

# CoSpot: A Cooperative VM Allocation Framework for Increased Revenue from Spot Instances

Syed M. Iqbal<sup>1,2</sup>, Haley Li<sup>2</sup>, Shane Bergsma<sup>3</sup>,  
Ivan Beschastnikh<sup>2</sup>, and Alan J. Hu<sup>2</sup>

<sup>1</sup> Amazon Web Services\*

<sup>2</sup> University of British Columbia

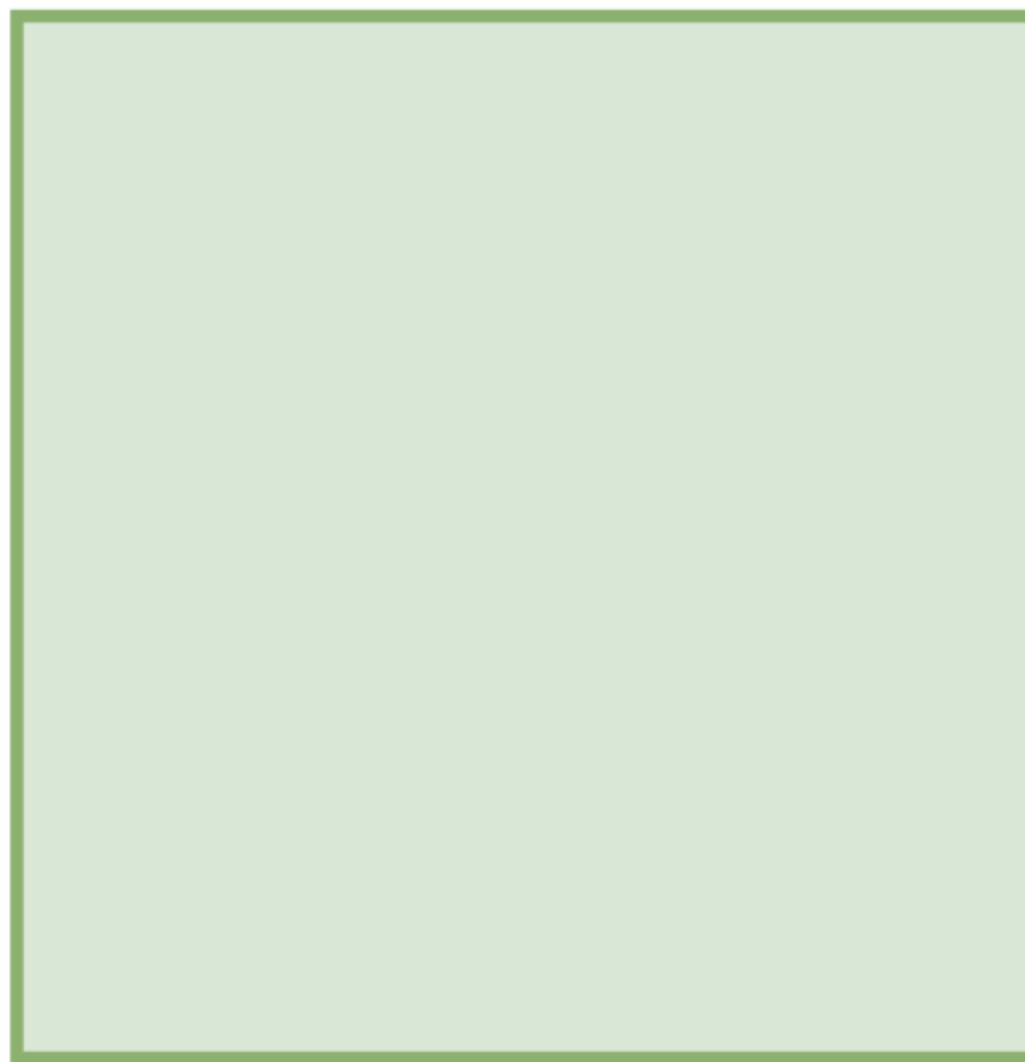
<sup>3</sup> Huawei Cloud, Toronto Research Center

\*Current affiliation. The author was affiliated with the University of British Columbia for this work.

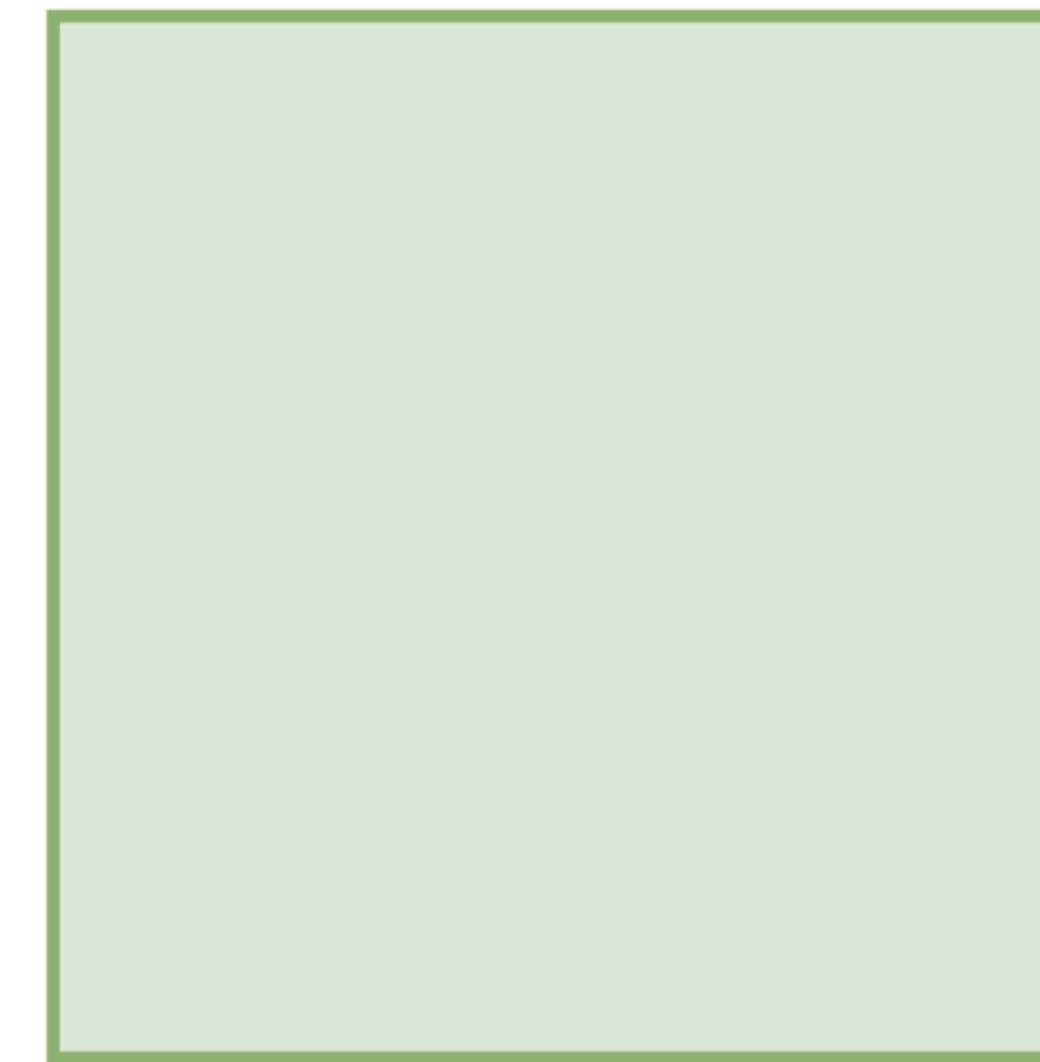
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$s_1$



