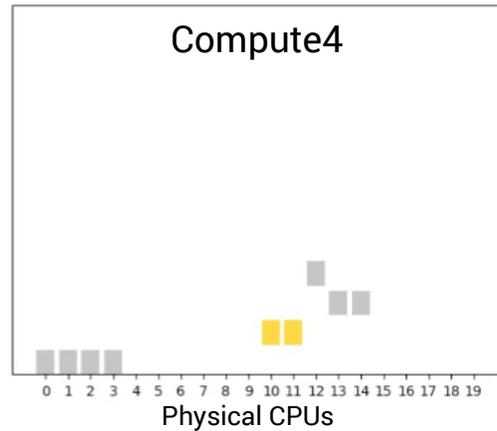
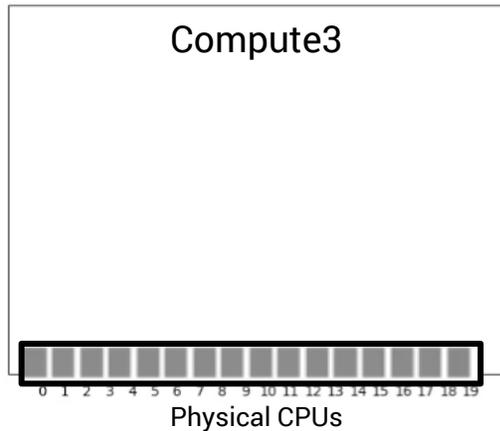
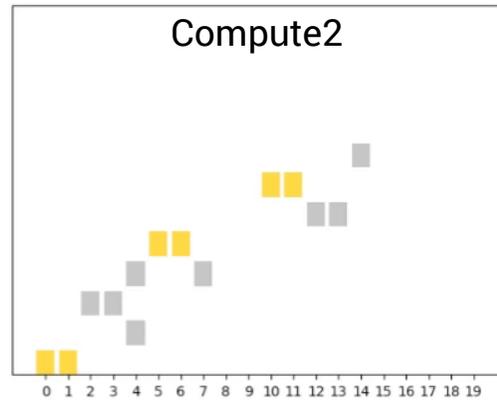
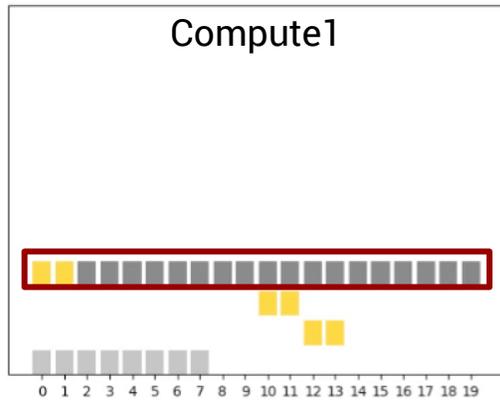
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

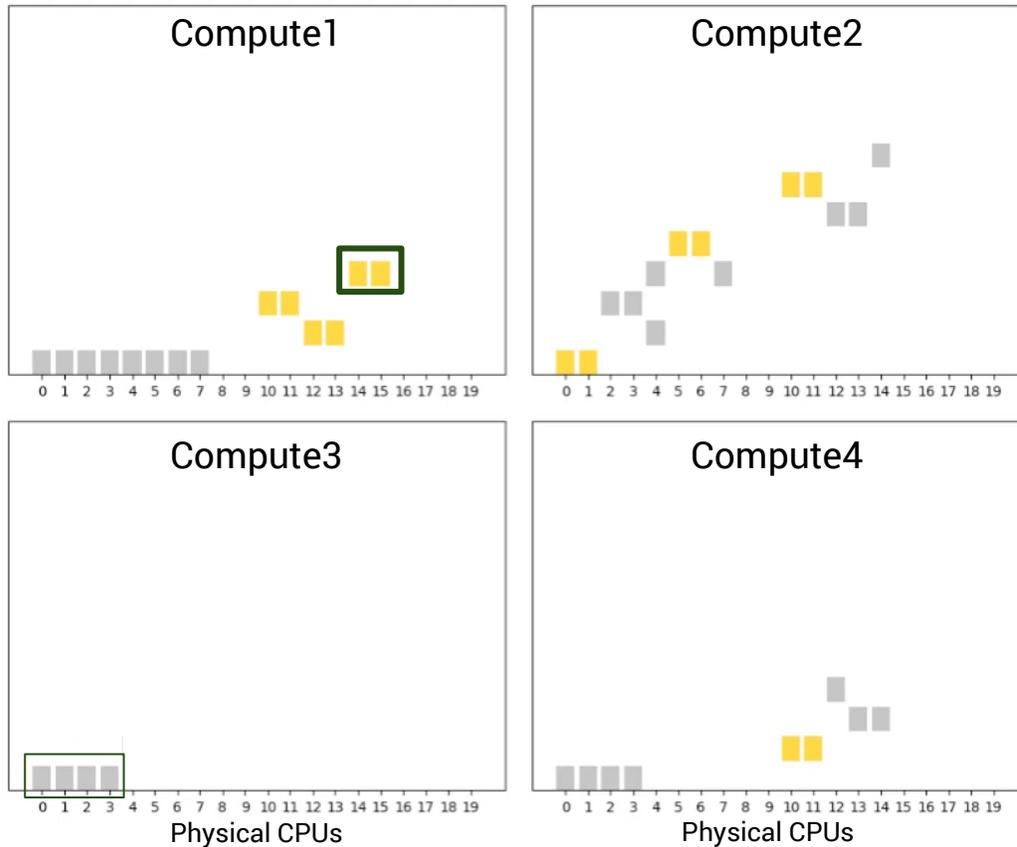
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

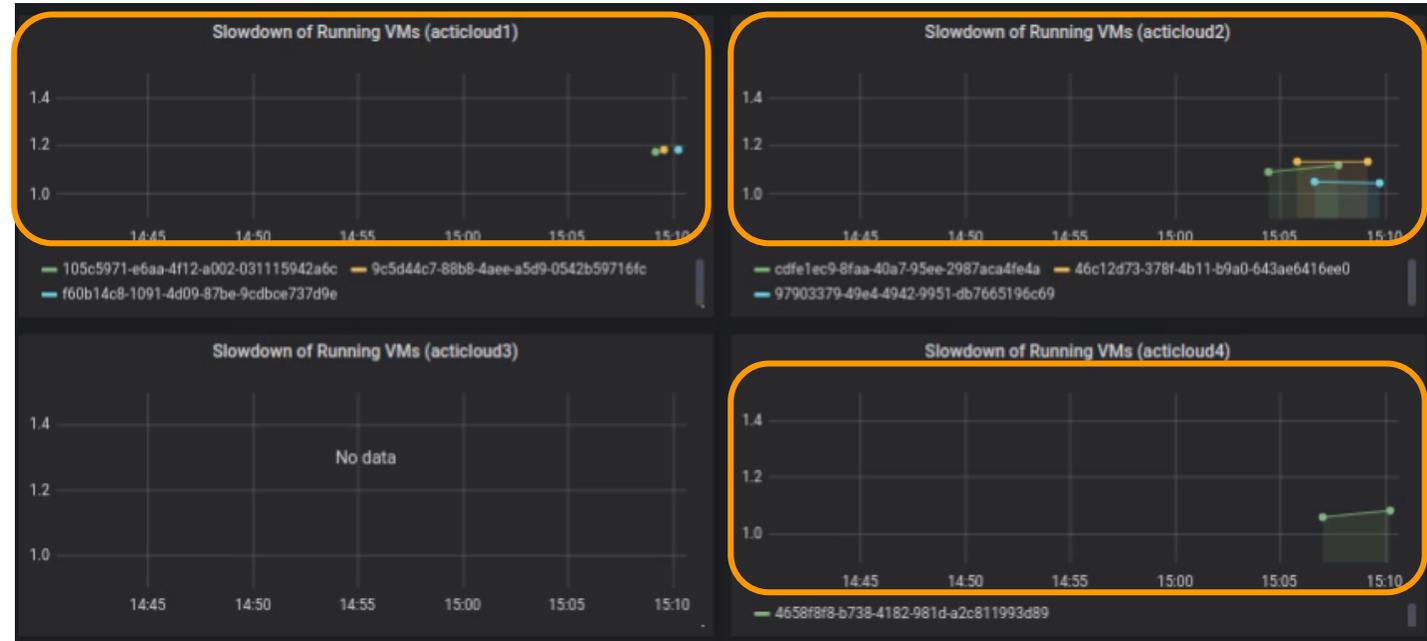
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

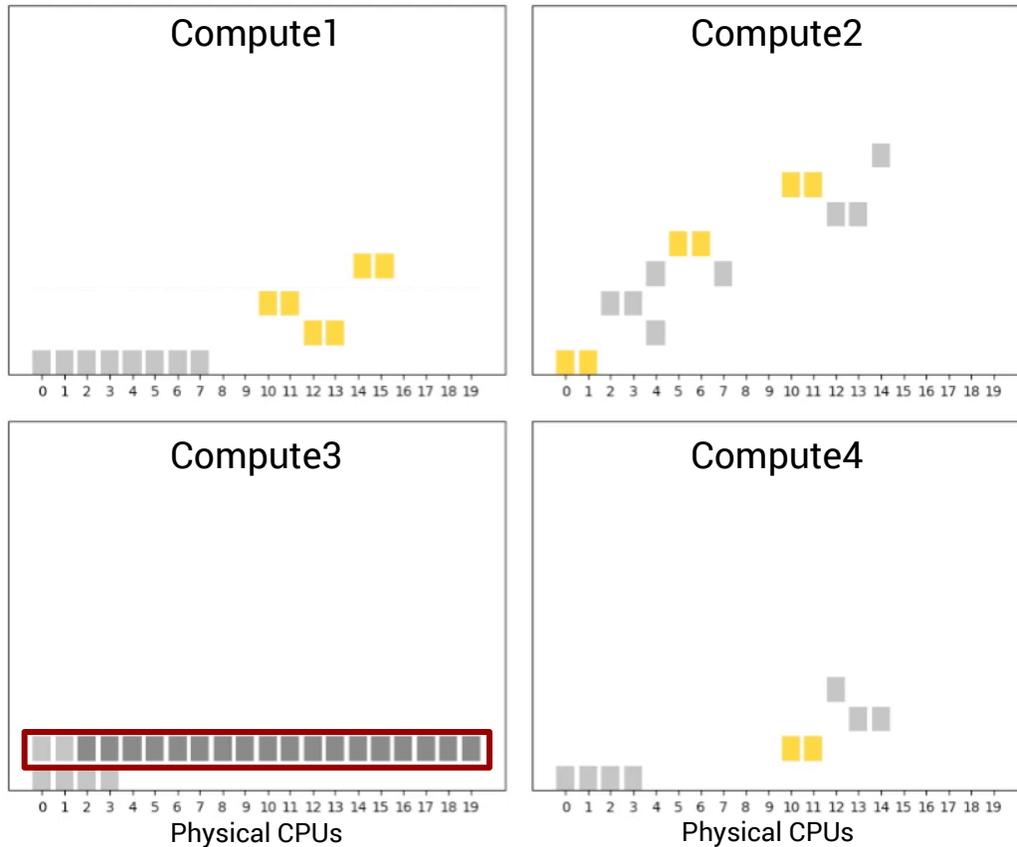
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