$s_2$

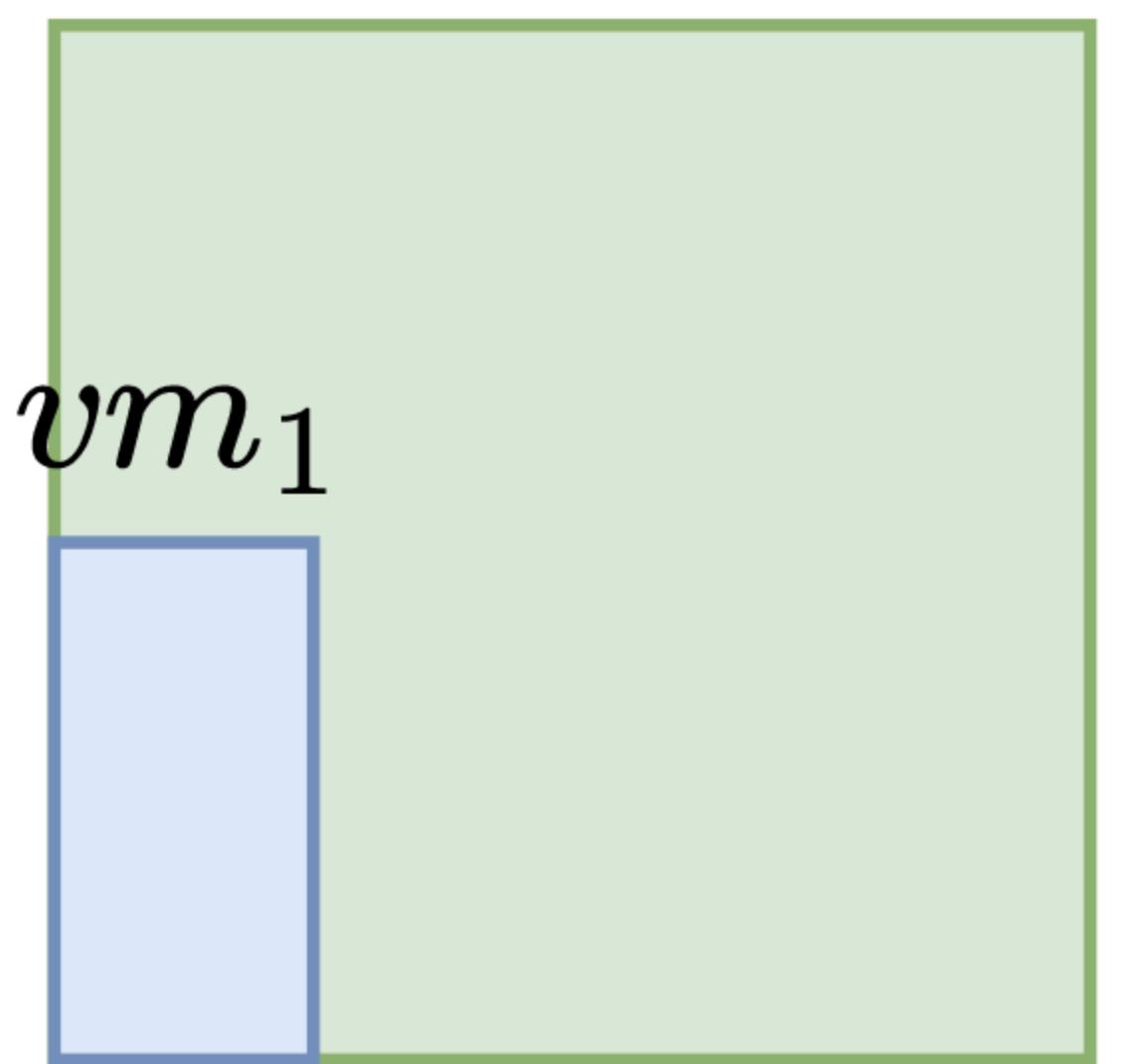


$s_3$

# Background



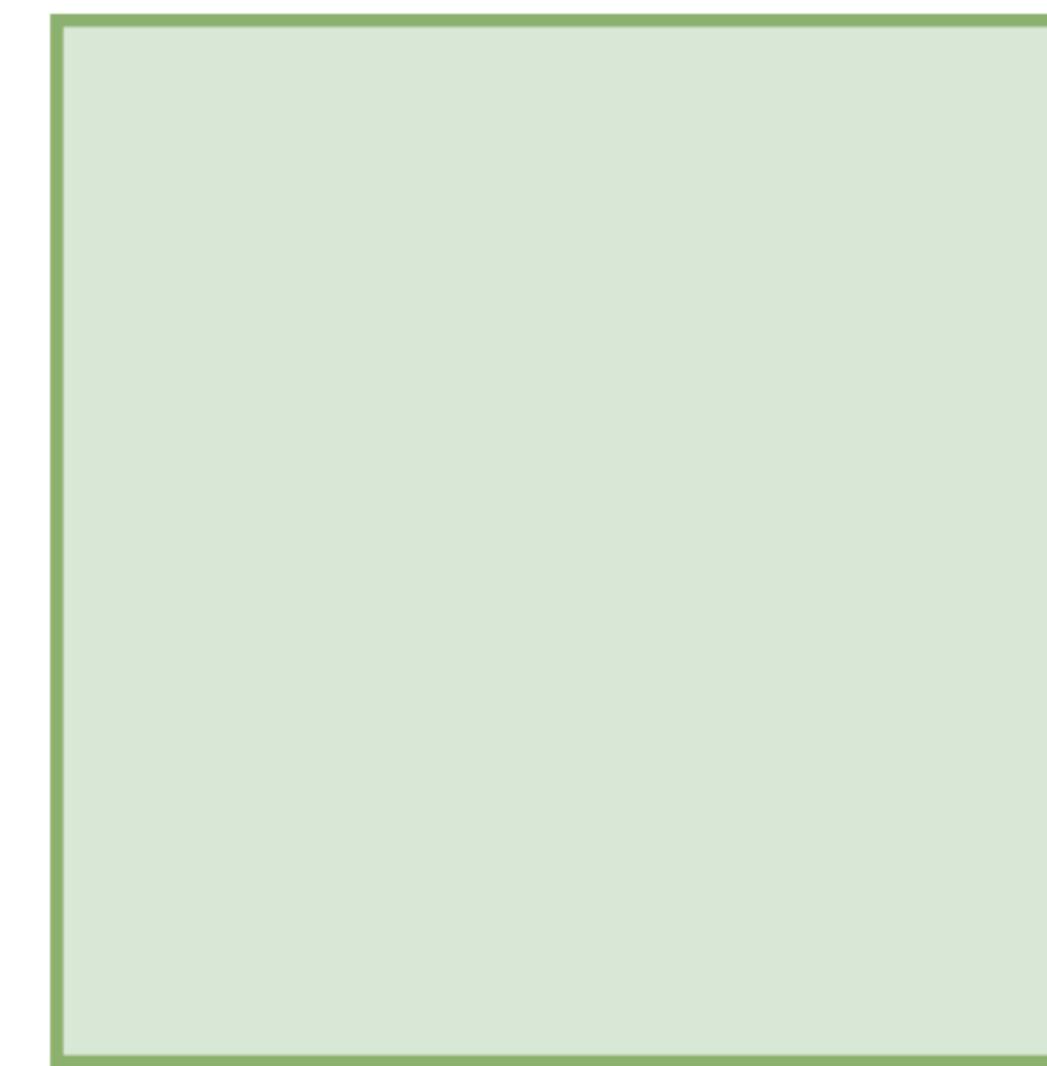
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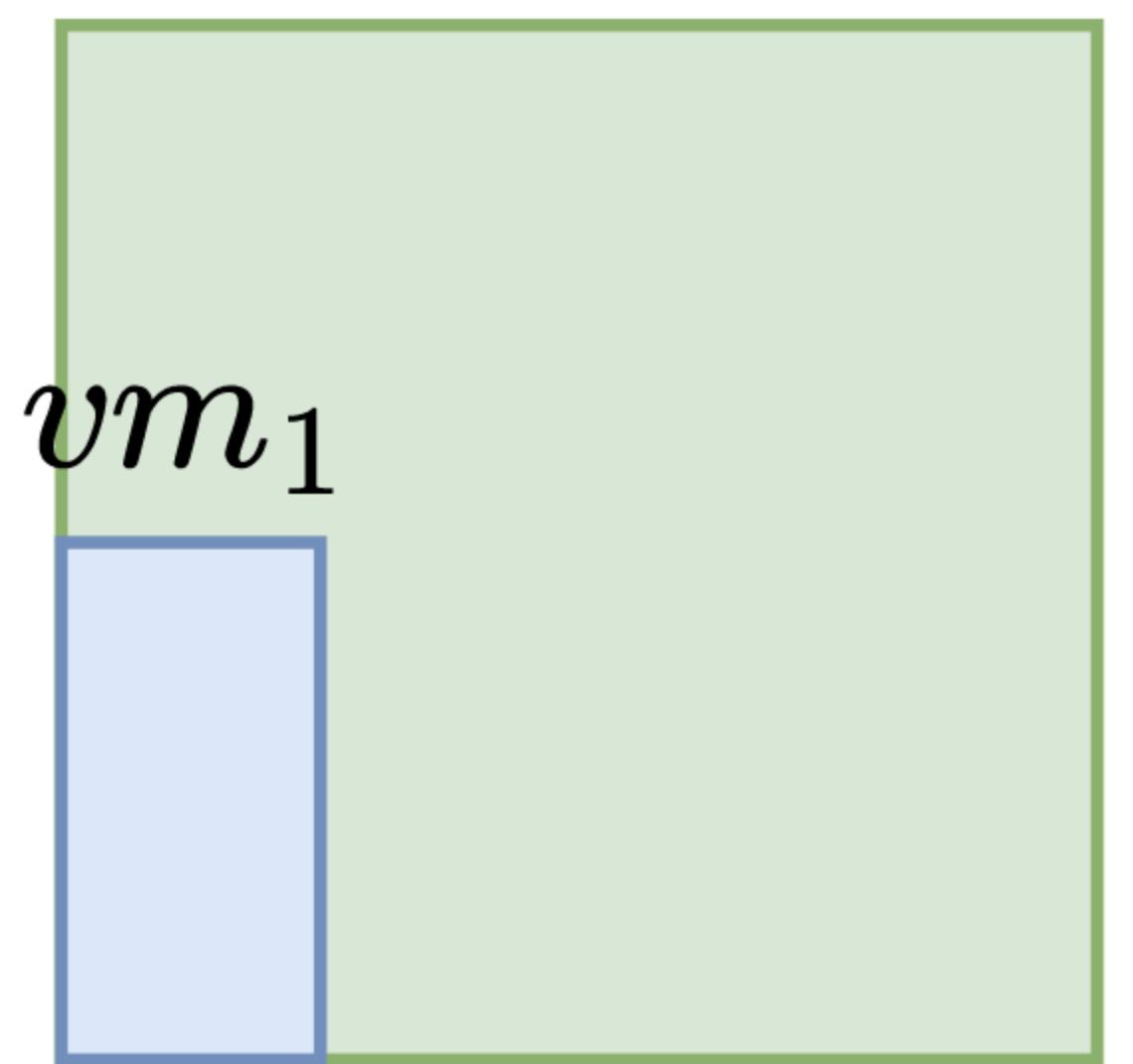


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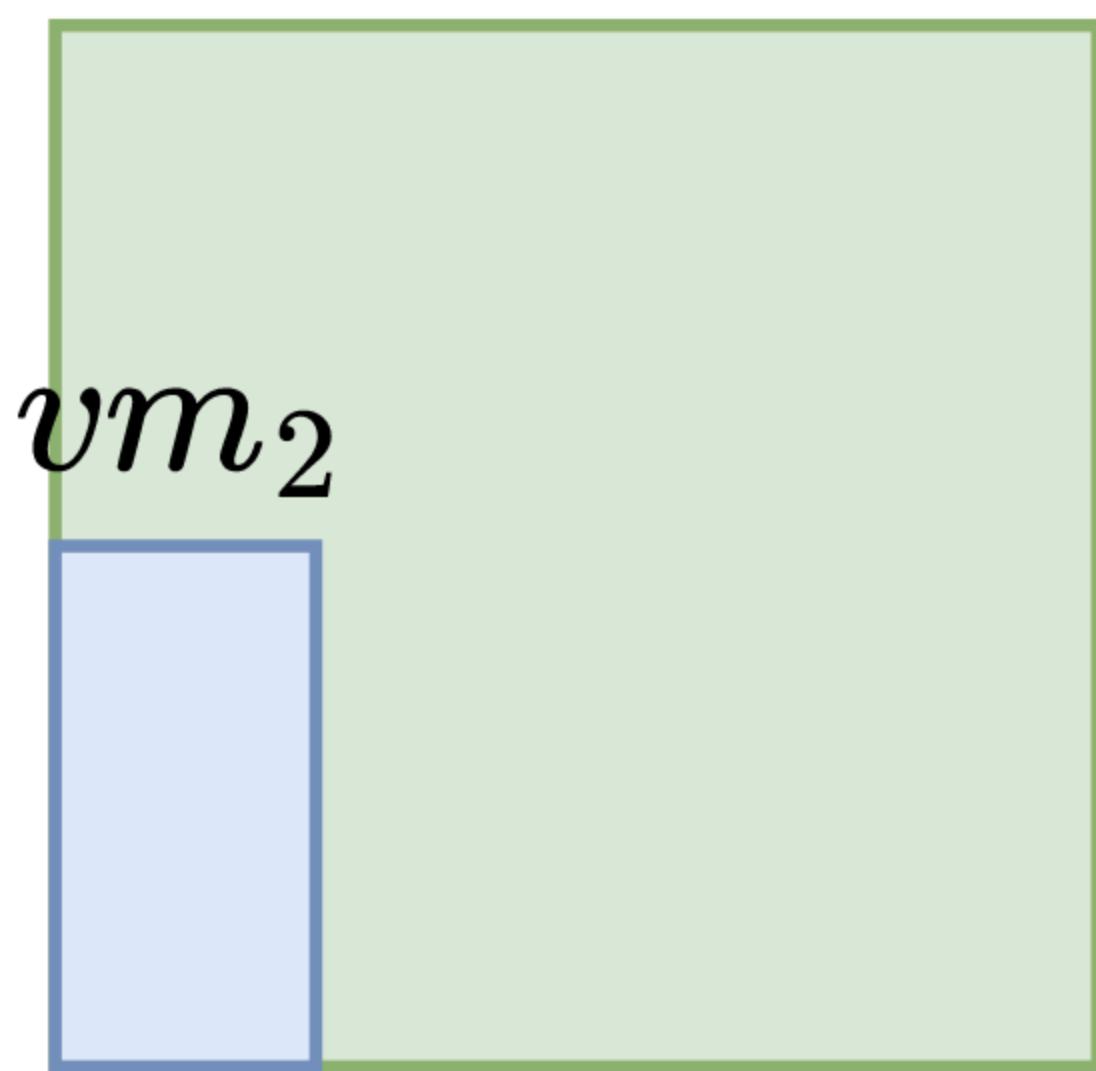
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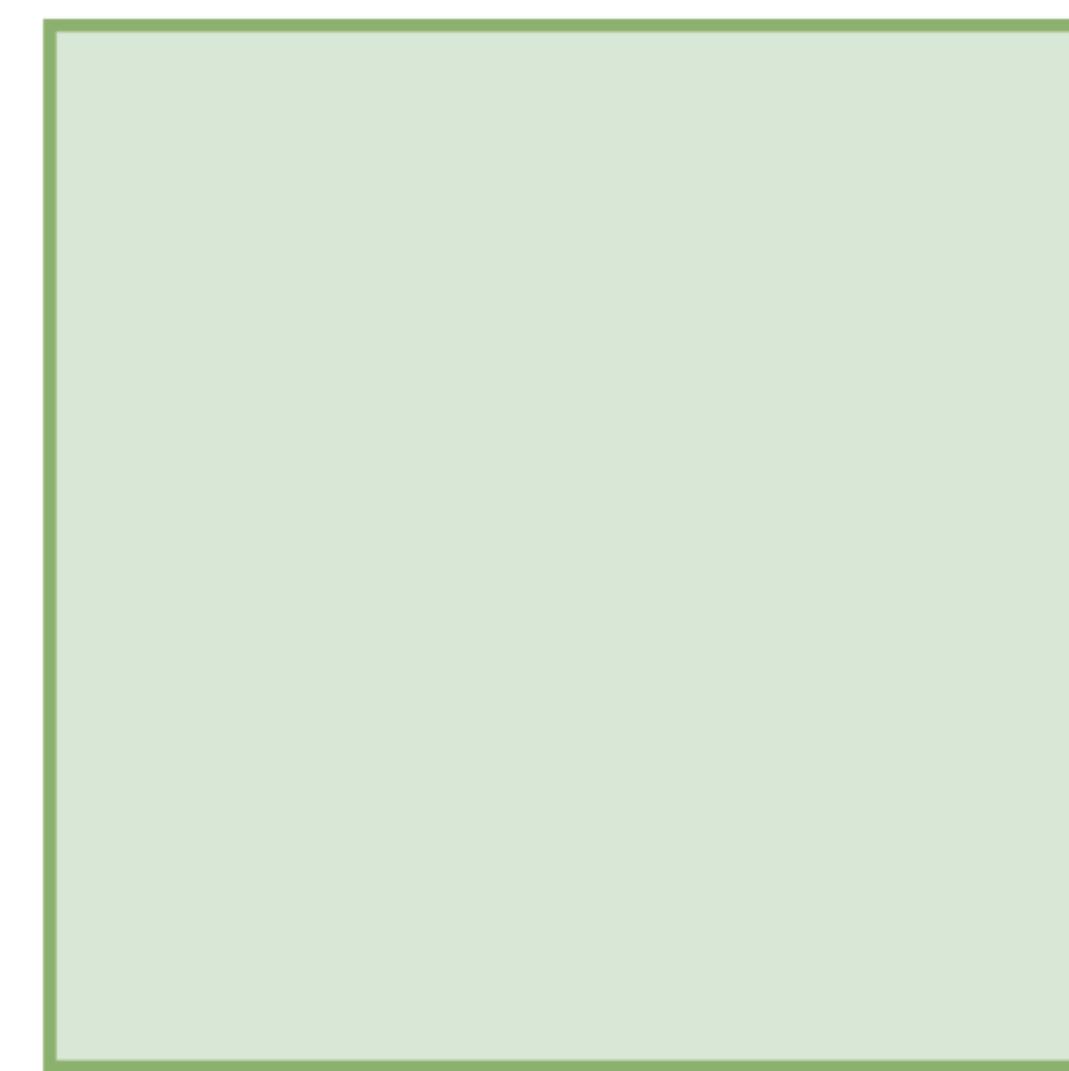
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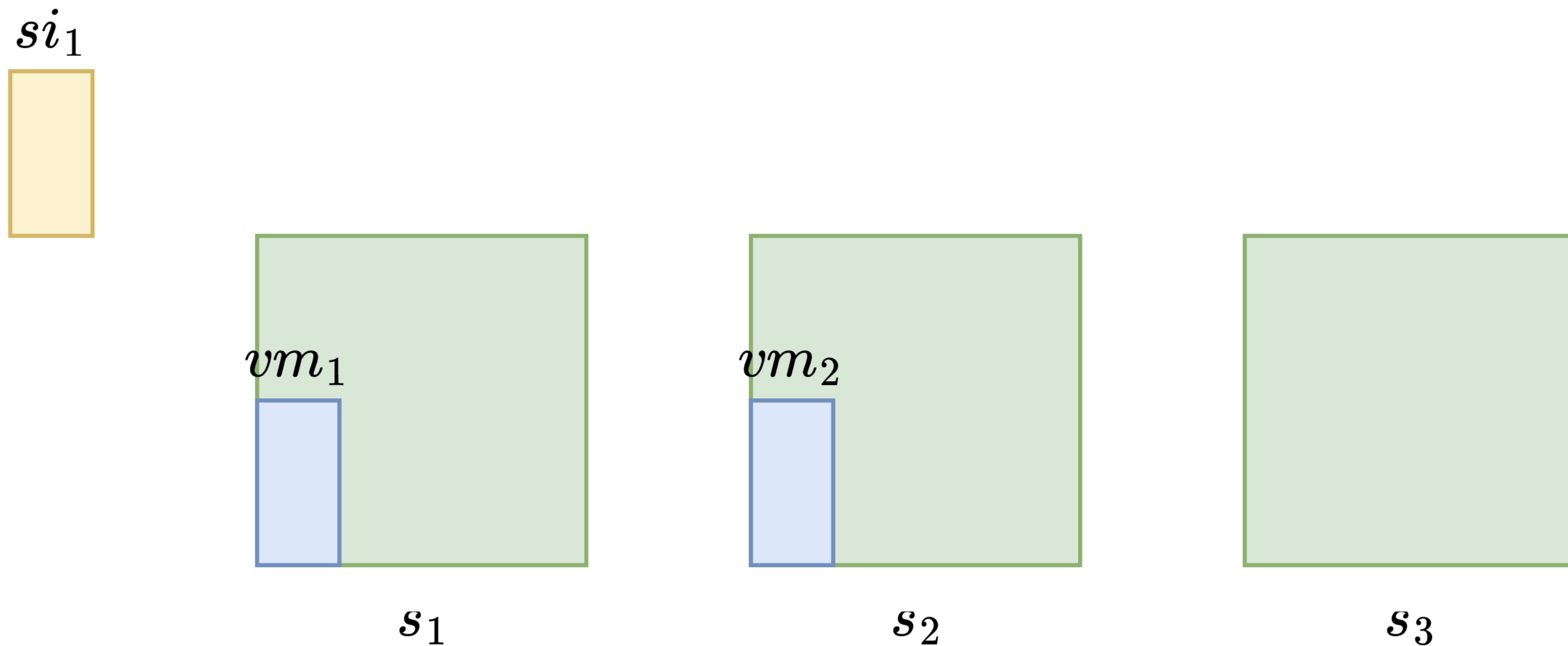


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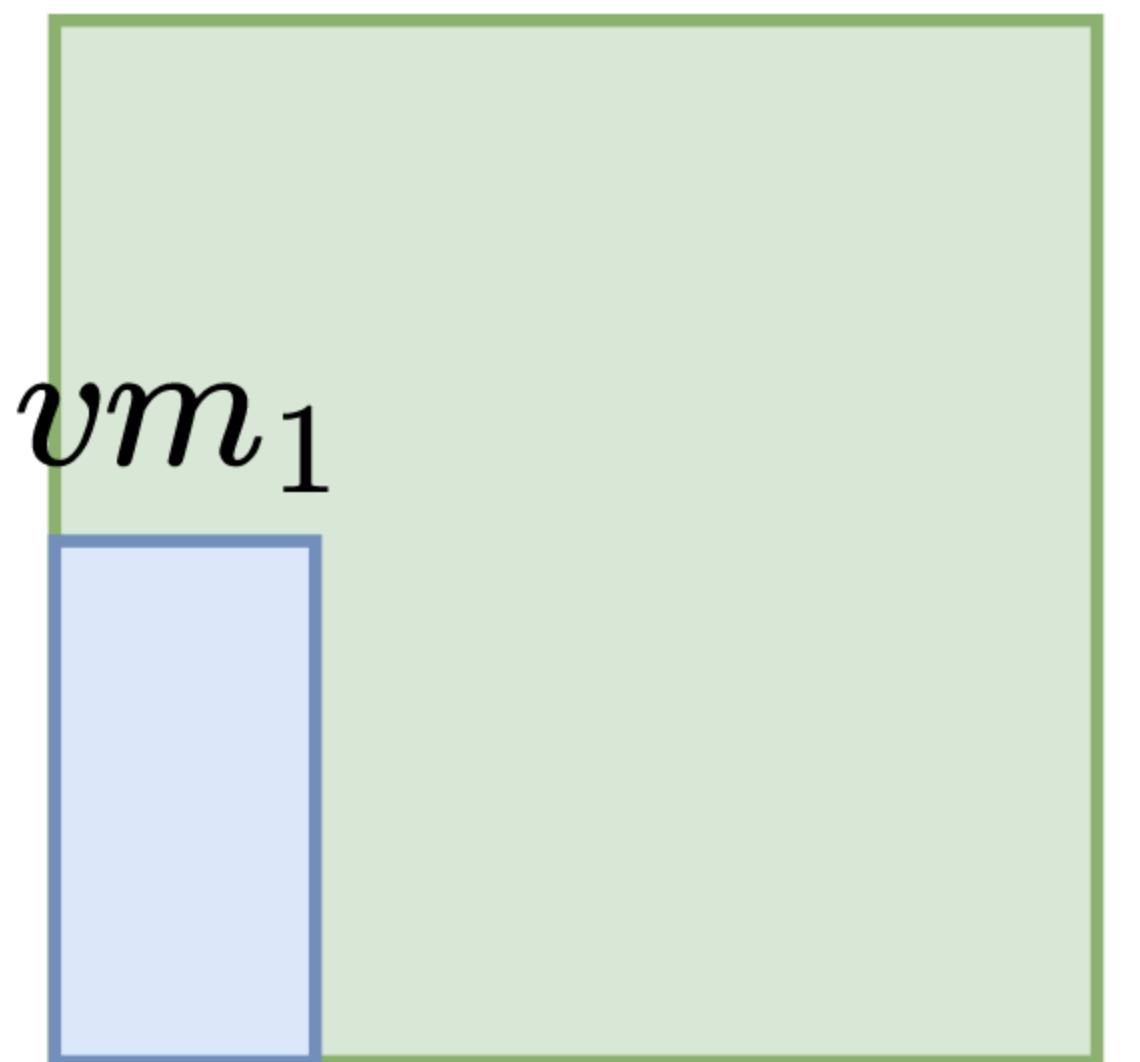


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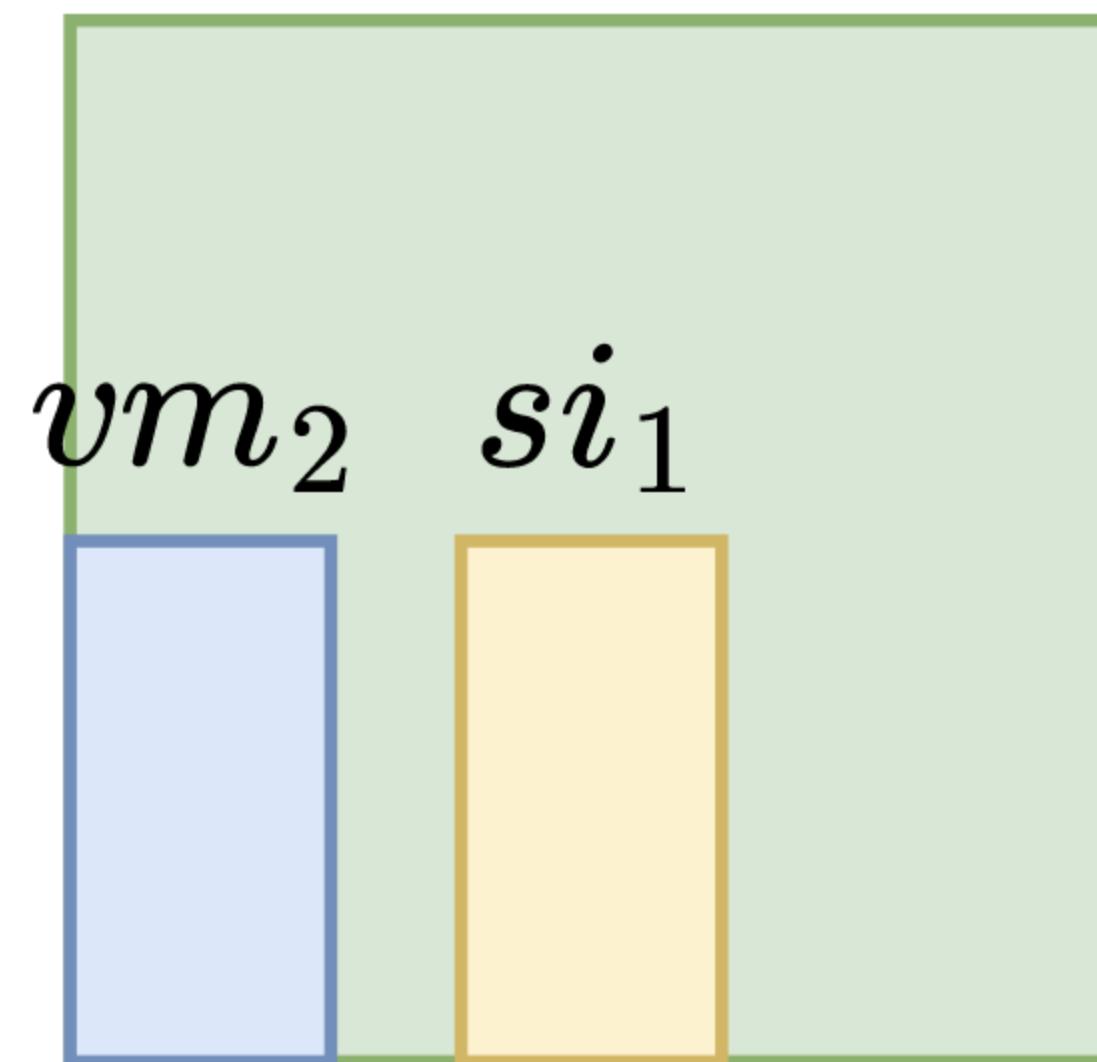
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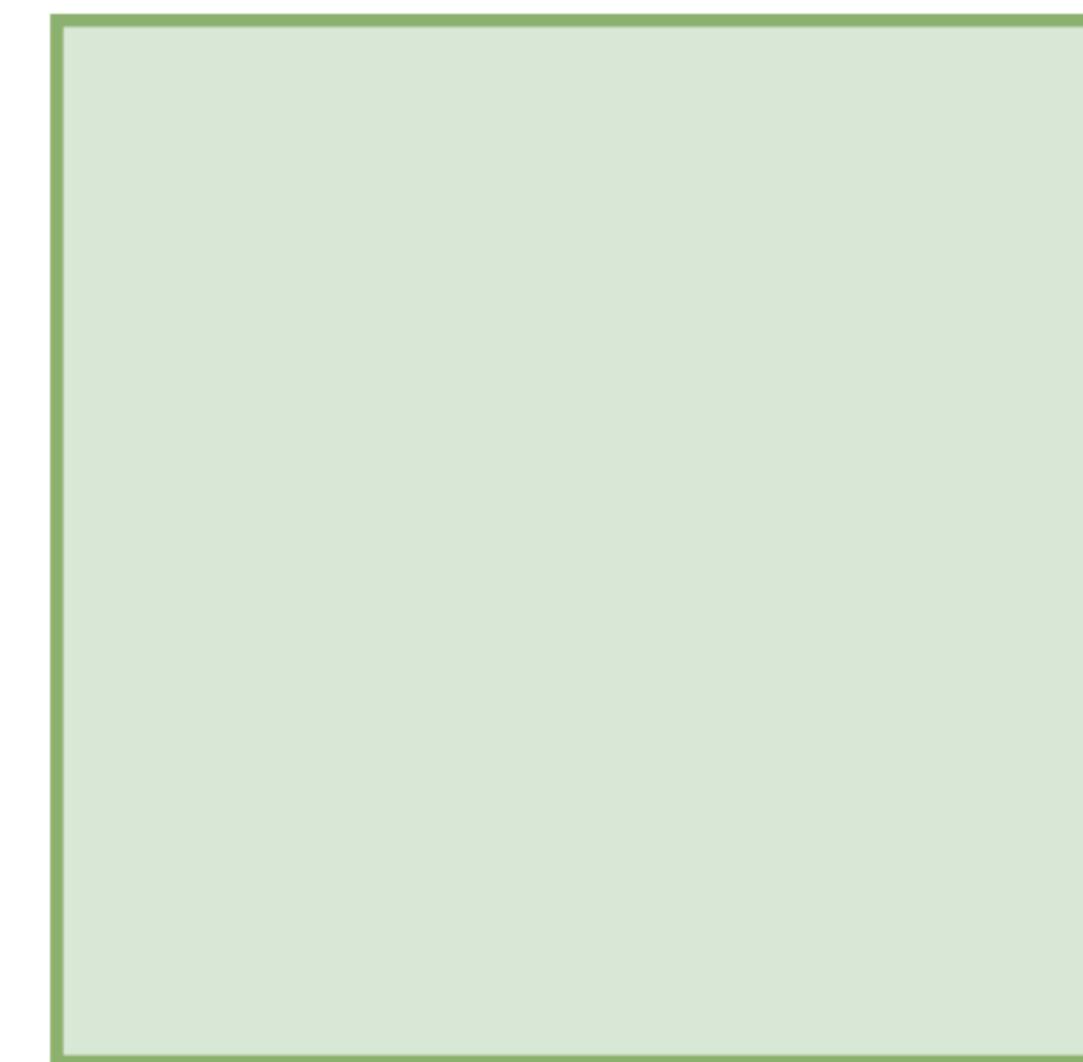
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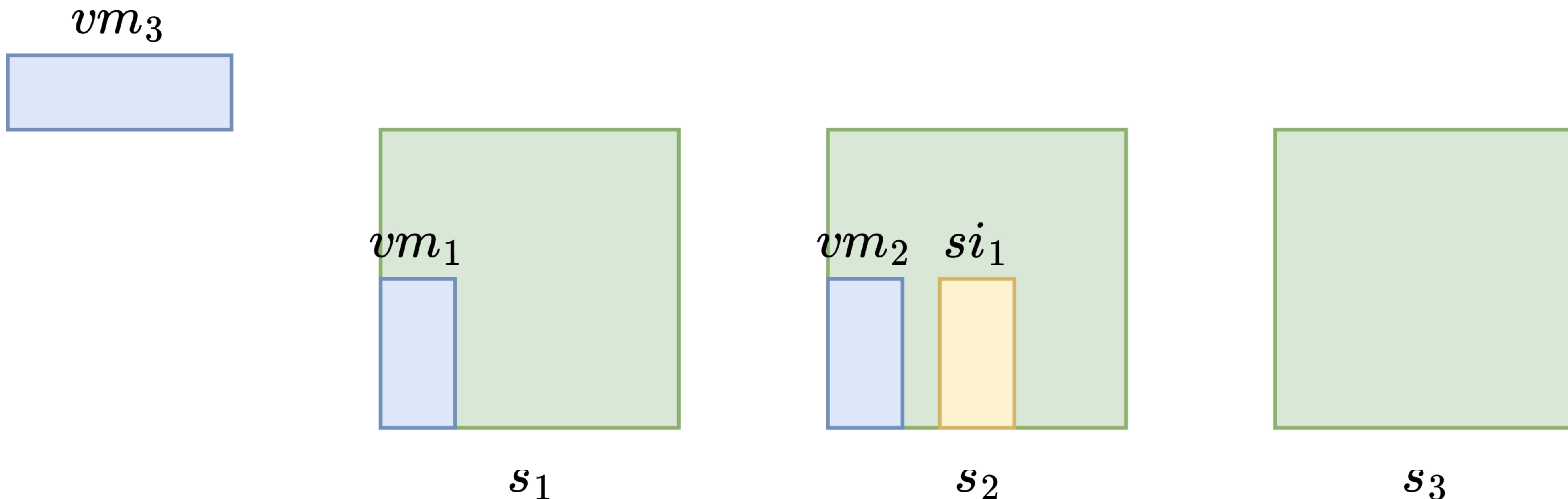