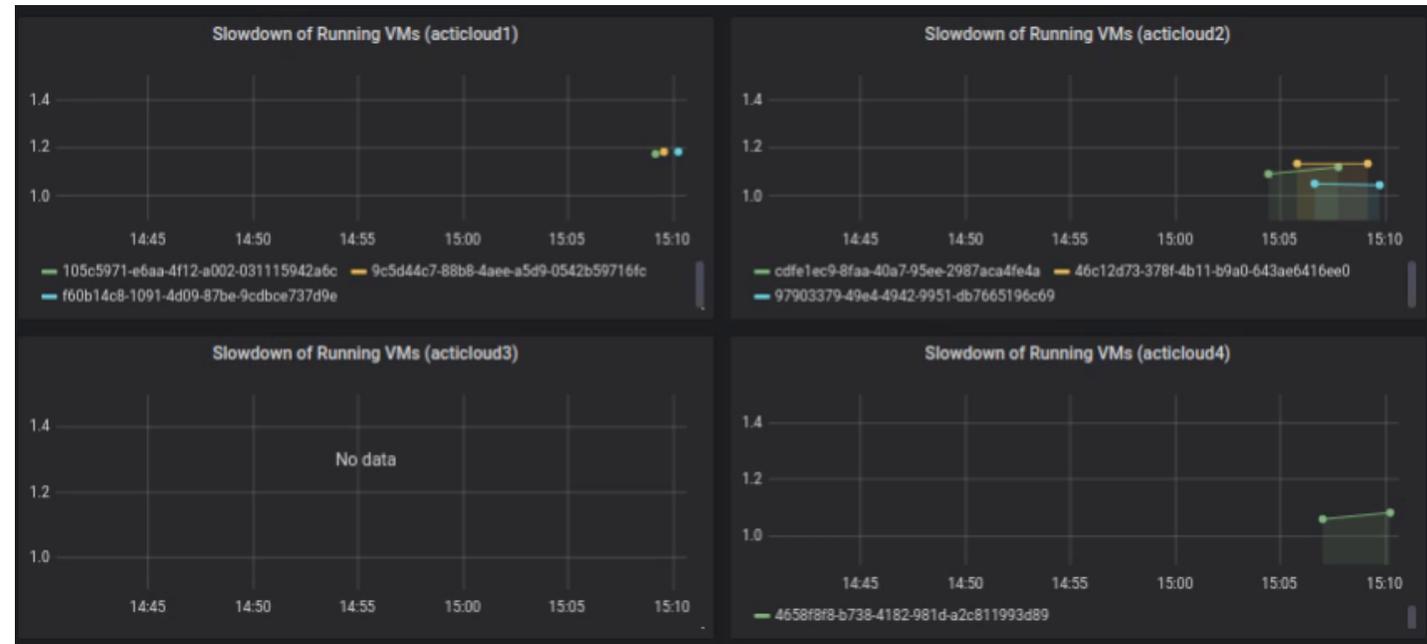
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

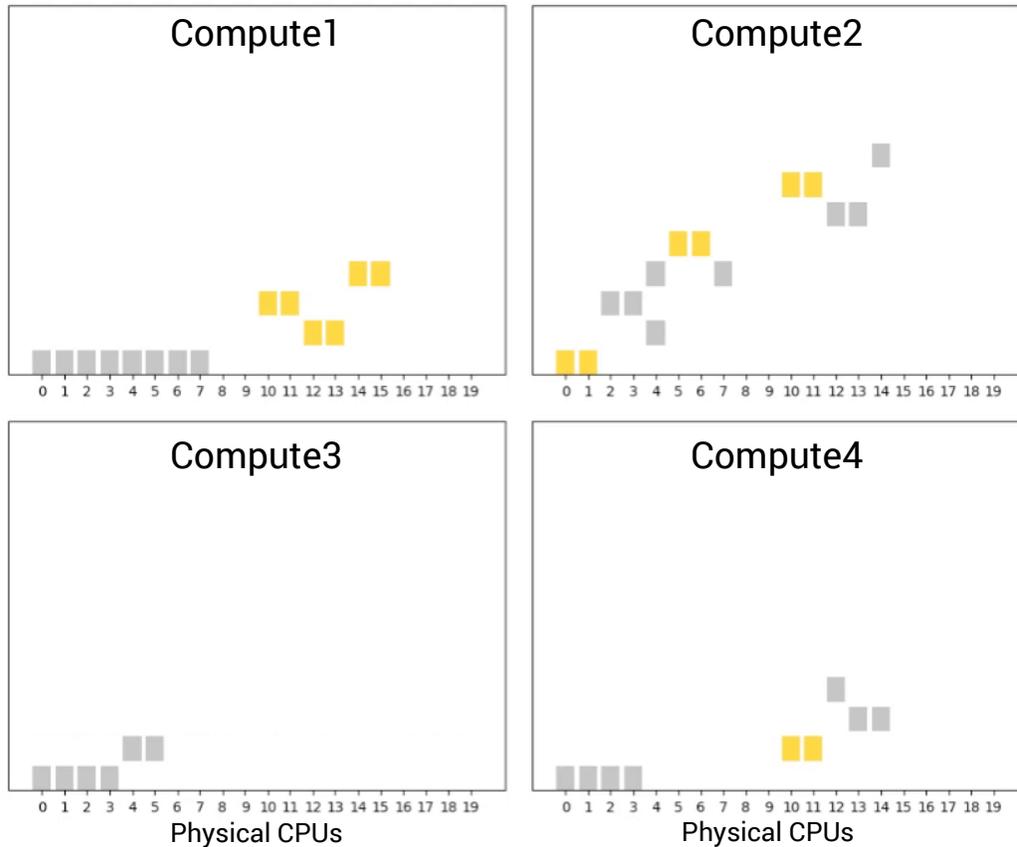
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## 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

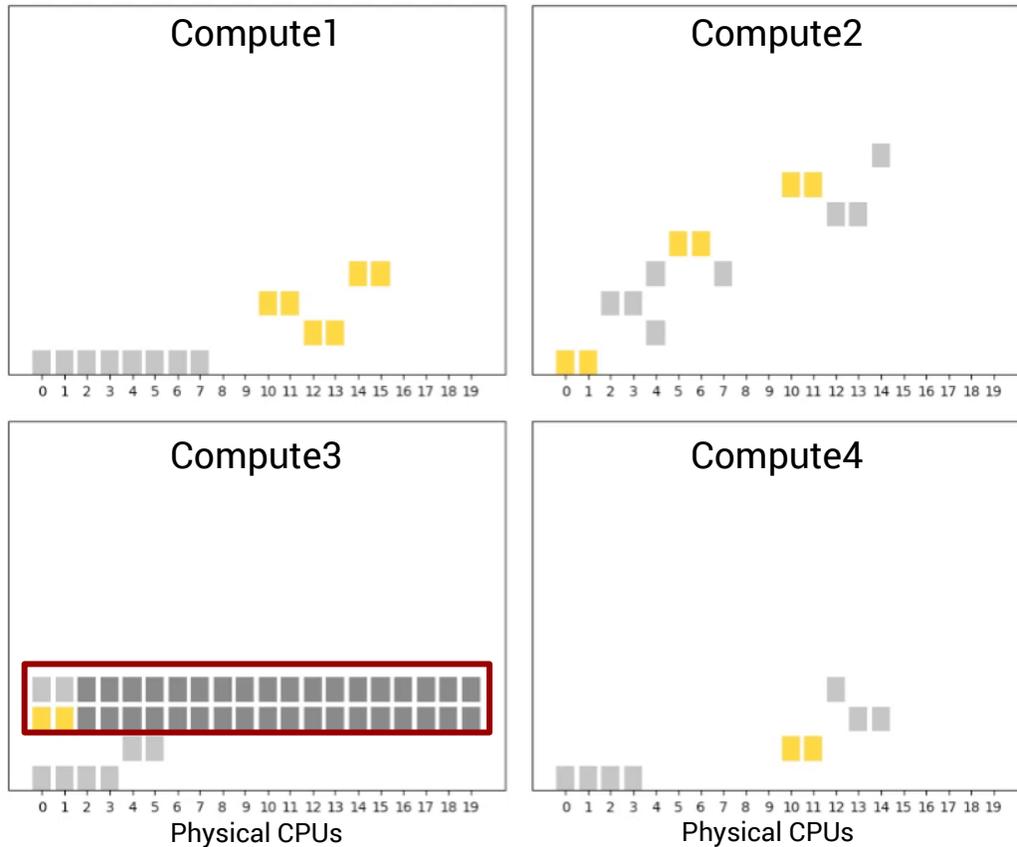
### ACTiManager.Internal:

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

# ACTiManager Demonstration



## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

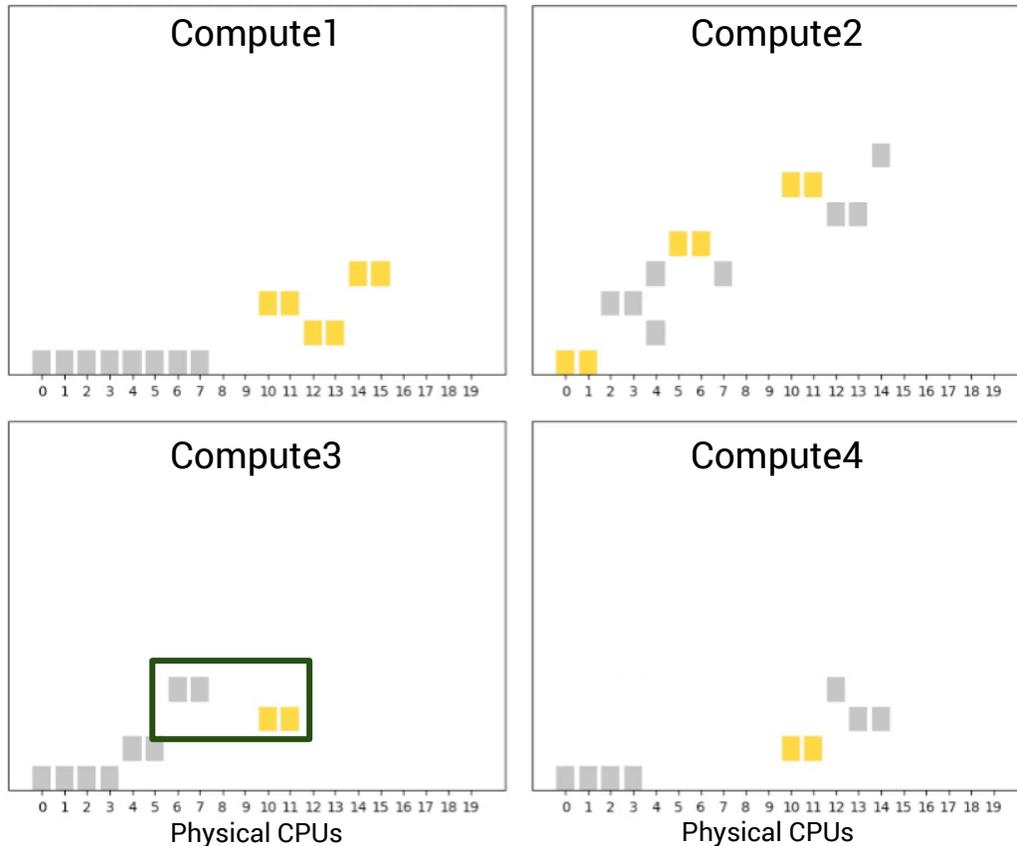
- Places VMs as "packed" as possible, to save resources (and power)
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