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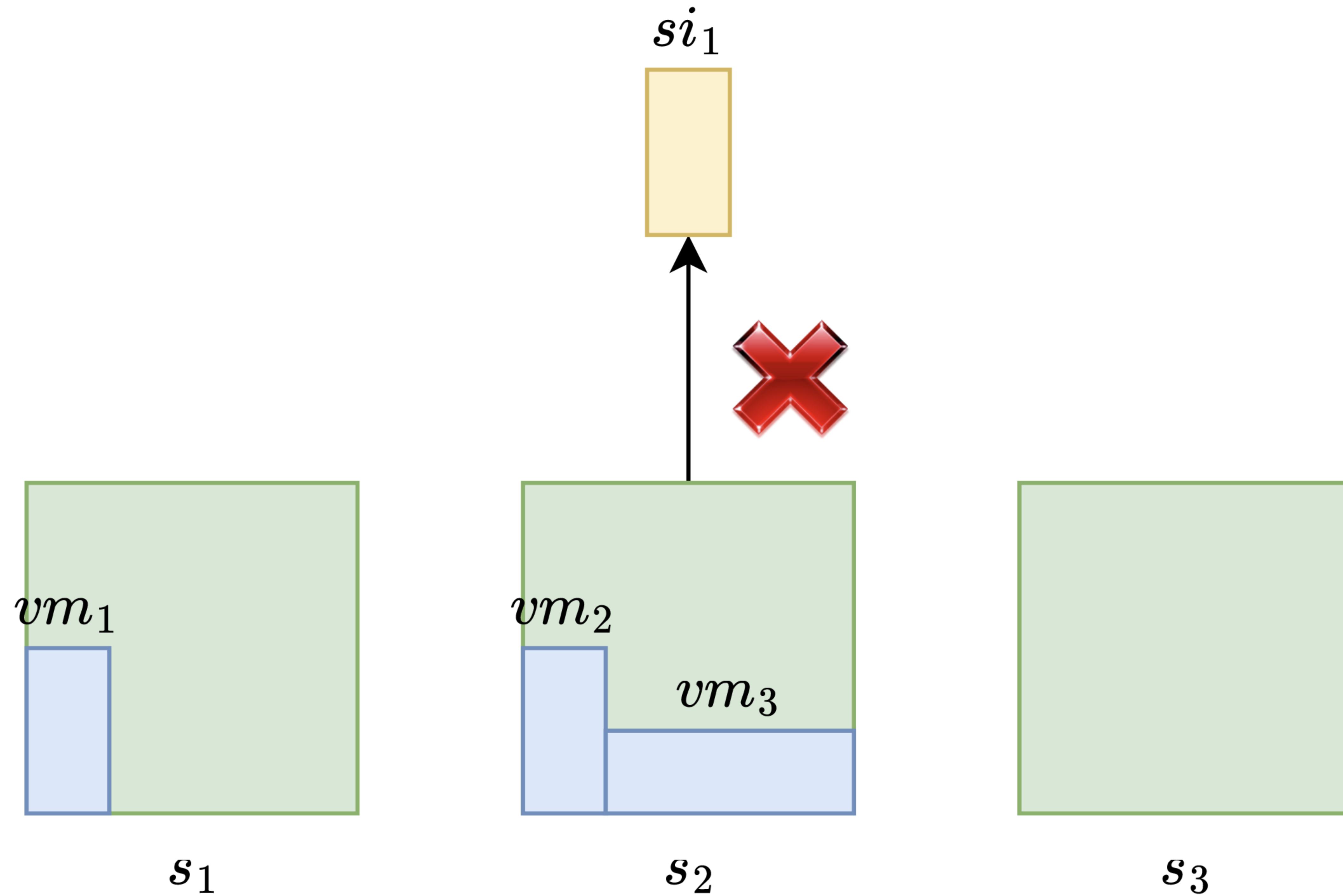


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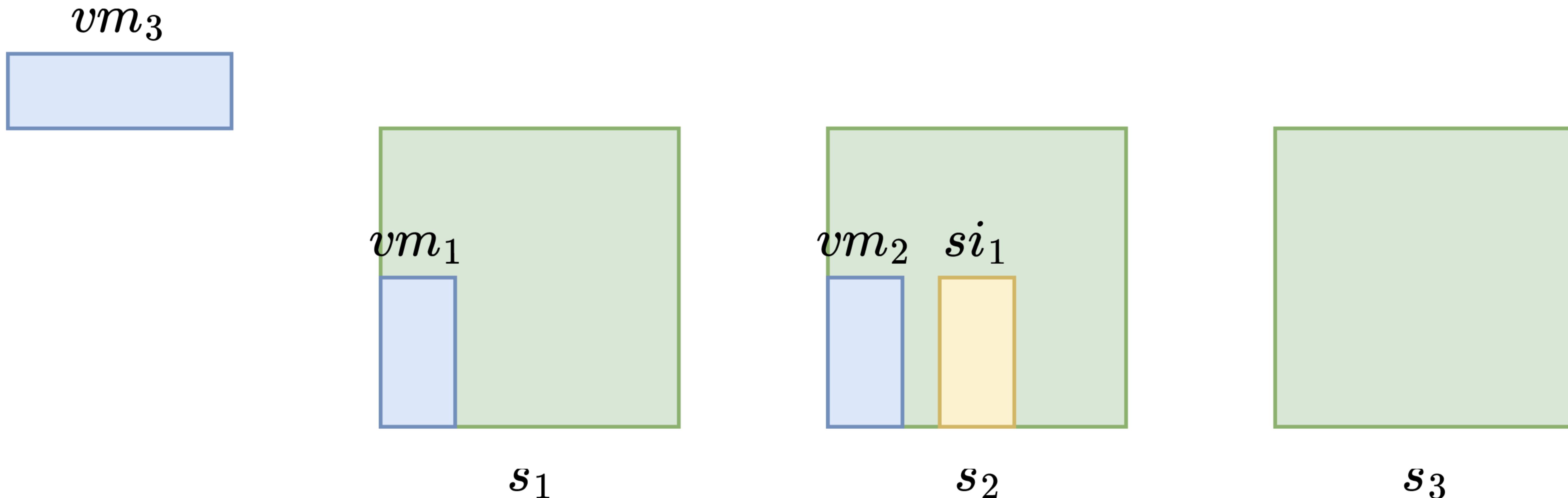
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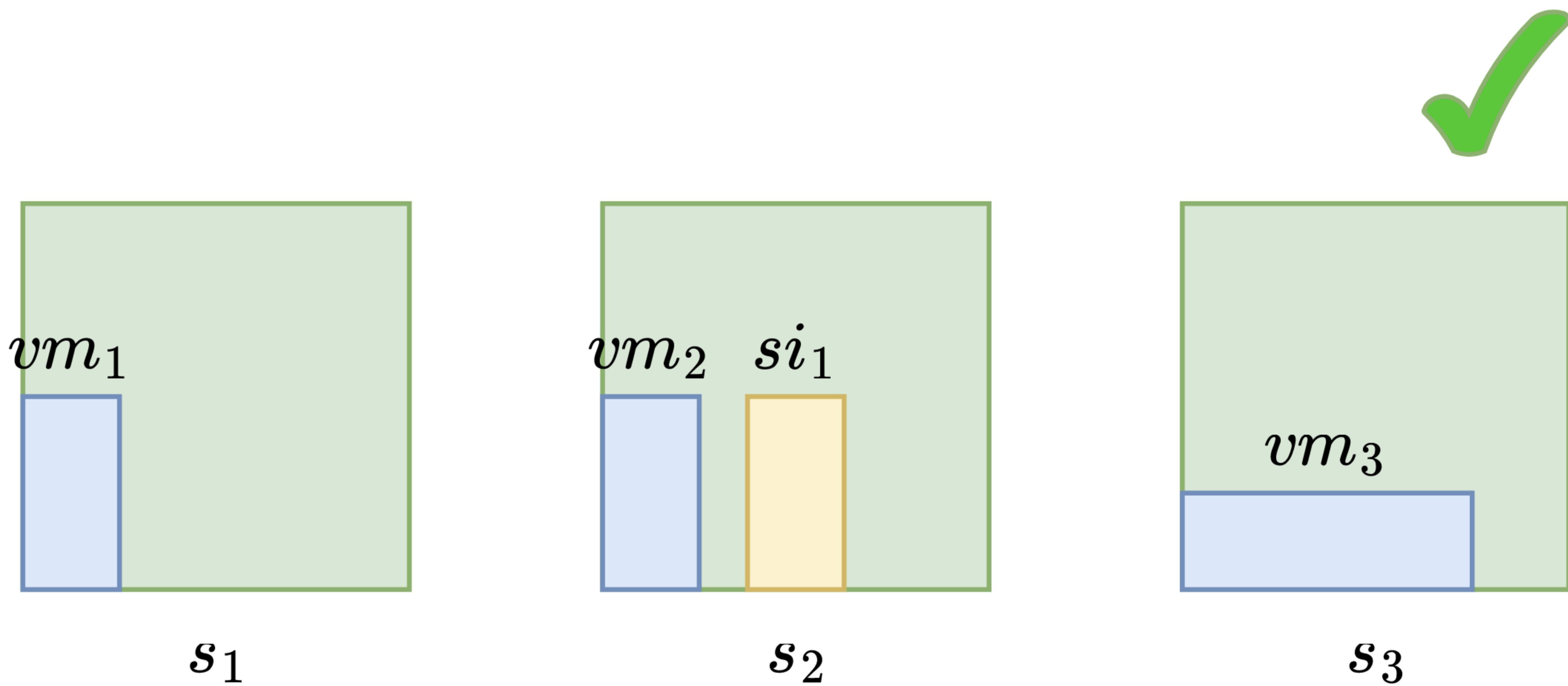
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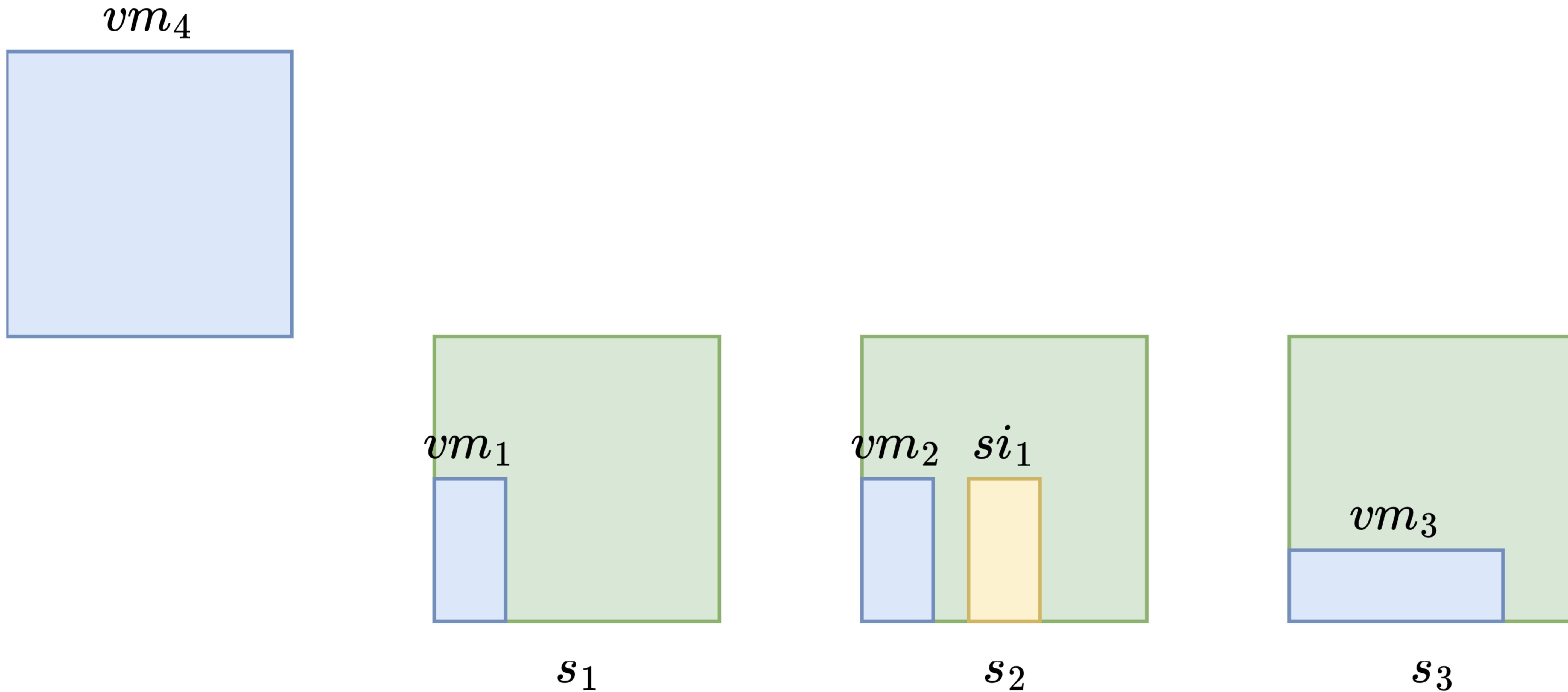
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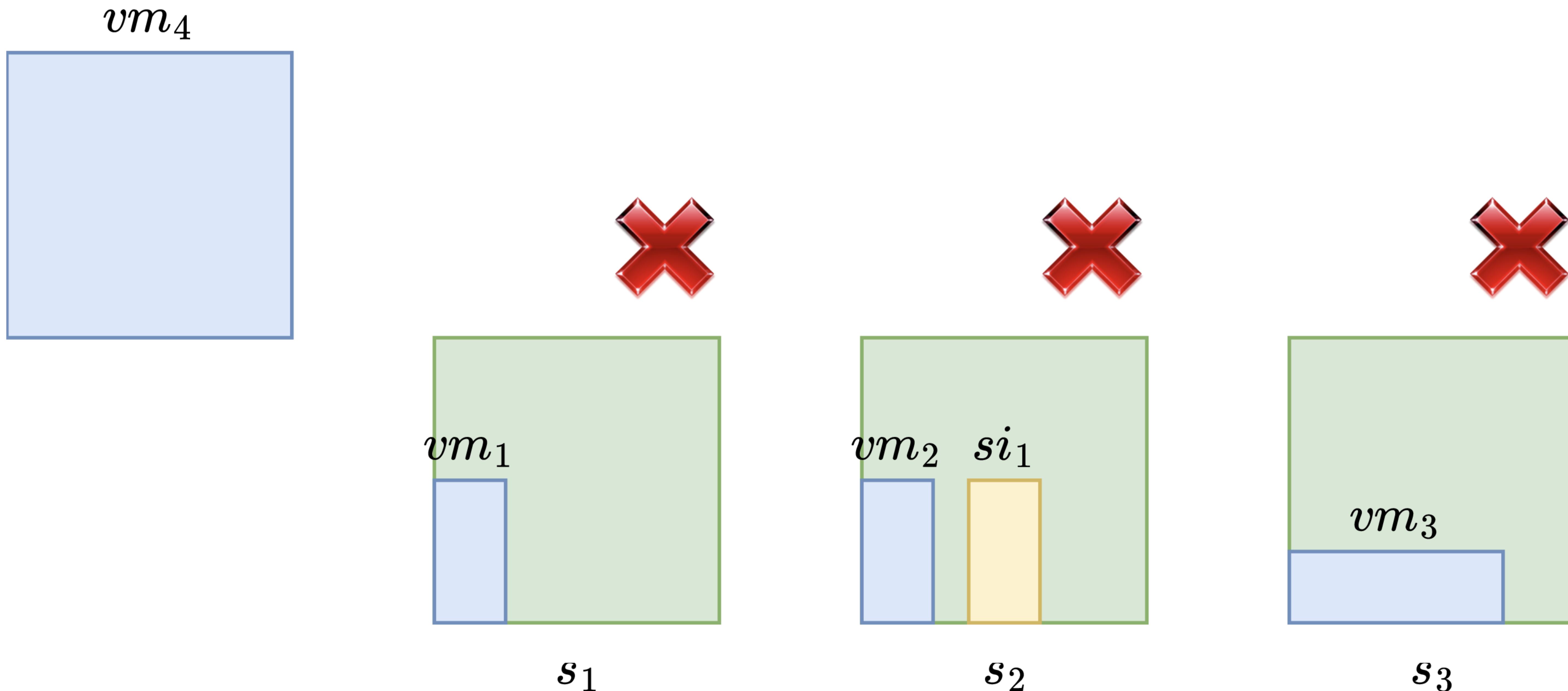
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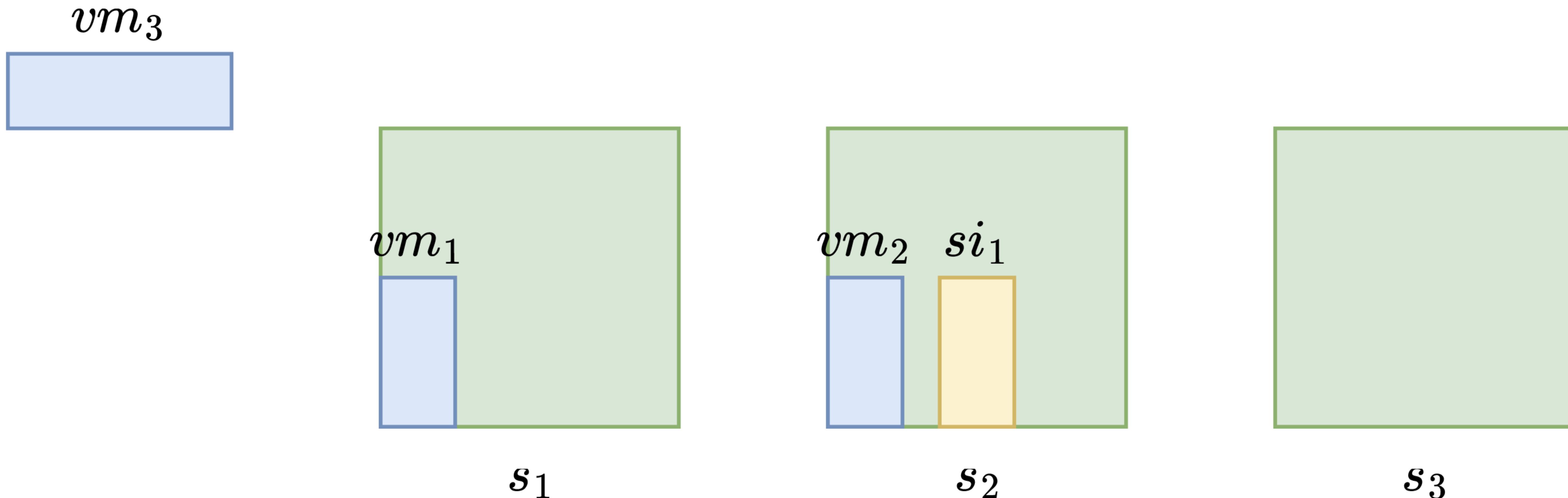