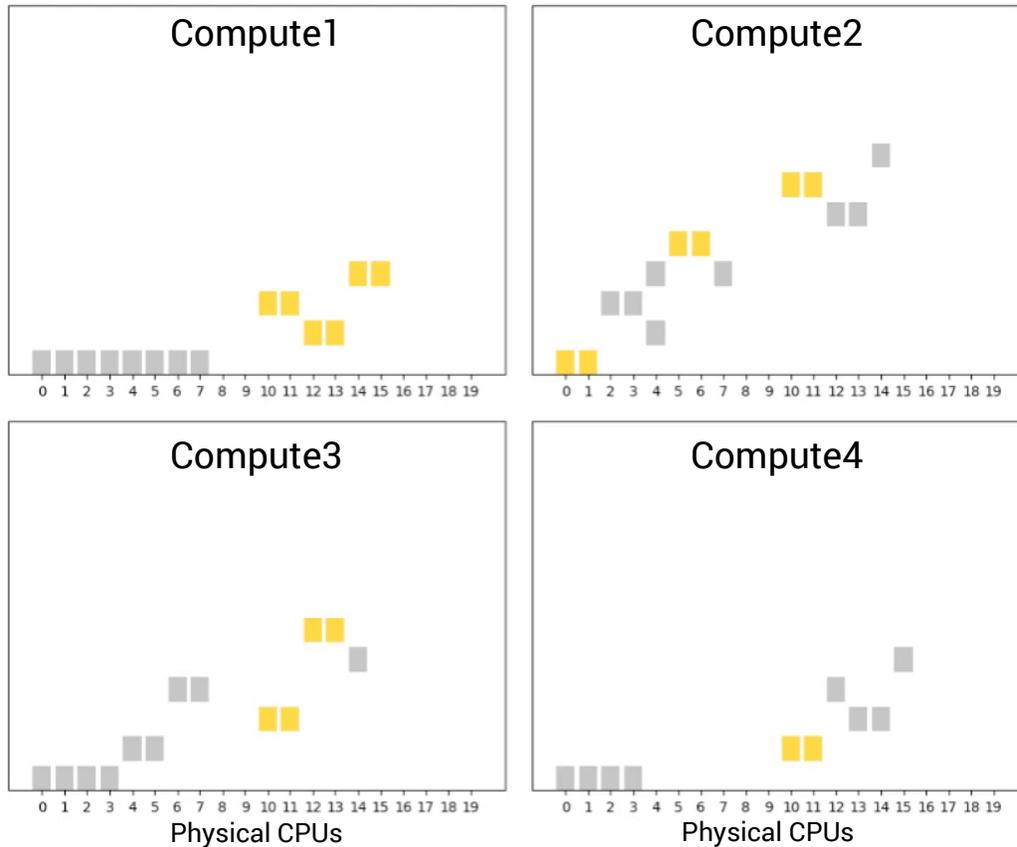
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

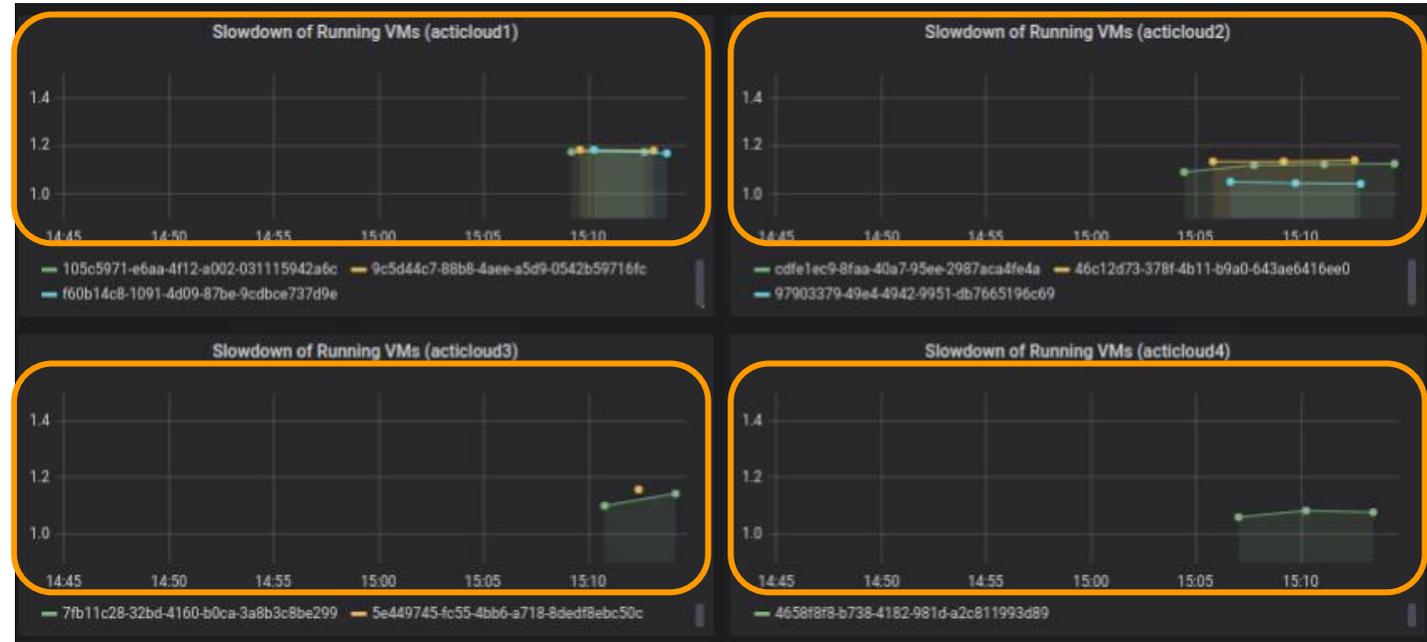
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

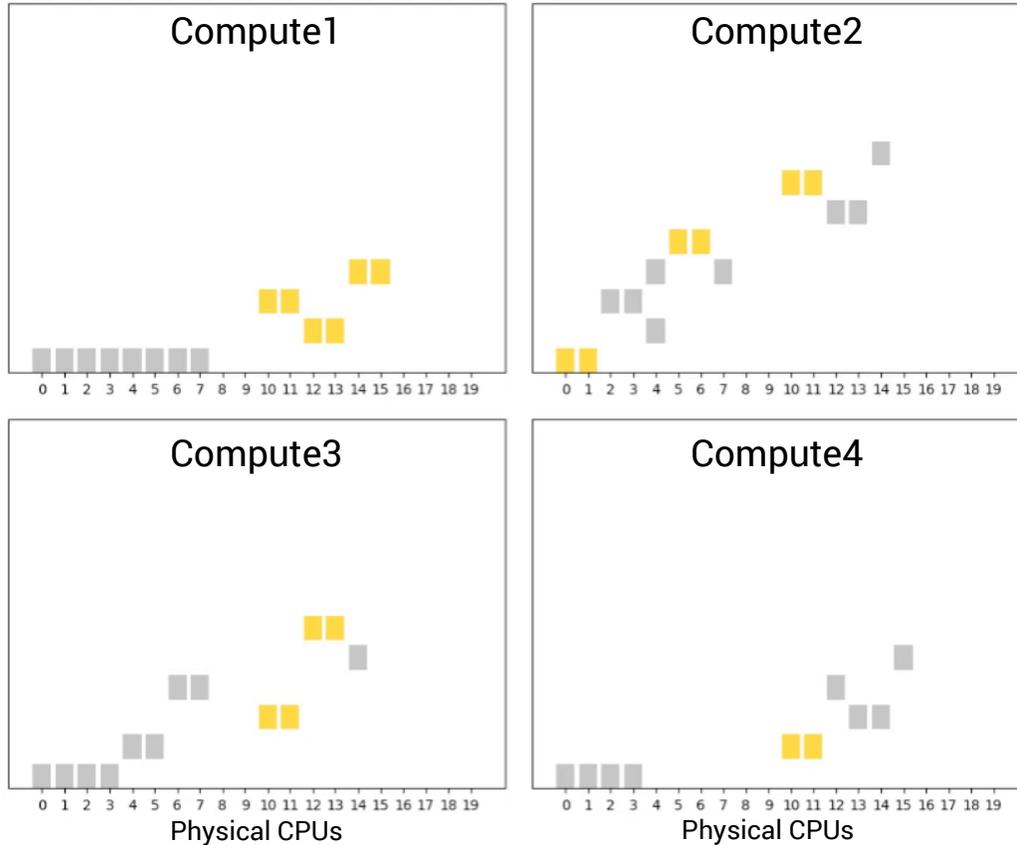
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

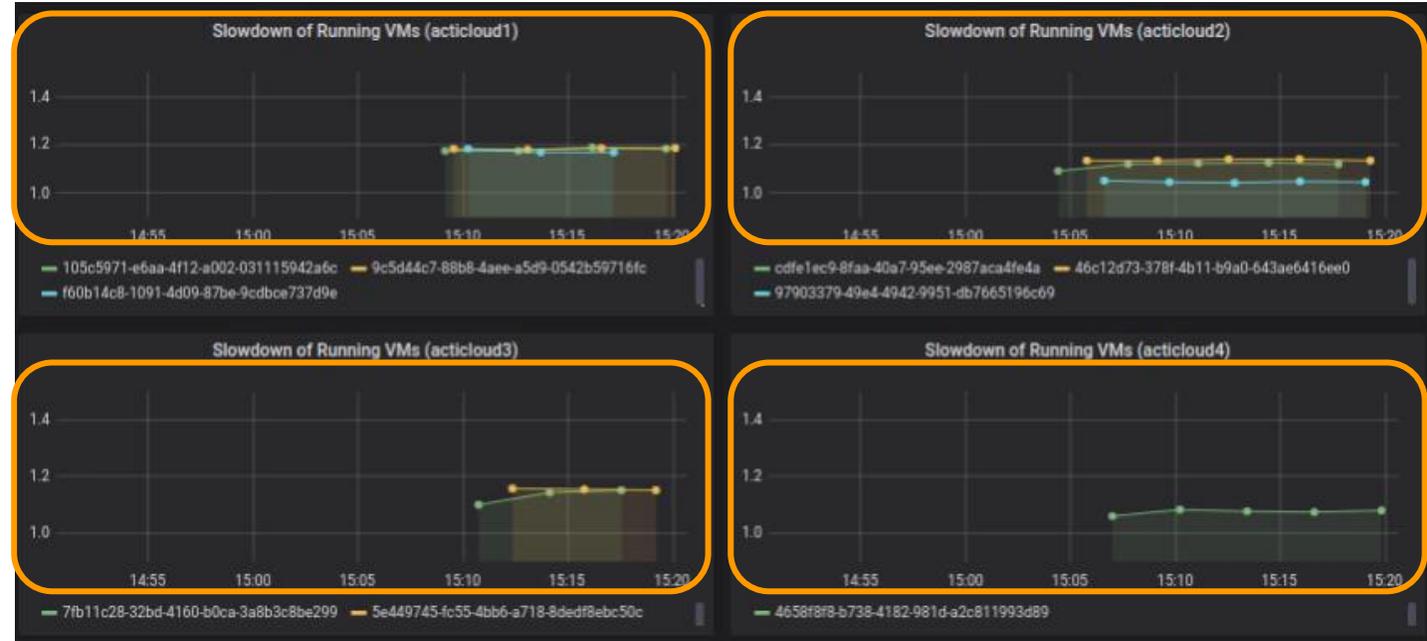
- Pins the VMs’ virtual cpus to servers’ physical cpus