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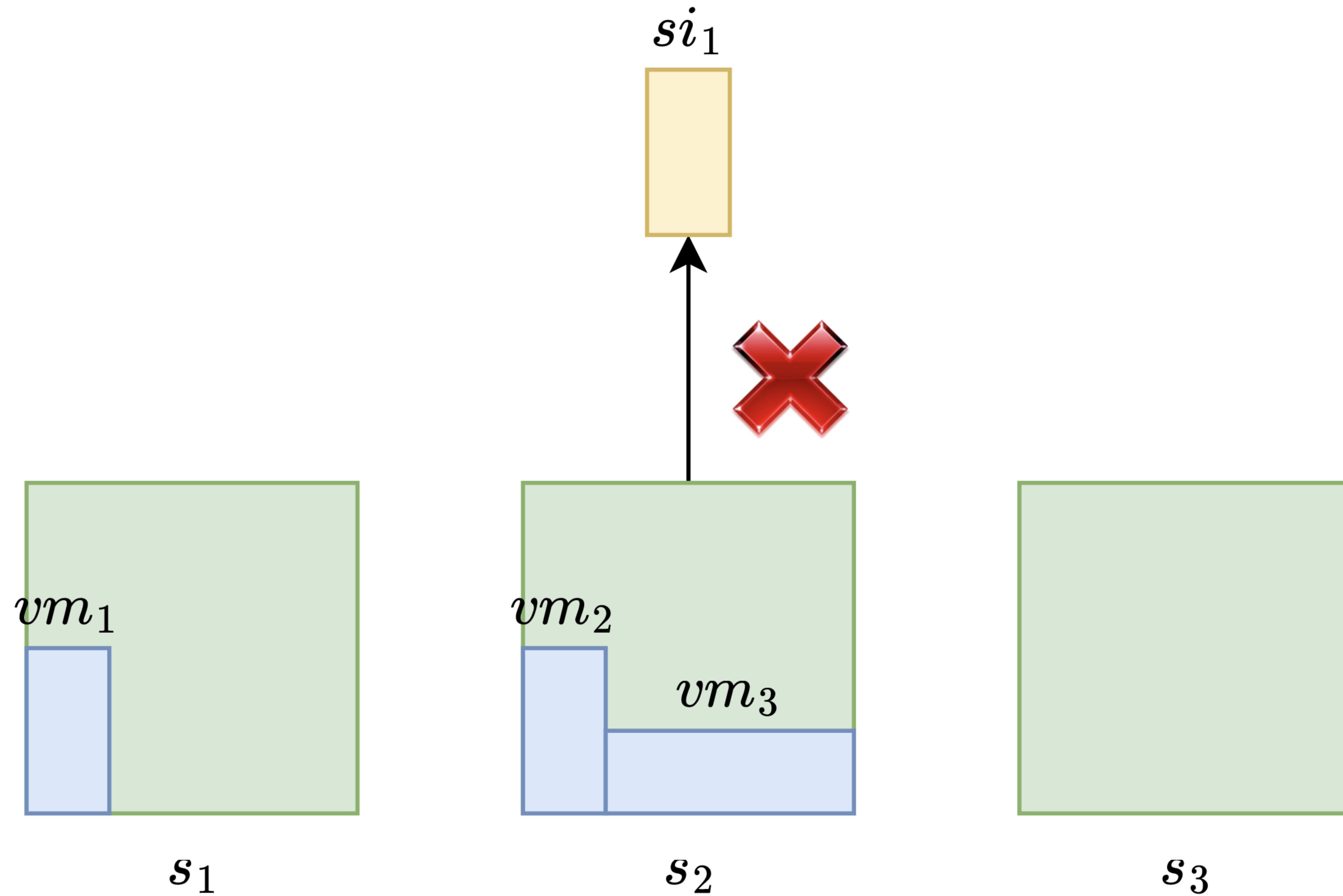
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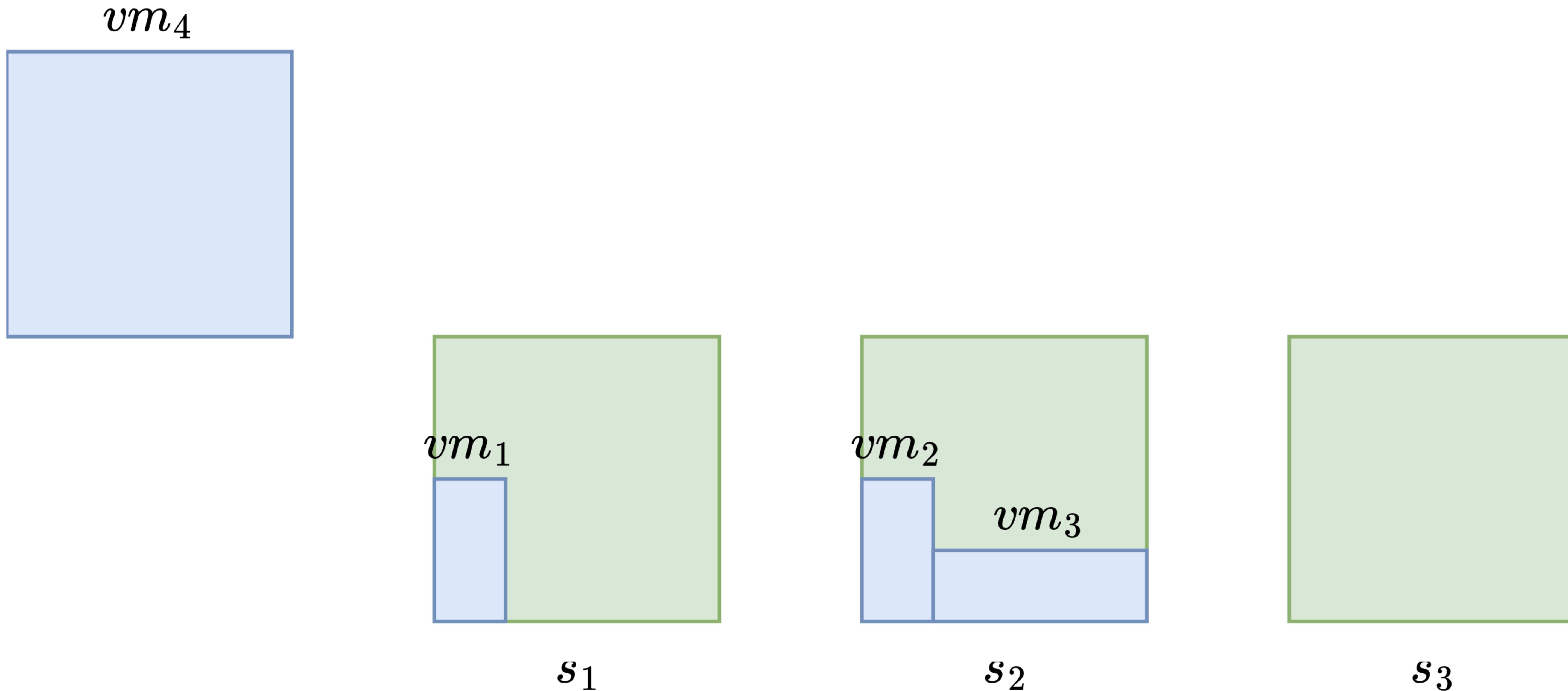
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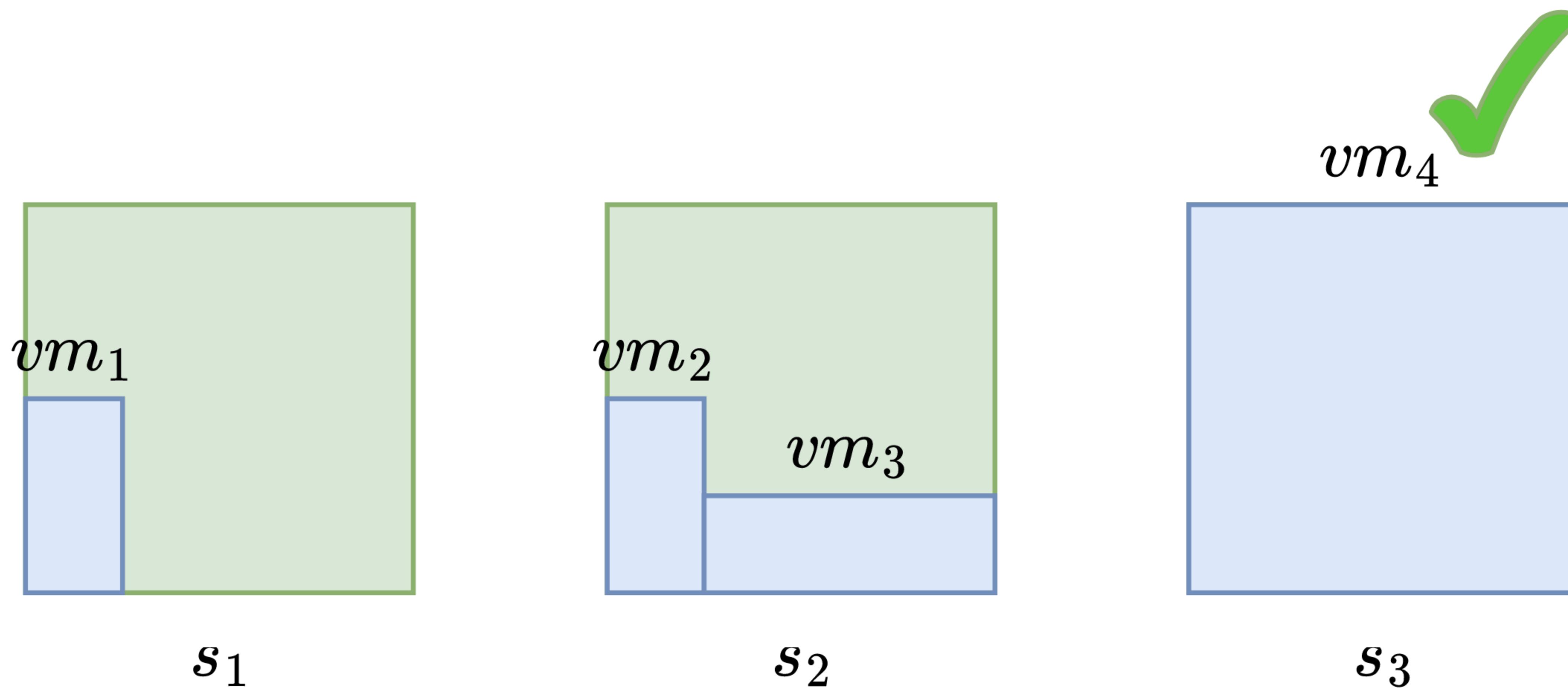
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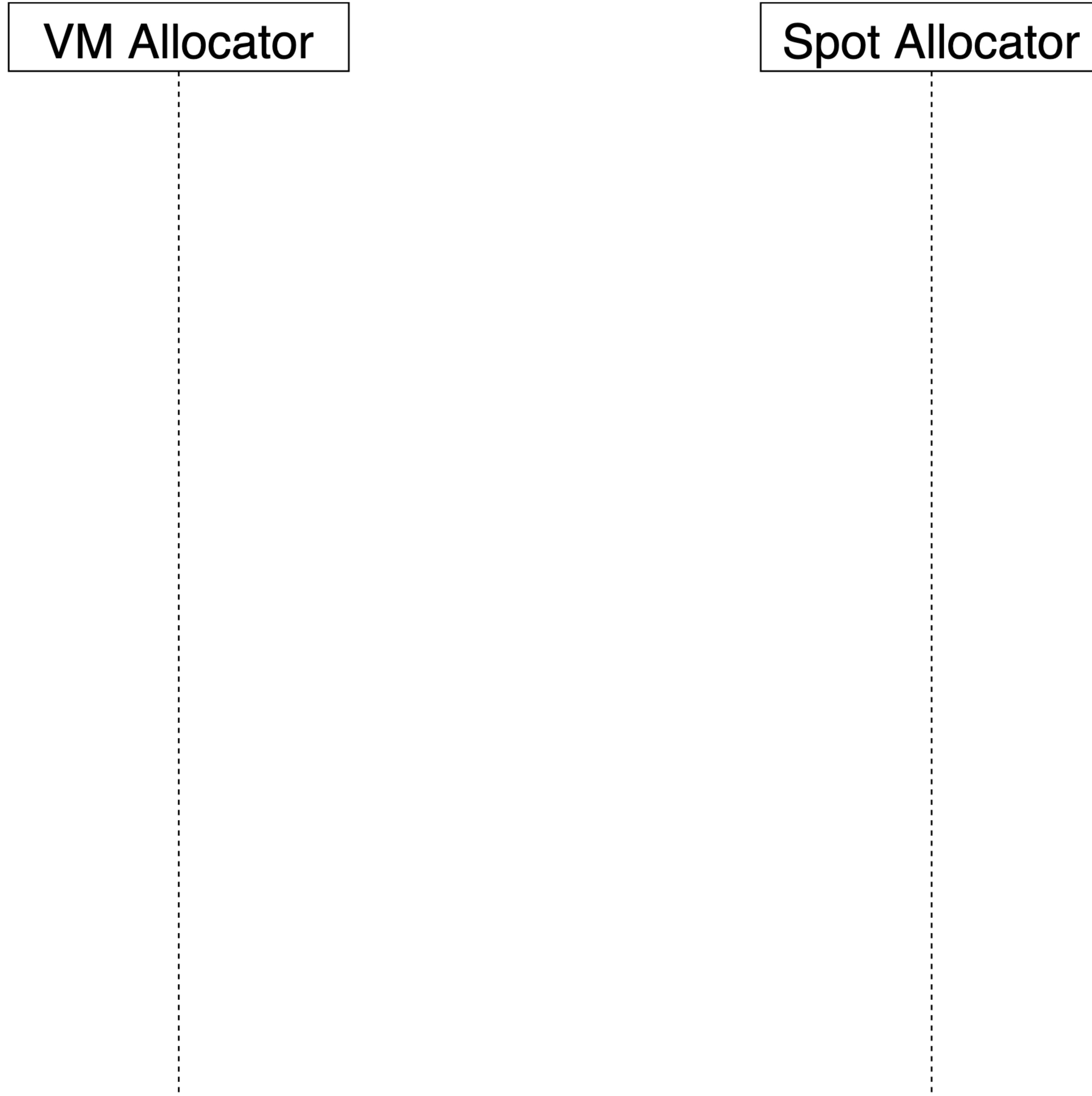
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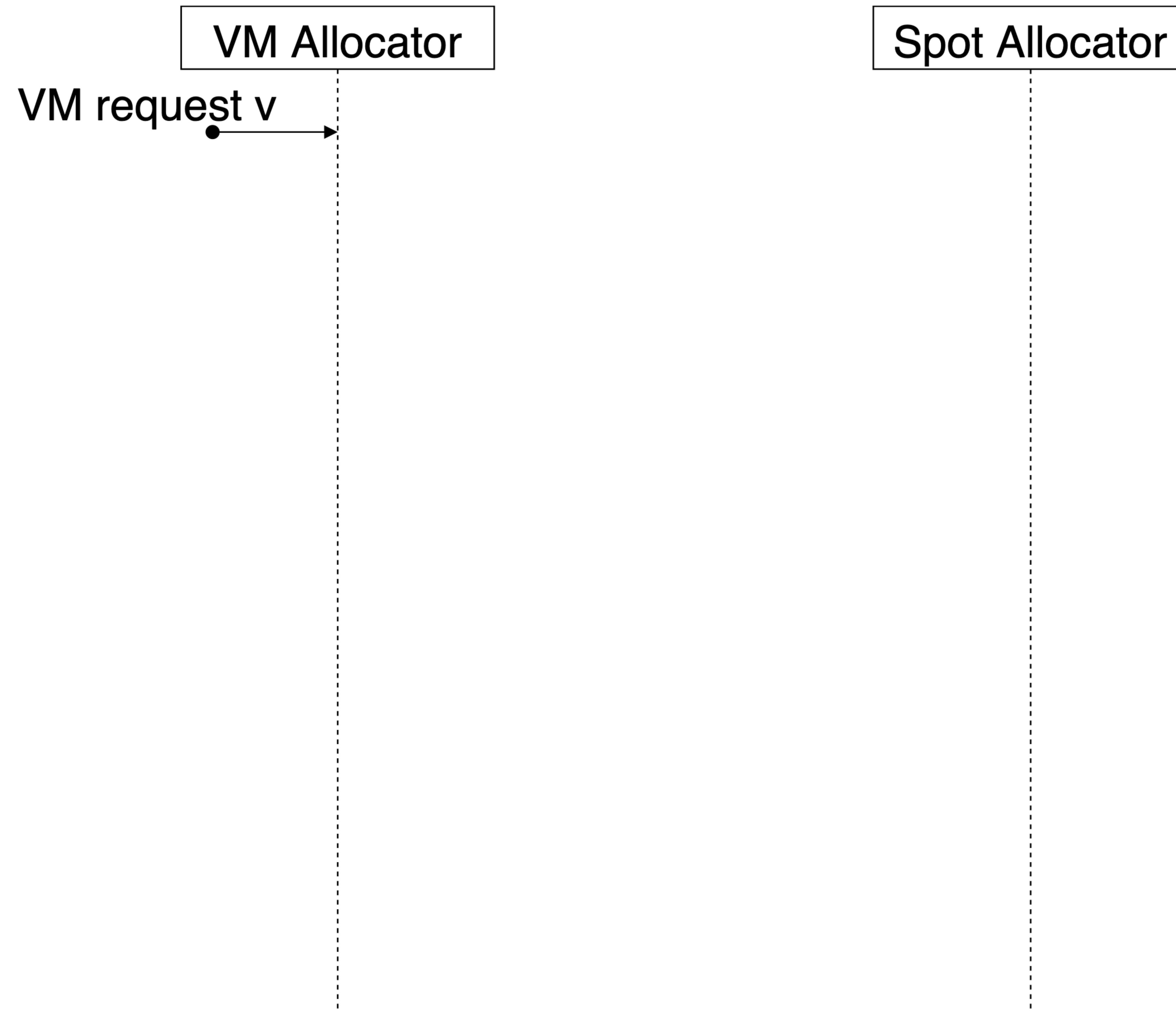
# Problem

**Can we increase spot instance revenue without impacting on-demand VM revenue?**

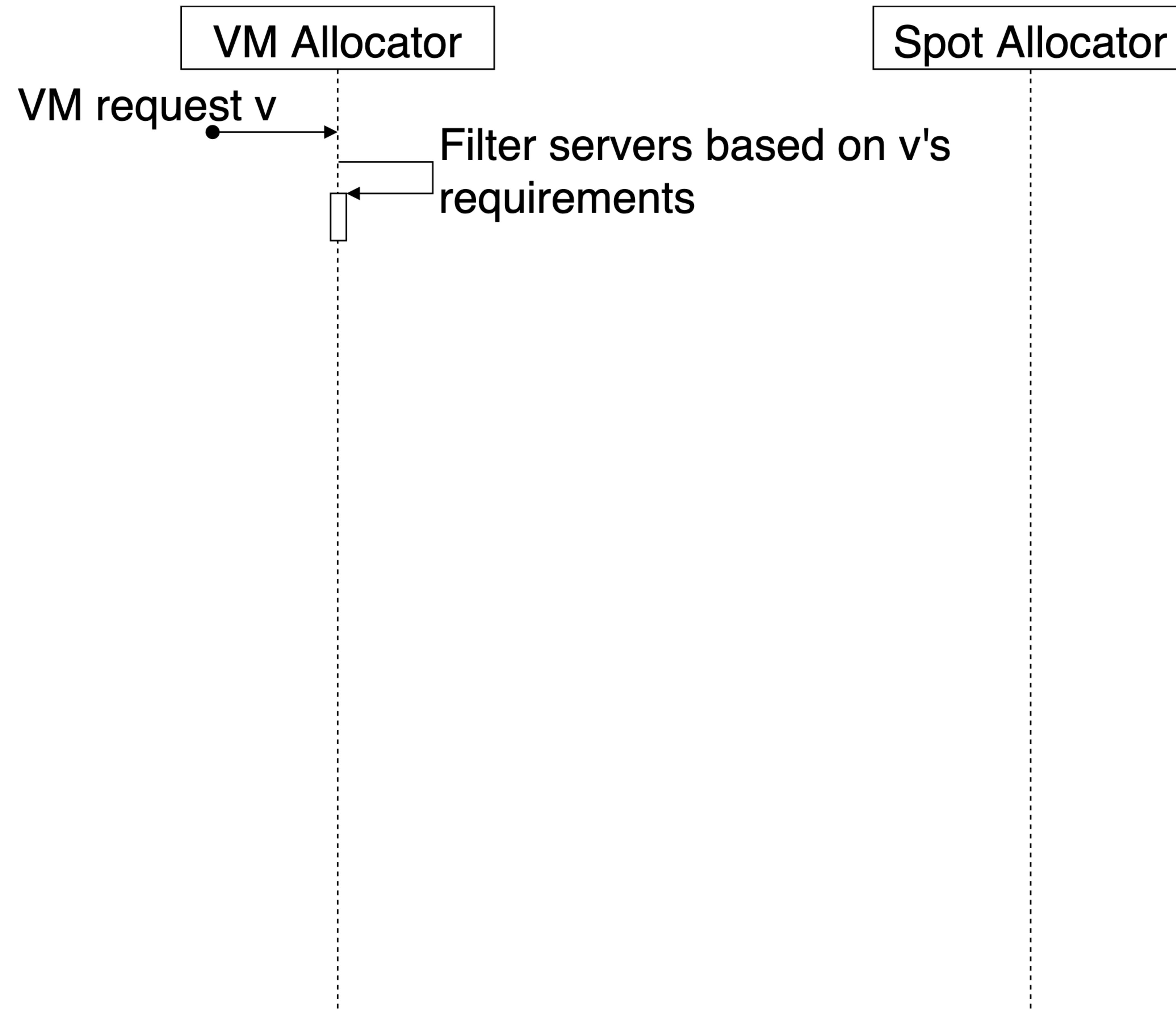
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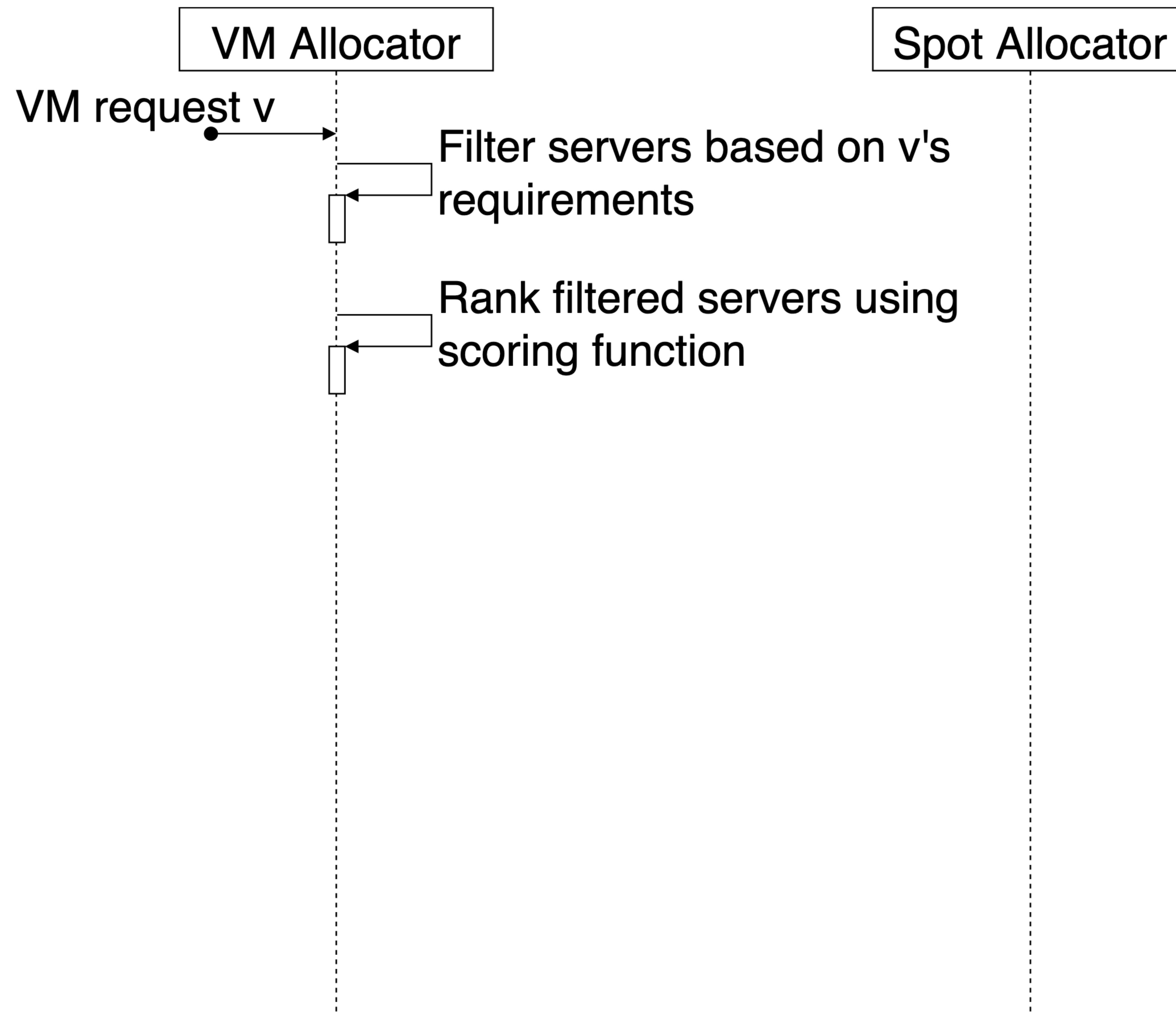
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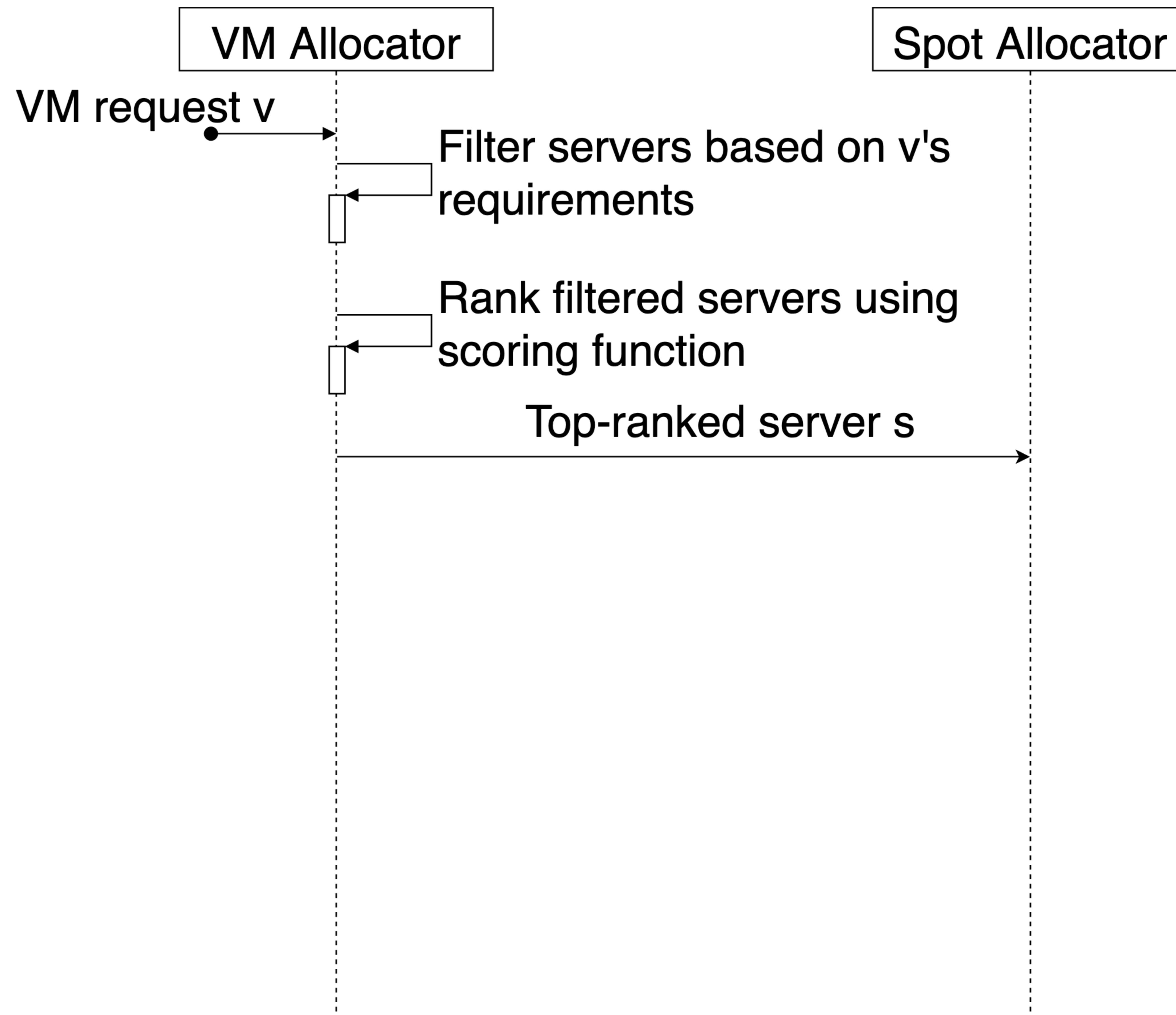
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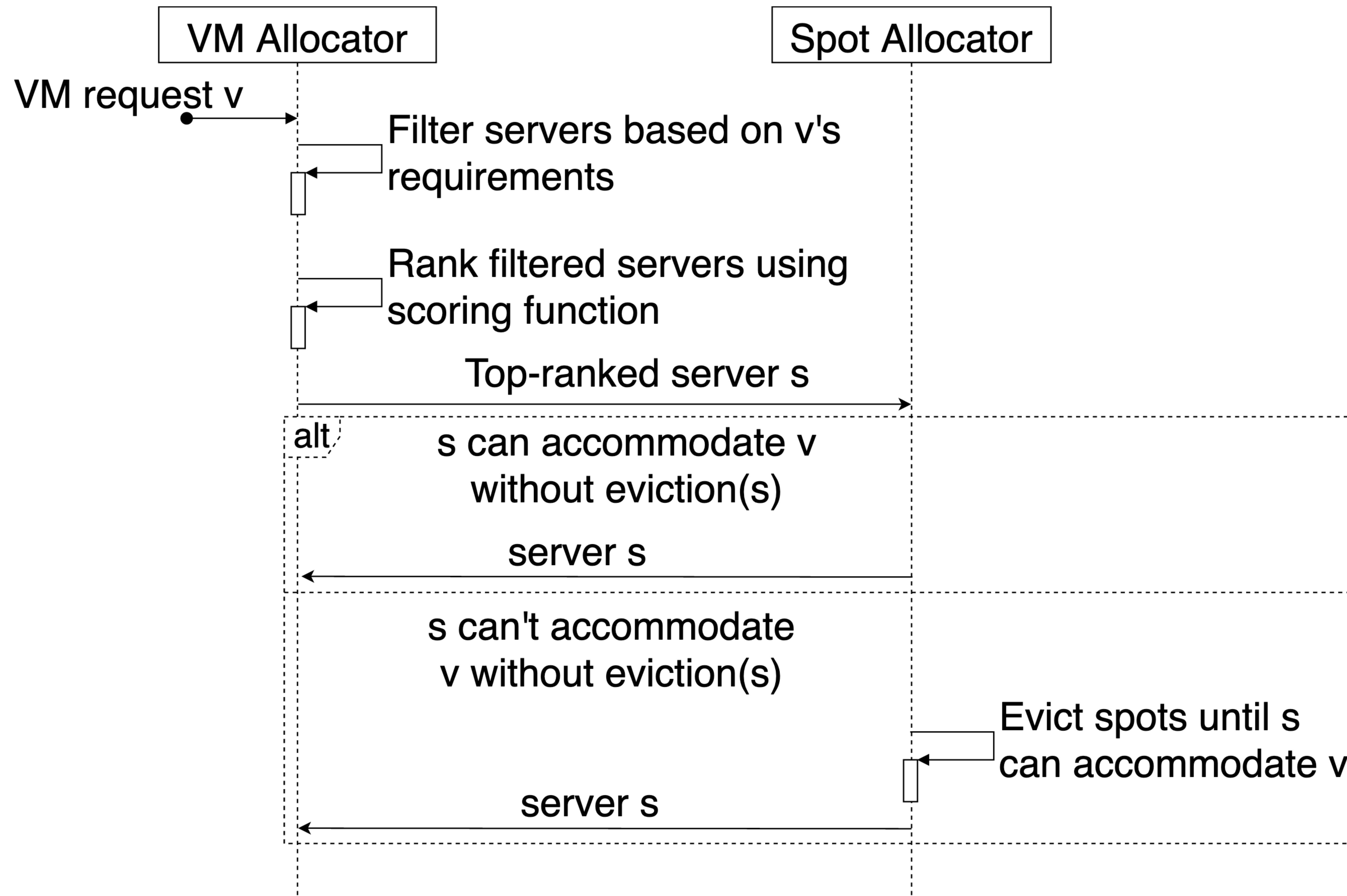
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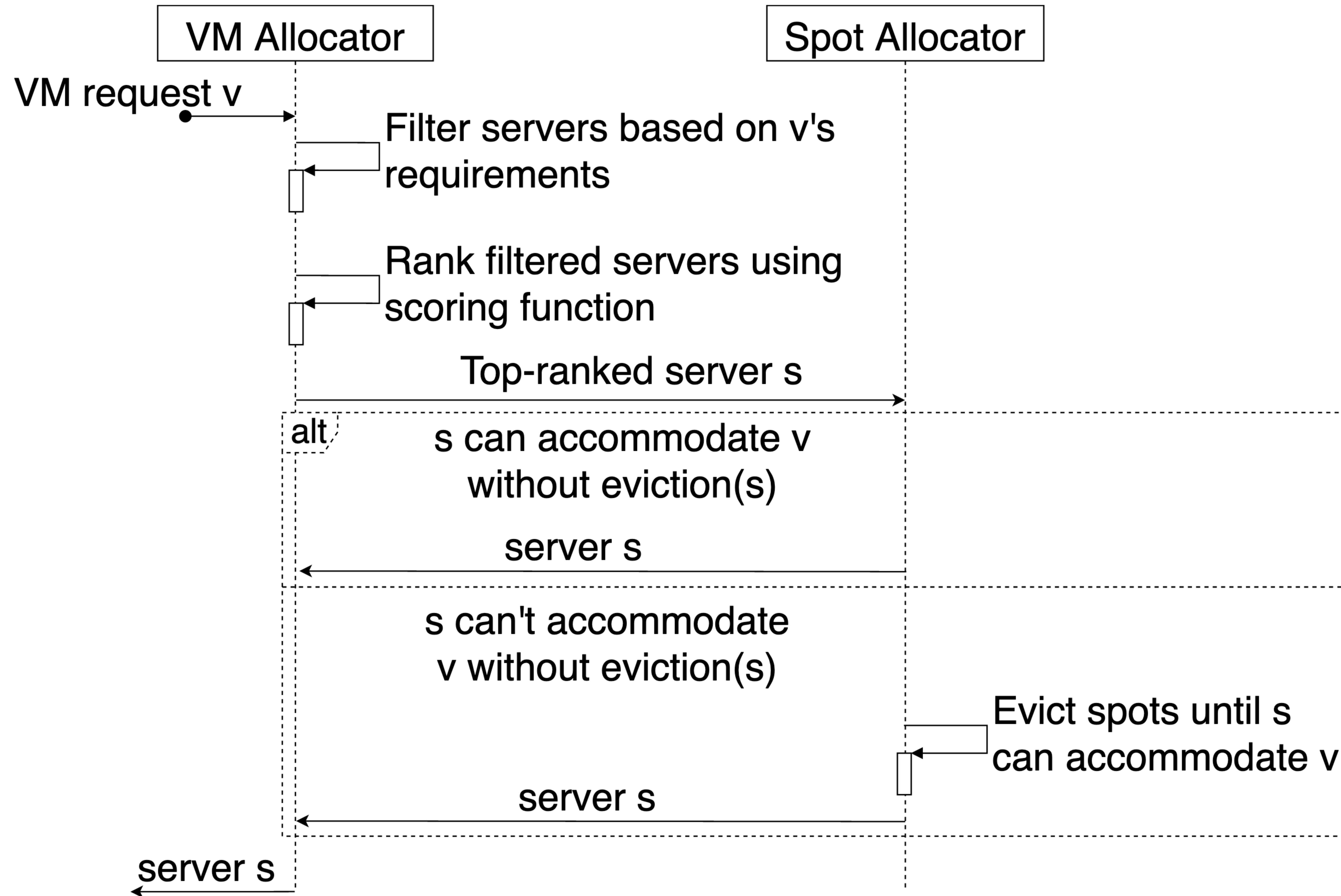
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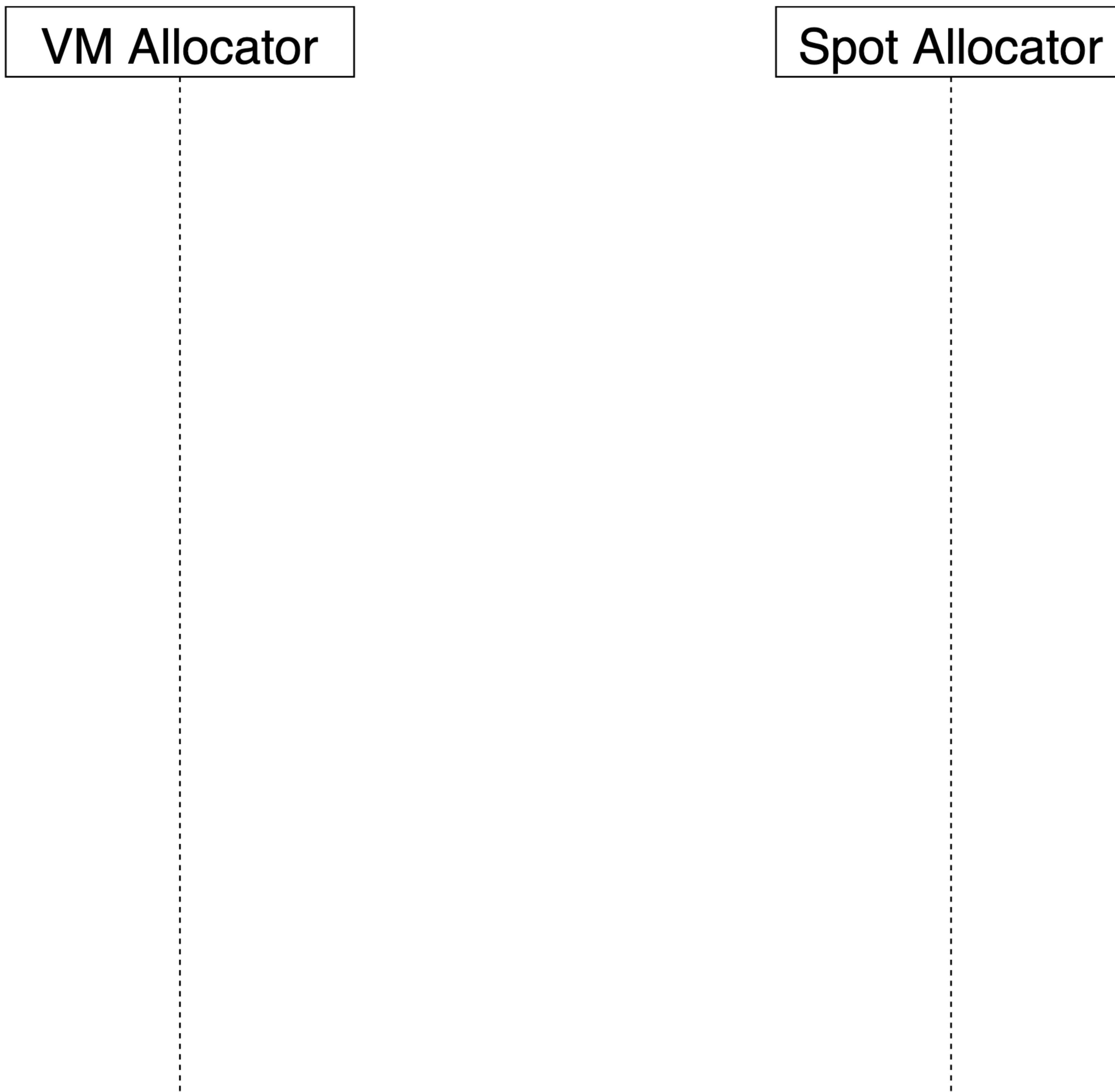