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

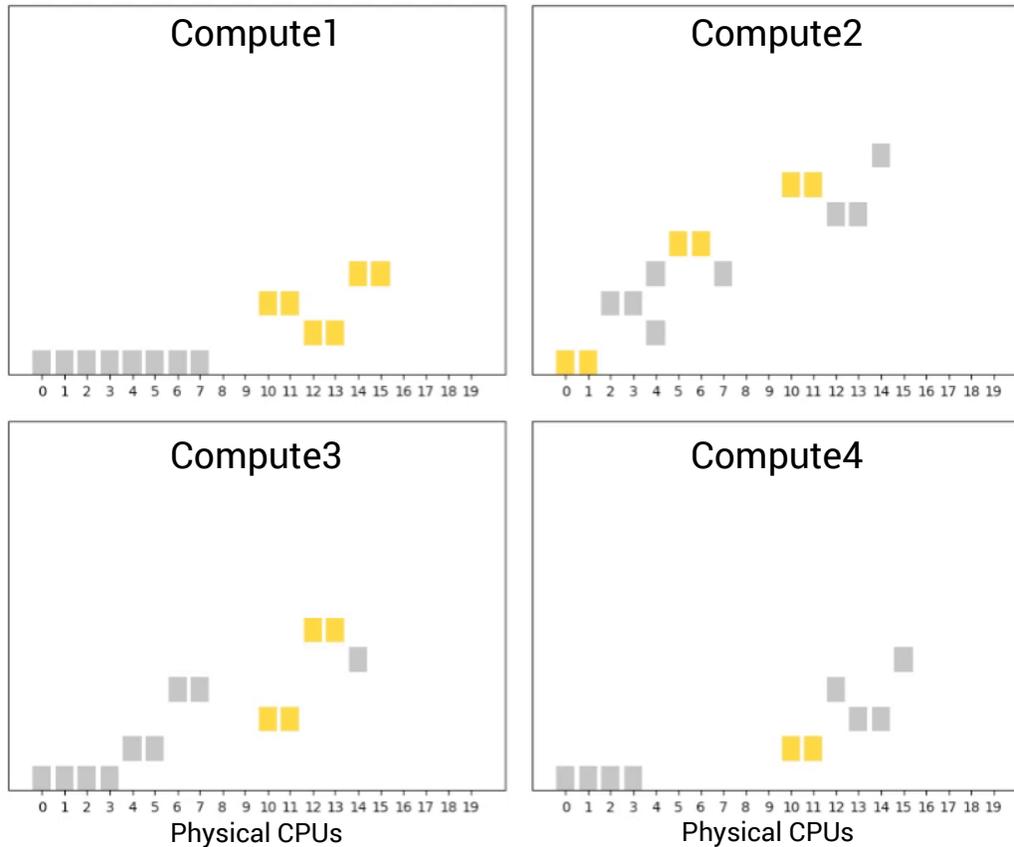
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## Actual Slowdown of Gold VMs



### ACTiManager.External:

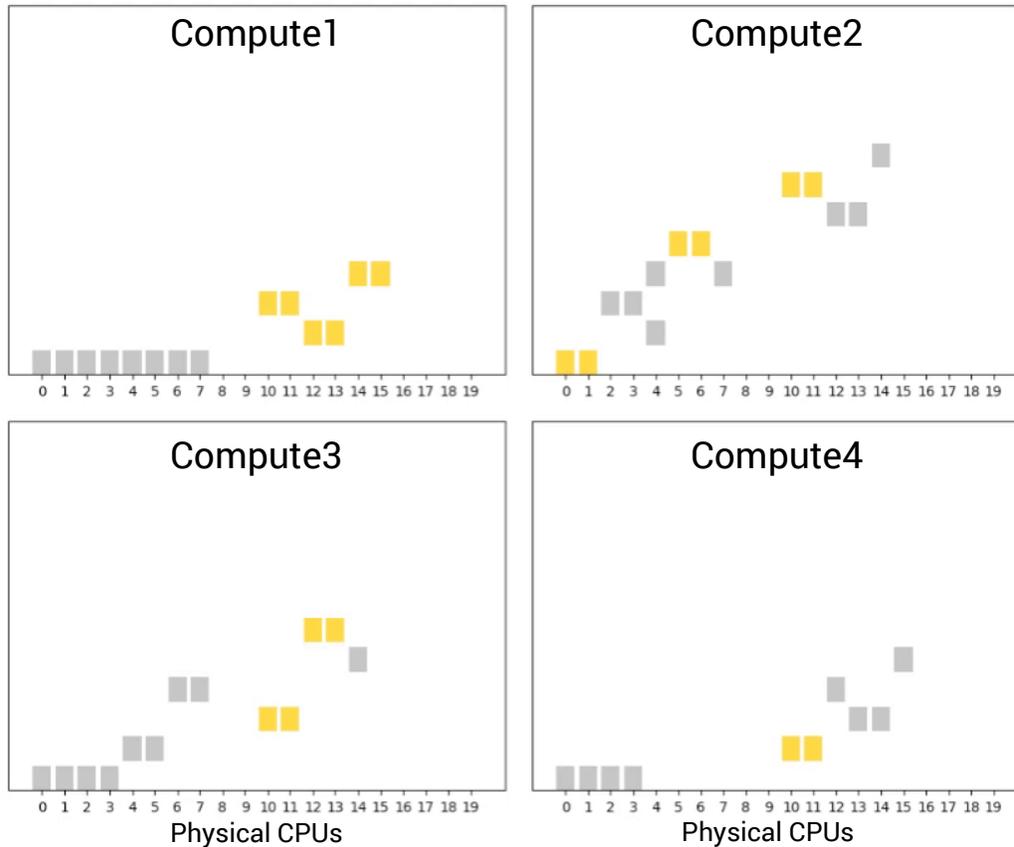
- Places VMs as “packed” as possible, to save resources (and power)
- Considers VMs’ **prioritization** - Gold/Silver VMs
- Considers VMs’ **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

### ACTiManager.Internal:

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

# ACTiManager Demonstration

## 4 20-core nodes cluster



## 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

### ACTiManager.Internal:

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

# Demonstration Scenarios

## 2. Internal component (vs. Linux scheduler)

- Server level
- Pinning of VMs to cores
- Detects interference

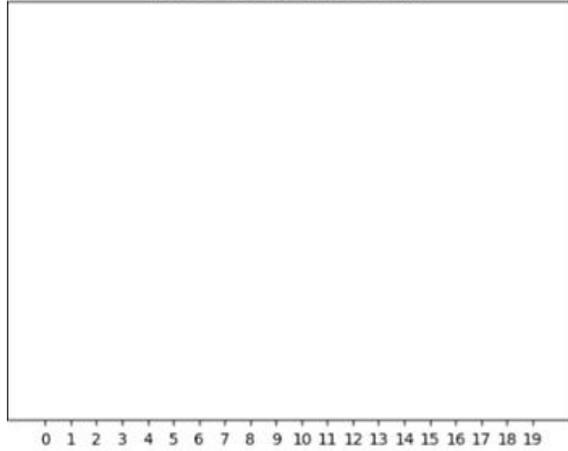


# ACTiManager.Internal



## Compute-1

VCPUS: 0 GOLD and 0 SILVER

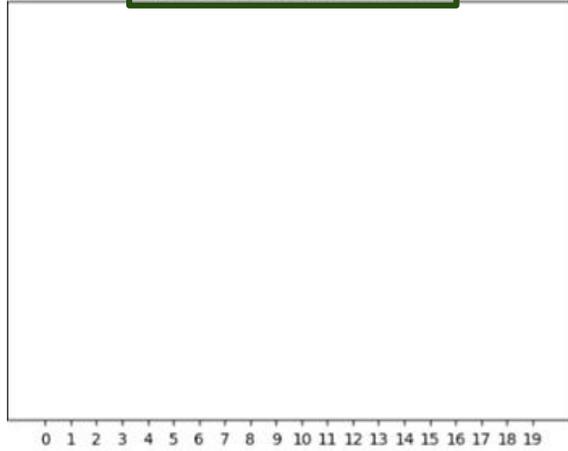


# ACTiManager.Internal



## Compute-1

VCPUS: 0 GOLD and 0 SILVER

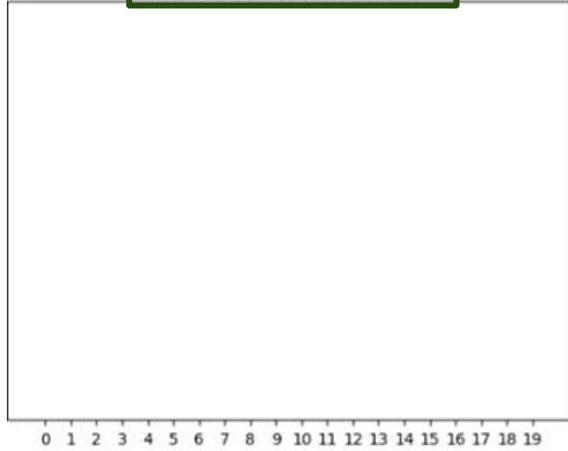


# ACTiManager.Internal



## Compute-1

VCPUS: 0 GOLD and 0 SILVER

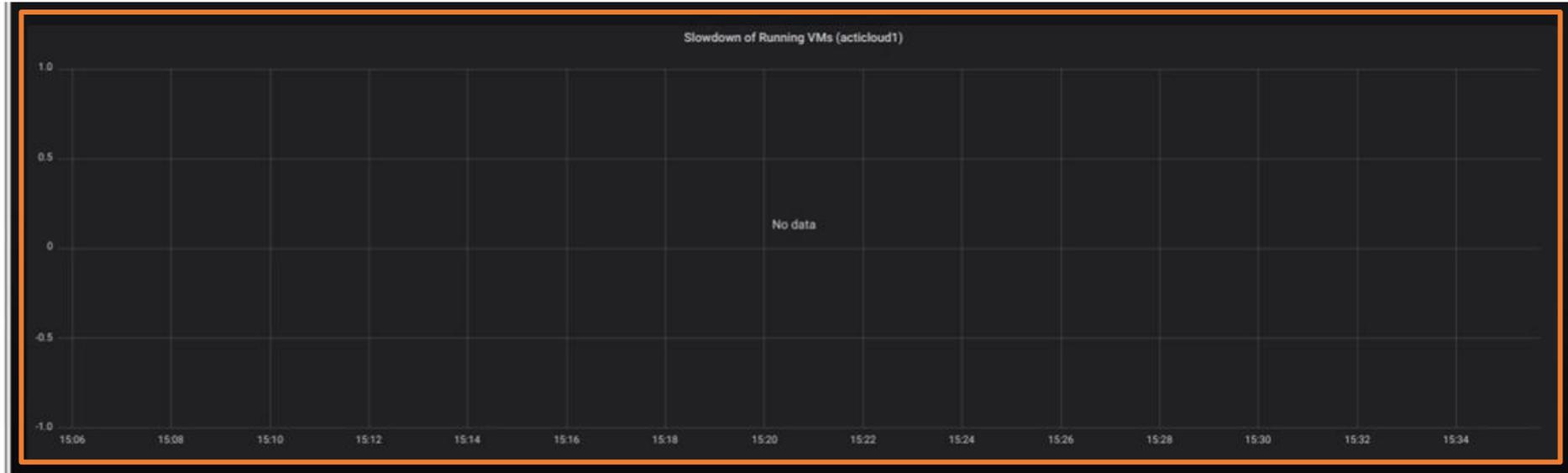
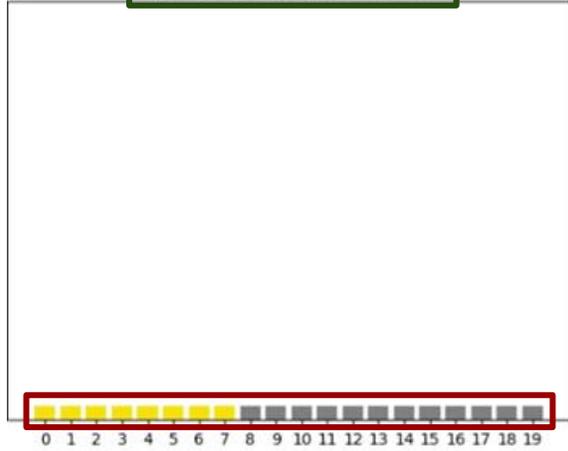


# ACTiManager.Internal



## Compute-1

VCPUS: 8 GOLD and 0 SILVER

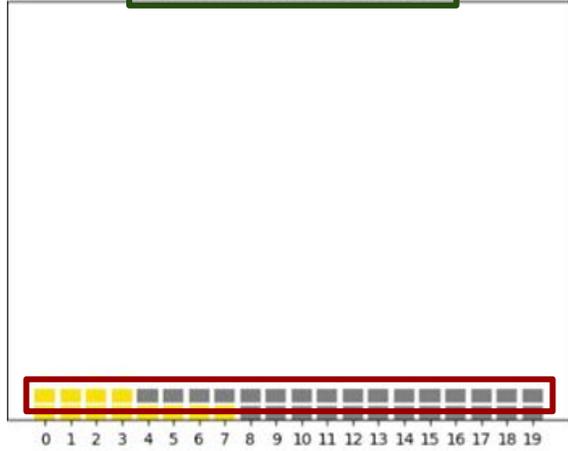


# ACTiManager.Internal



## Compute-1

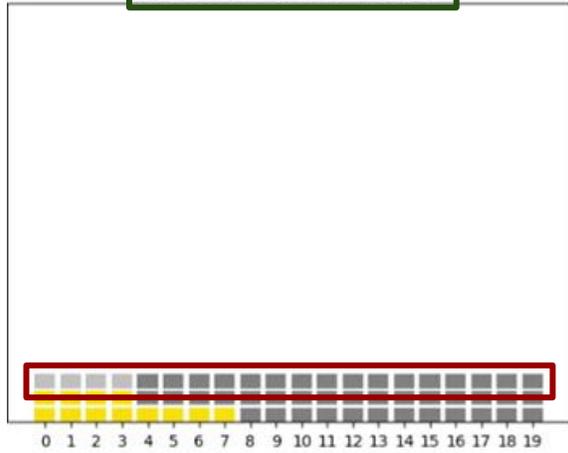
VCPUS: 12 GOLD and 0 SILVER



# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 4 SILVER

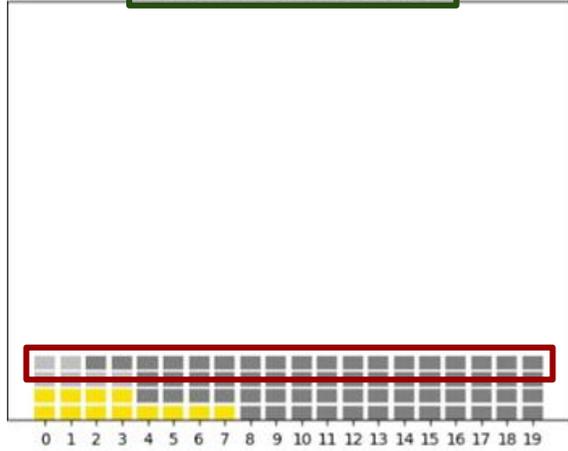


# ACTiManager.Internal



## Compute-1

VCPUS: 12 GOLD and 6 SILVER

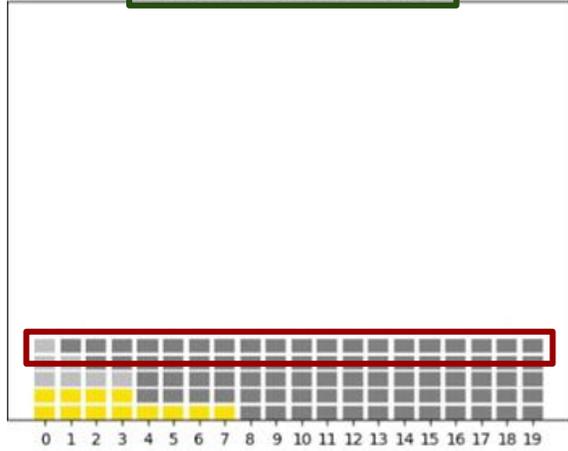


# ACTiManager.Internal



## Compute-1

VCPUS: 12 GOLD and 7 SILVER

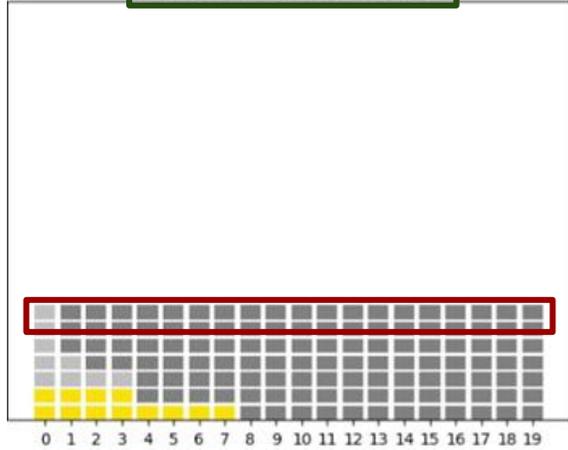


# ACTiManager.Internal



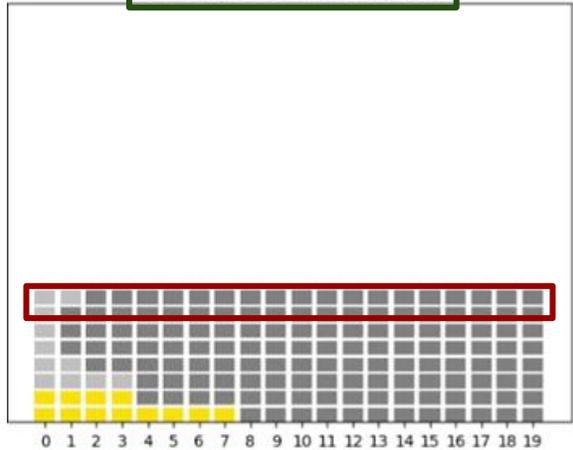
## Compute-1

VCPUS: 12 GOLD and 9 SILVER



# ACTiManager.Internal

**Compute-1**  
VCPUS: 12 GOLD and 11 SILVER

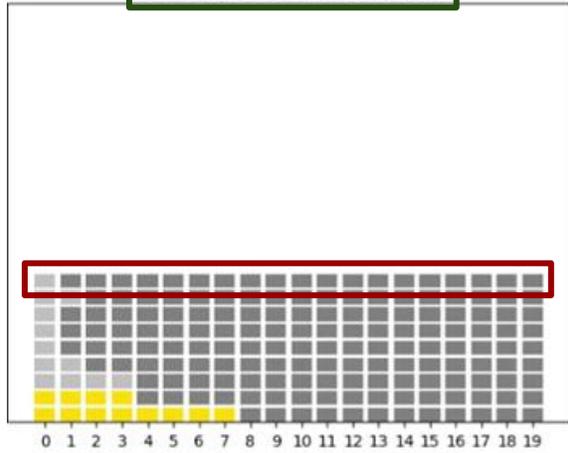


# ACTiManager.Internal



## Compute-1

VCPUS: 12 GOLD and 12 SILVER

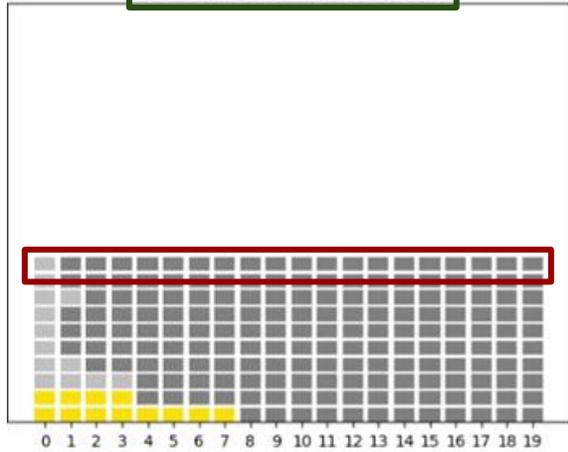


# ACTiManager.Internal



## Compute-1

VCPUS: 12 GOLD and 13 SILVER

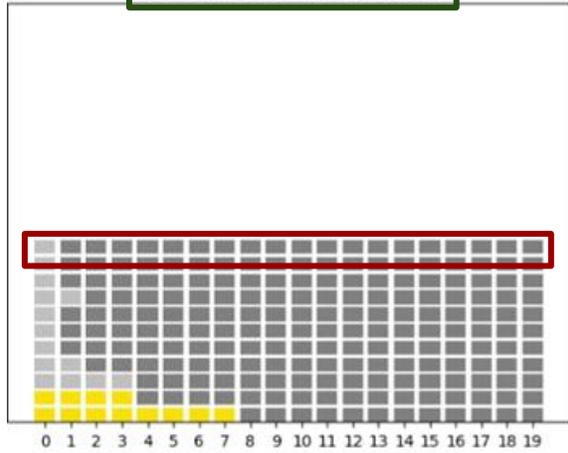


# ACTiManager.Internal



## Compute-1

VCPUS: 12 GOLD and 14 SILVER

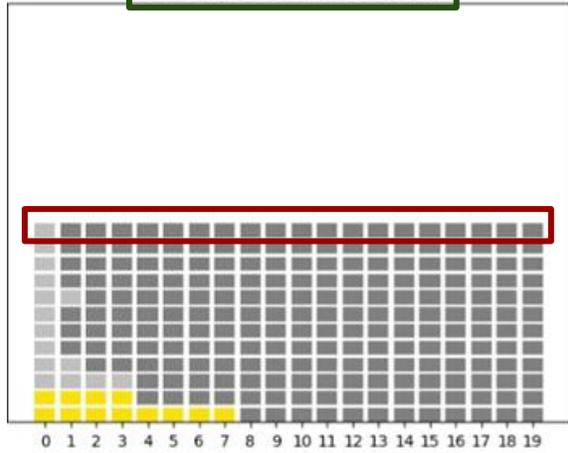


# ACTiManager.Internal



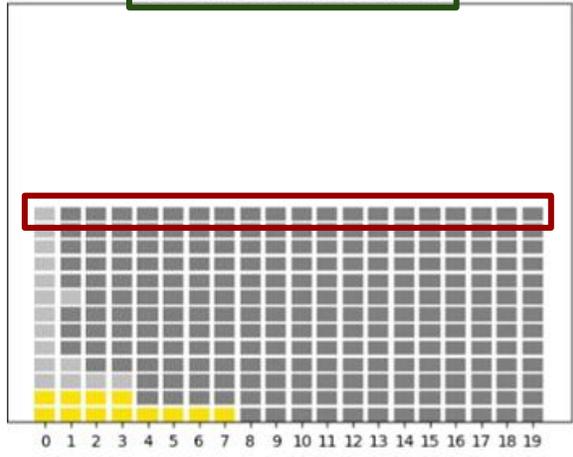
## Compute-1

VCPUS: 12 GOLD and 15 SILVER



# ACTiManager.Internal

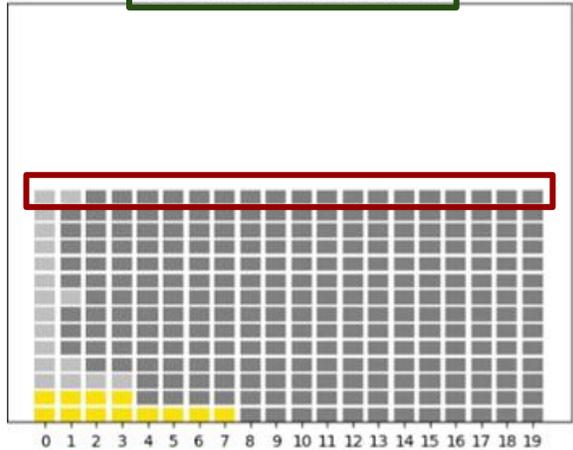
**Compute-1**  
VCPUS: 12 GOLD and 16 SILVER



# ACTiManager.Internal

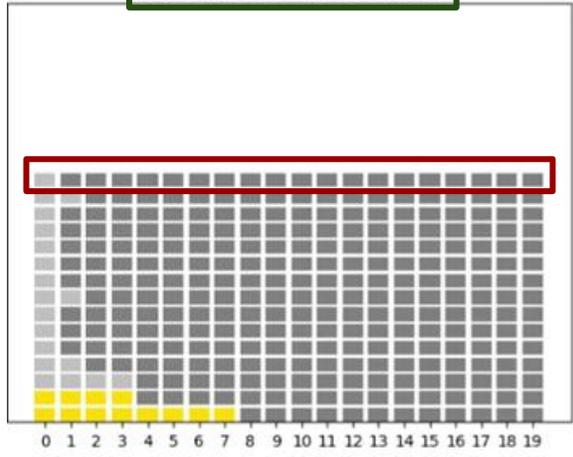


**Compute-1**  
VCPUS: 12 GOLD and 18 SILVER



# ACTiManager.Internal

**Compute-1**  
VCPUS: 12 GOLD and 19 SILVER

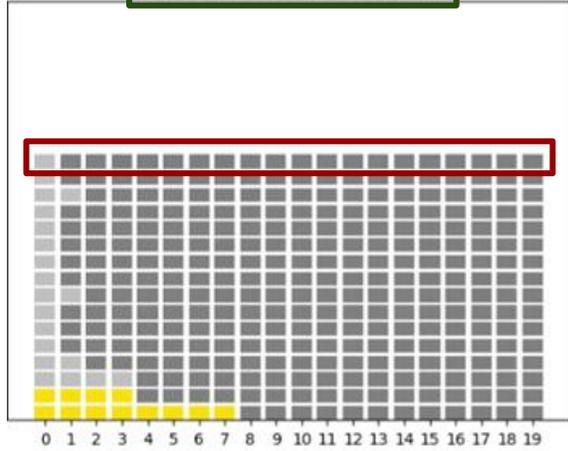


# ACTiManager.Internal



## Compute-1

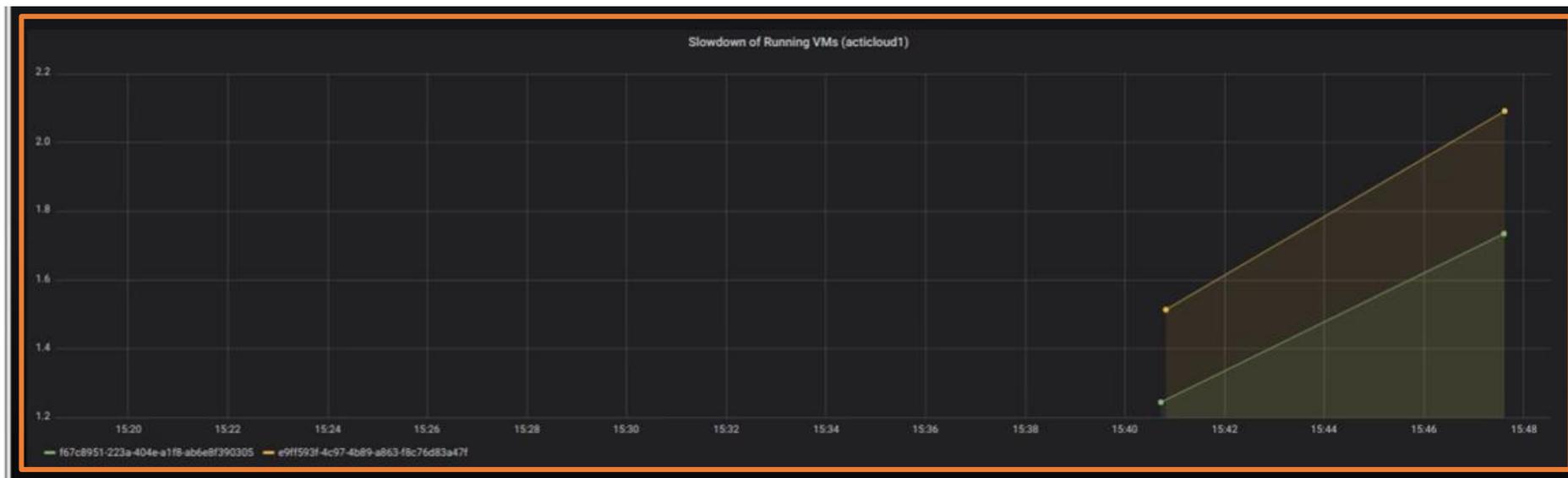
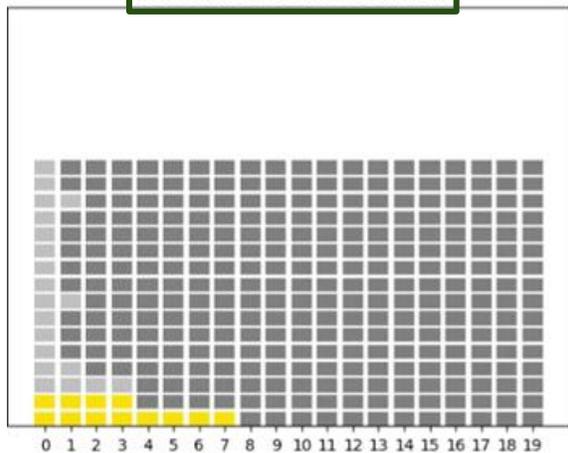
VCPUS: 12 GOLD and 20 SILVER



# ACTiManager.Internal

## Compute-1

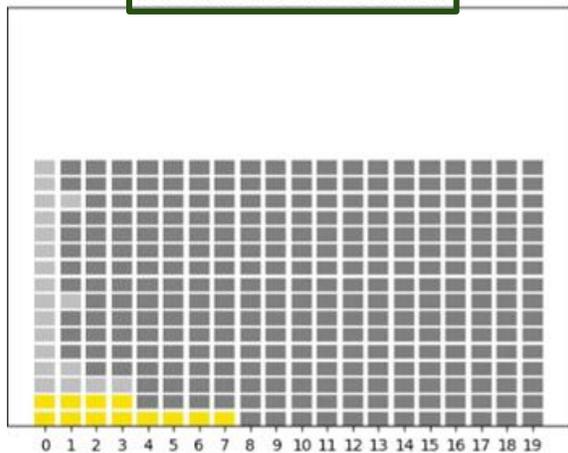
VCPUS: 12 GOLD and 20 SILVER



# ACTiManager.Internal

## Compute-1

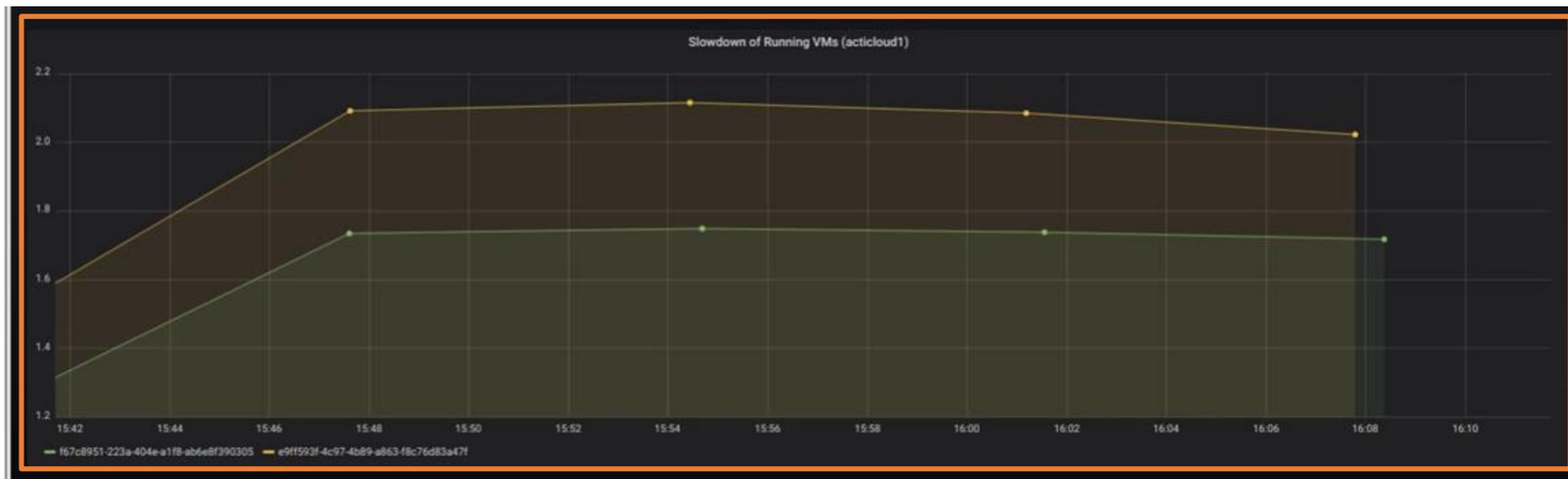
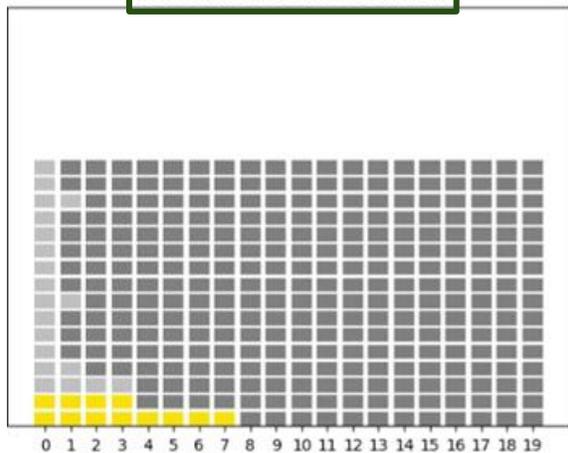
VCPUS: 12 GOLD and 20 SILVER



# ACTiManager.Internal

## Compute-1

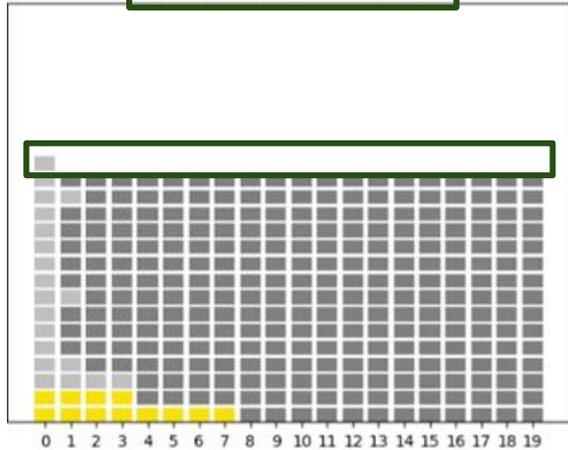
VCPUS: 12 GOLD and 20 SILVER



# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



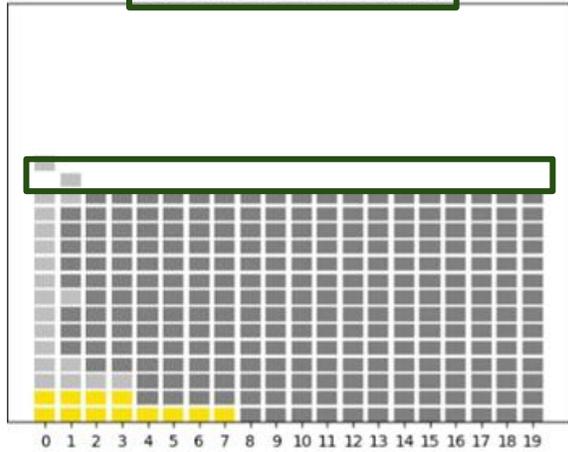
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



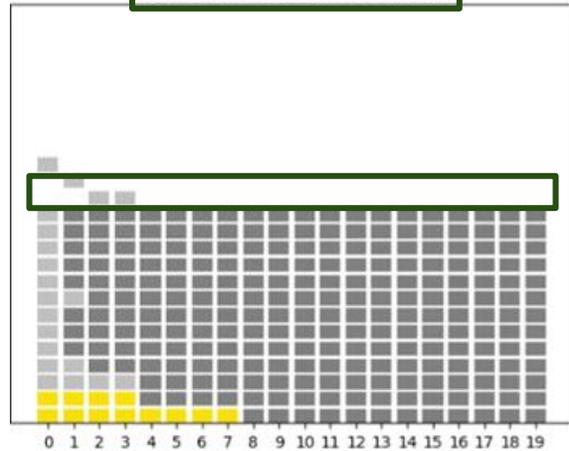
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



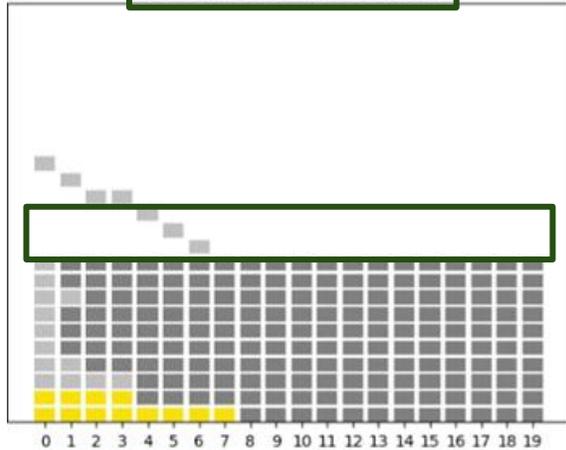
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



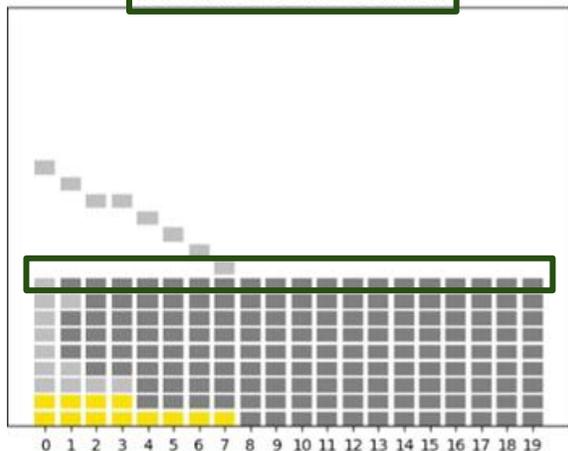
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



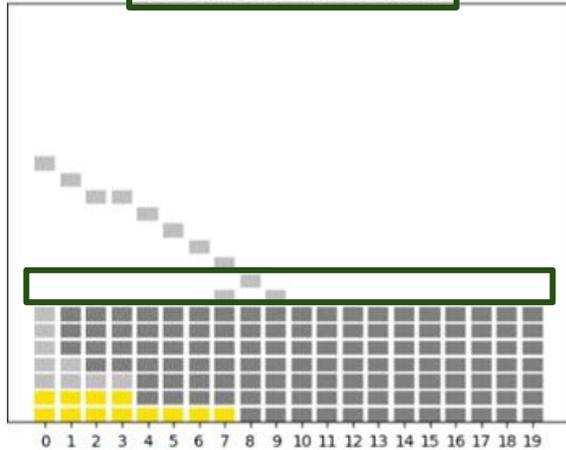
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



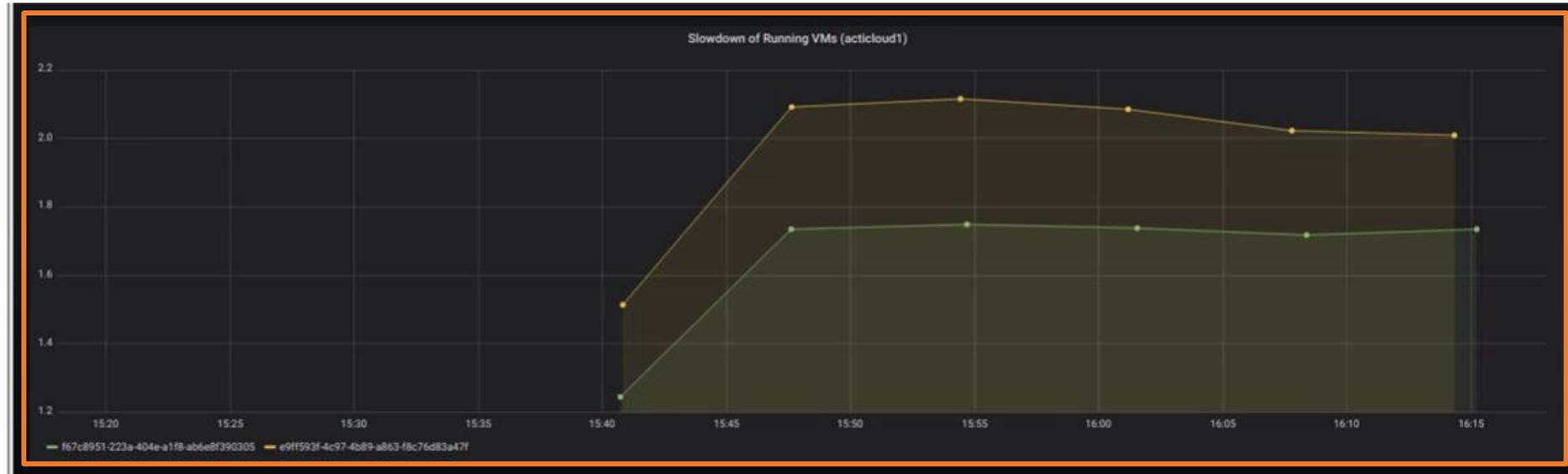
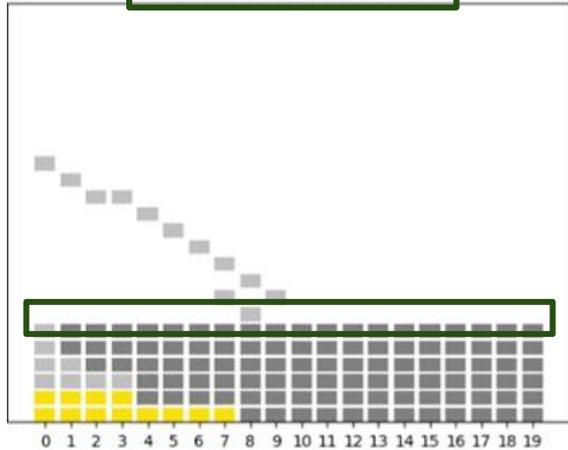
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



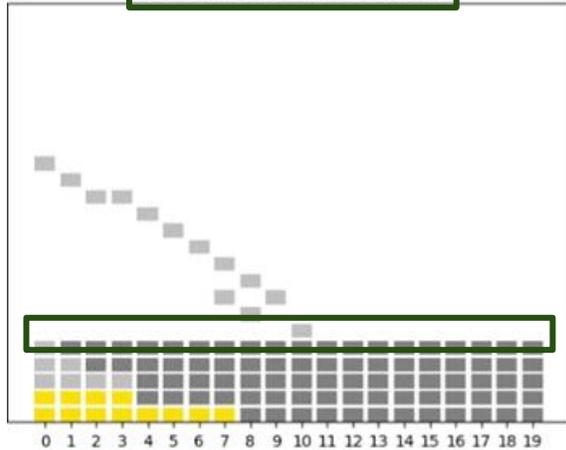
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



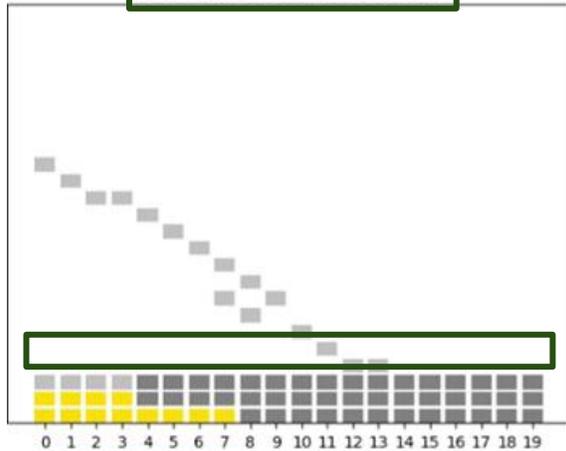
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



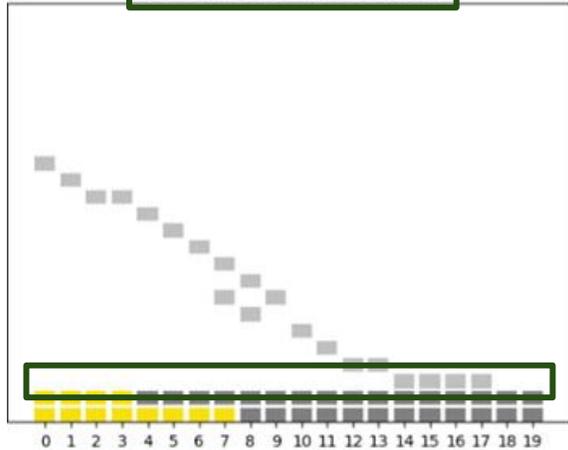
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



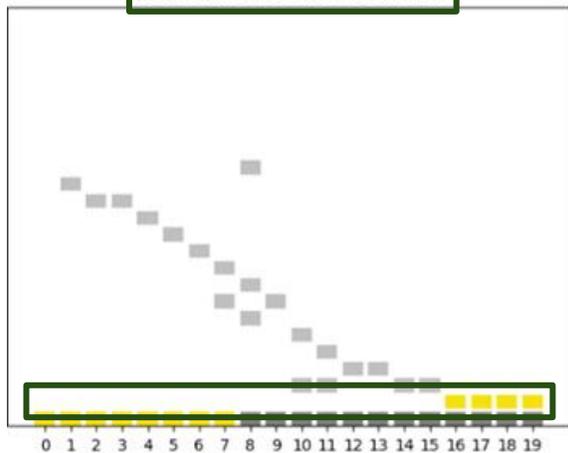
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



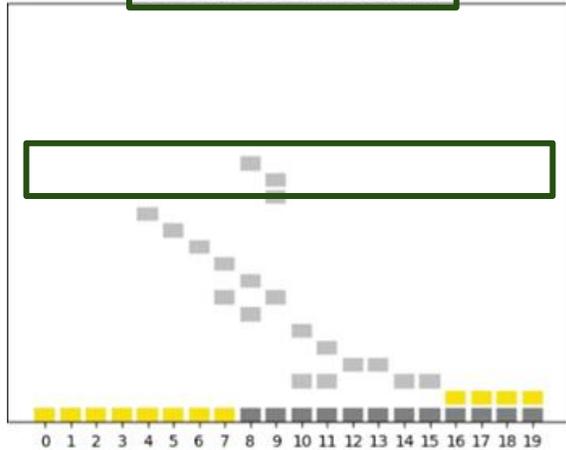
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



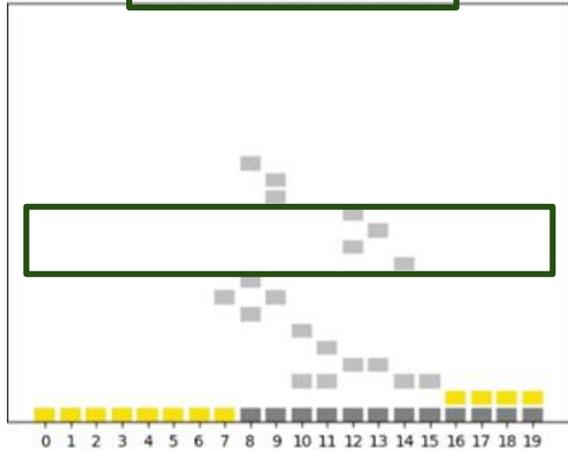
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

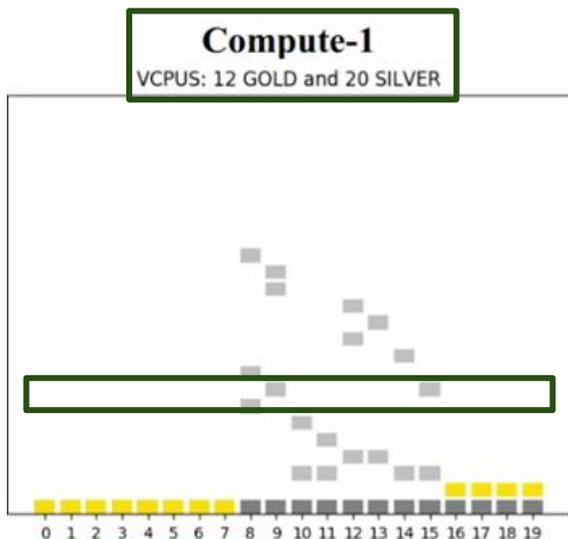
VCPUS: 12 GOLD and 20 SILVER



ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal



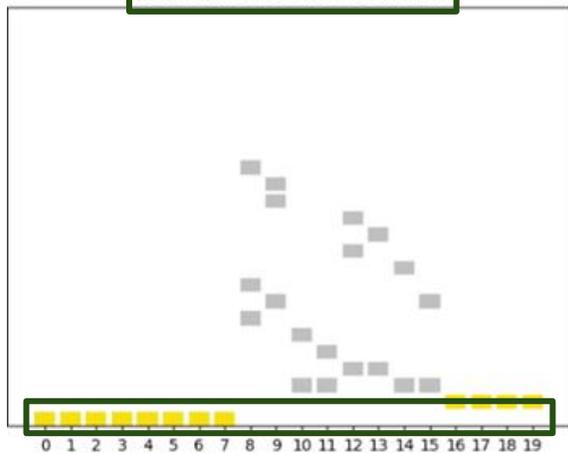
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



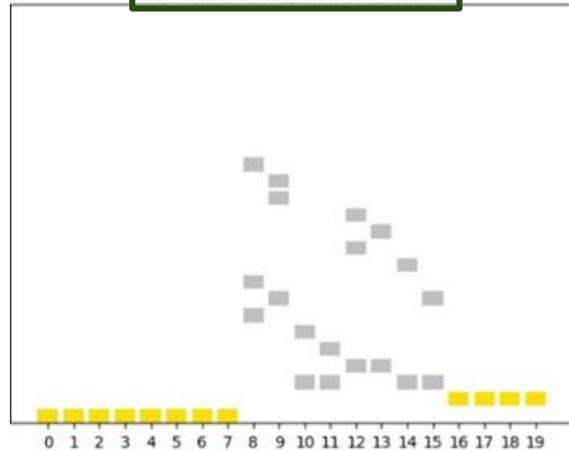
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



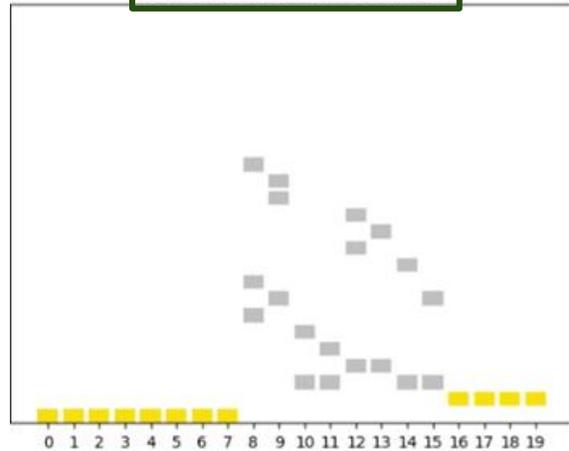
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



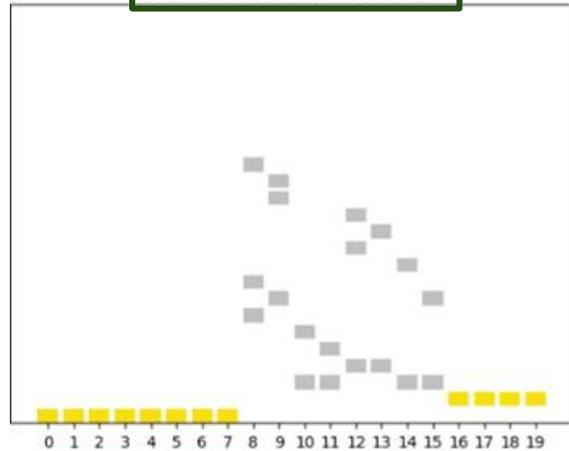
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



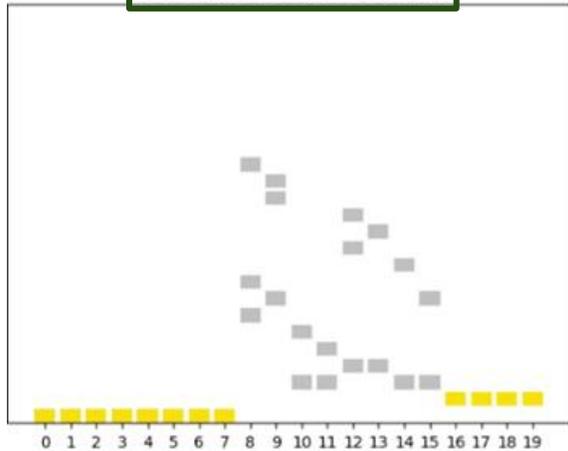
### ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



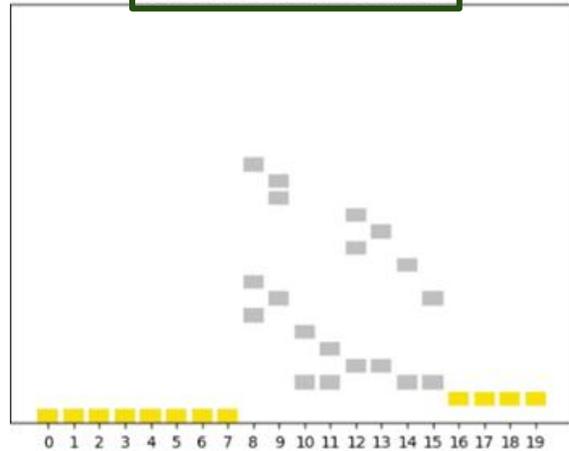
ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs

# ACTiManager.Internal

## Compute-1

VCPUS: 12 GOLD and 20 SILVER



ACTiManager.Internal:

- Pins the VMs' virtual cpus to servers' physical cpus
- Considers VMs' **prioritization** - Gold/Silver VMs
- Considers VMs' **characterization** - Noisy/Quiet and Sensitive/Insensitive VMs