# CoSpot Framework

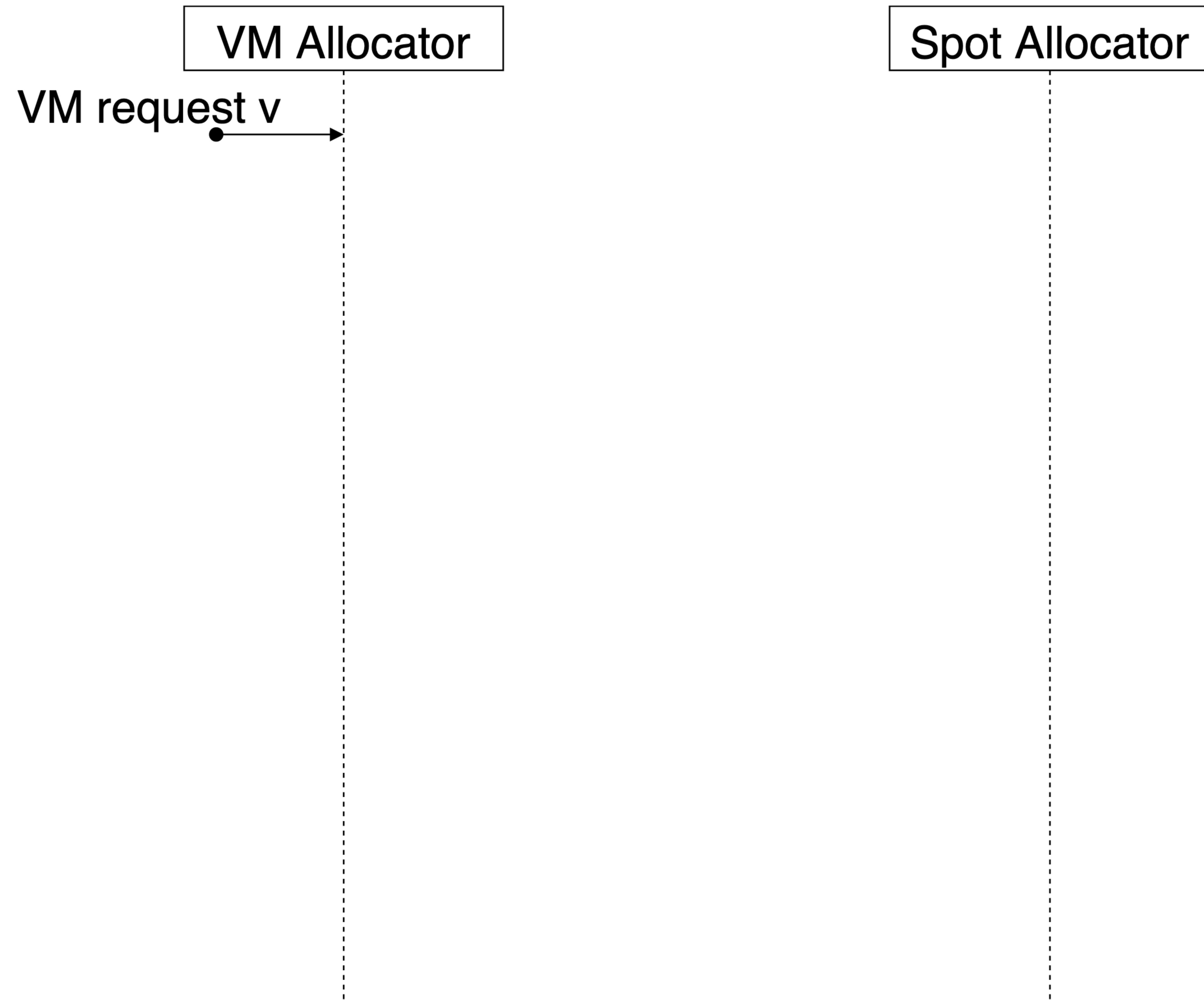
**The freedom created by not choosing the top-ranked server for VM allocation gives the spot allocator flexibility to achieve greater spot revenue**

- Our CoSpot framework consists of two parameters:
  - Offer Top-N
  - Spot Avoiding Filter

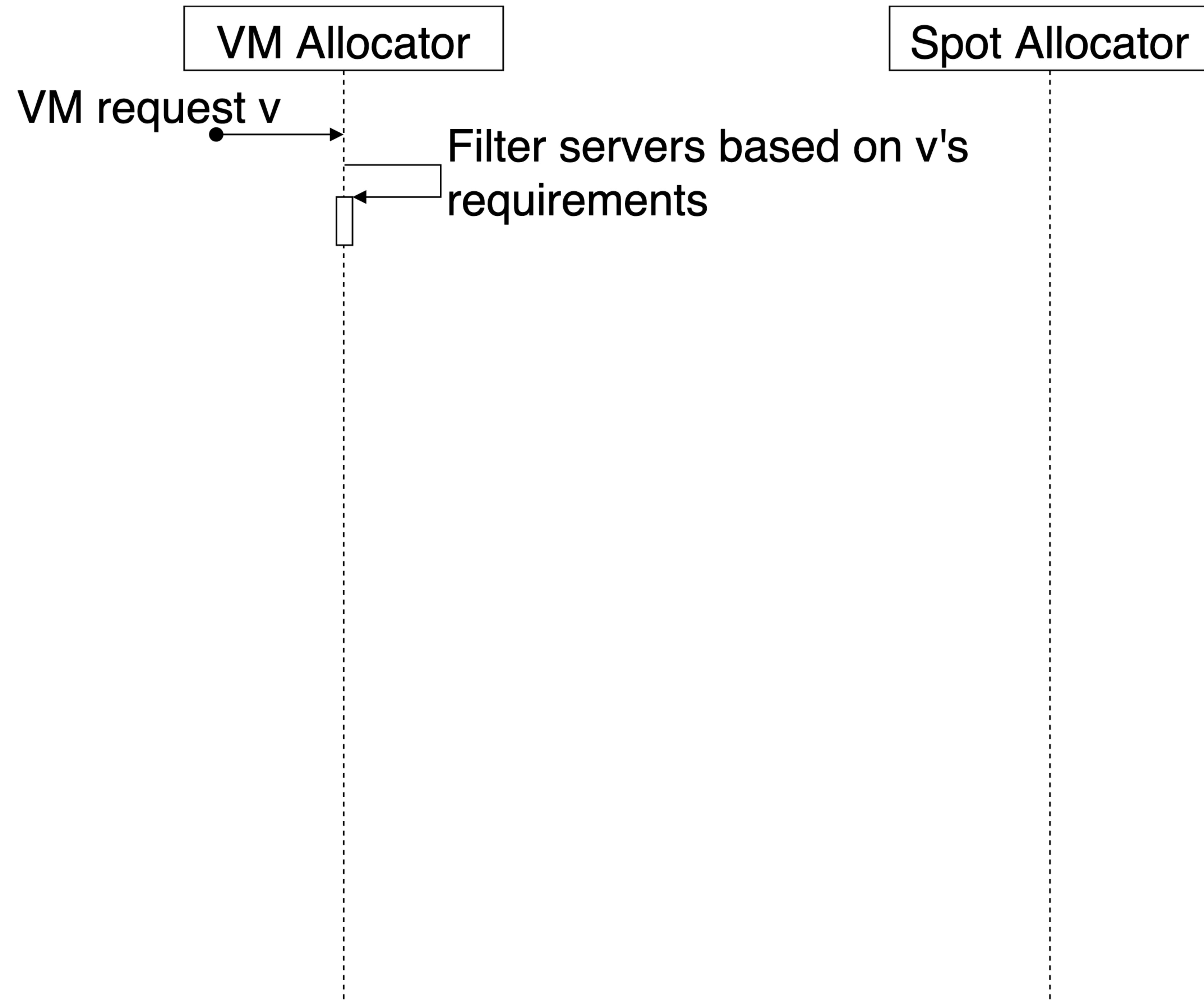
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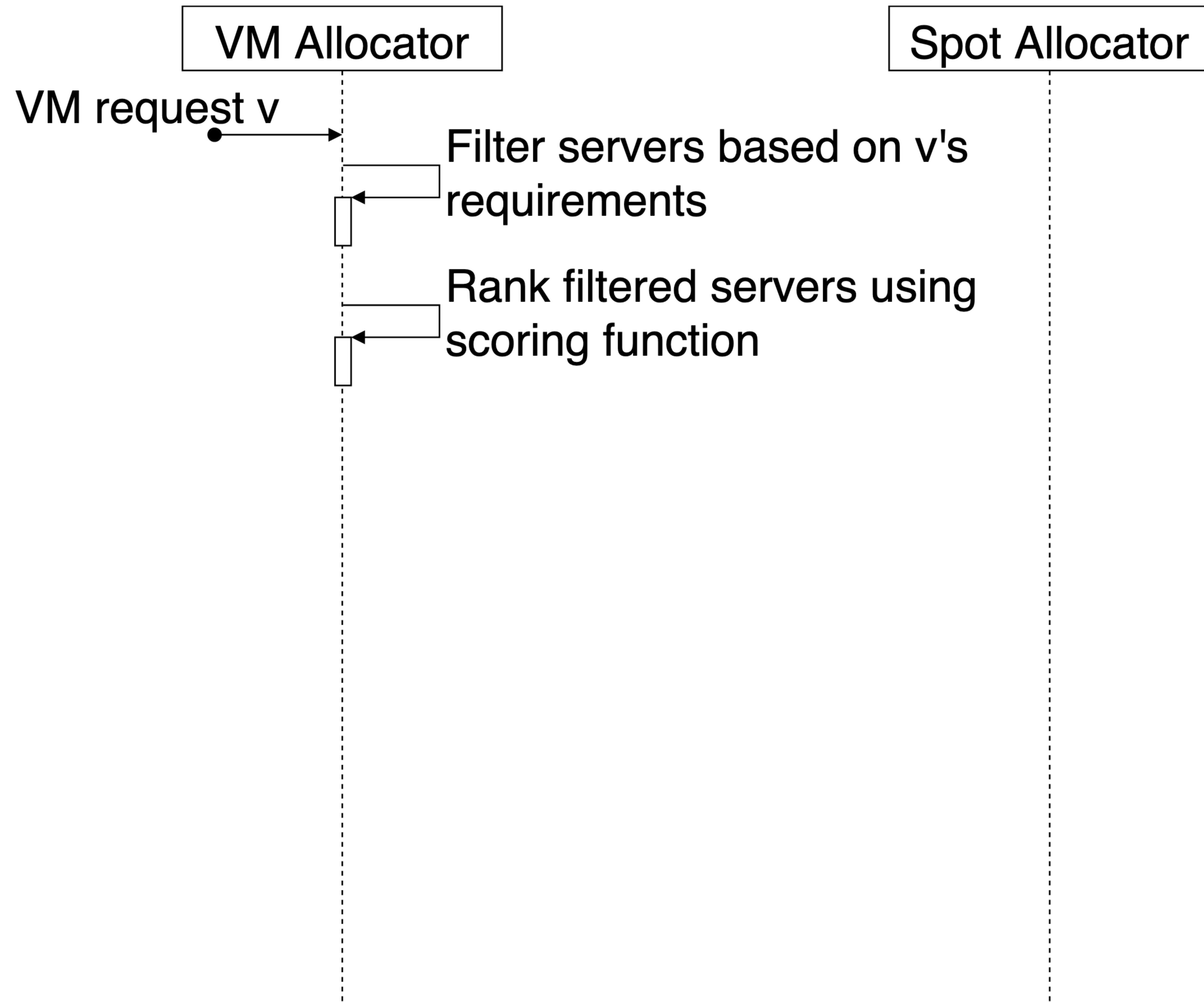
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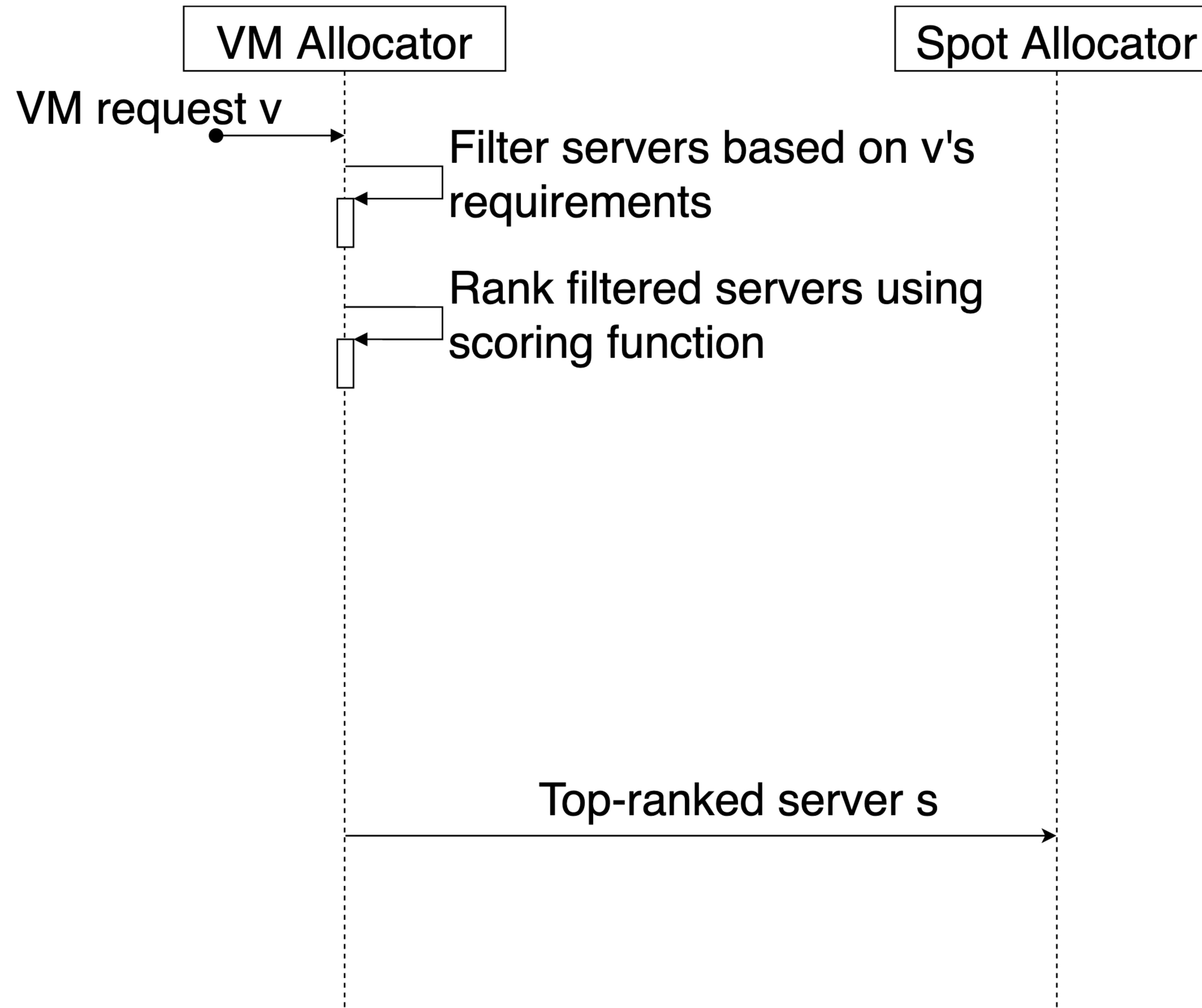
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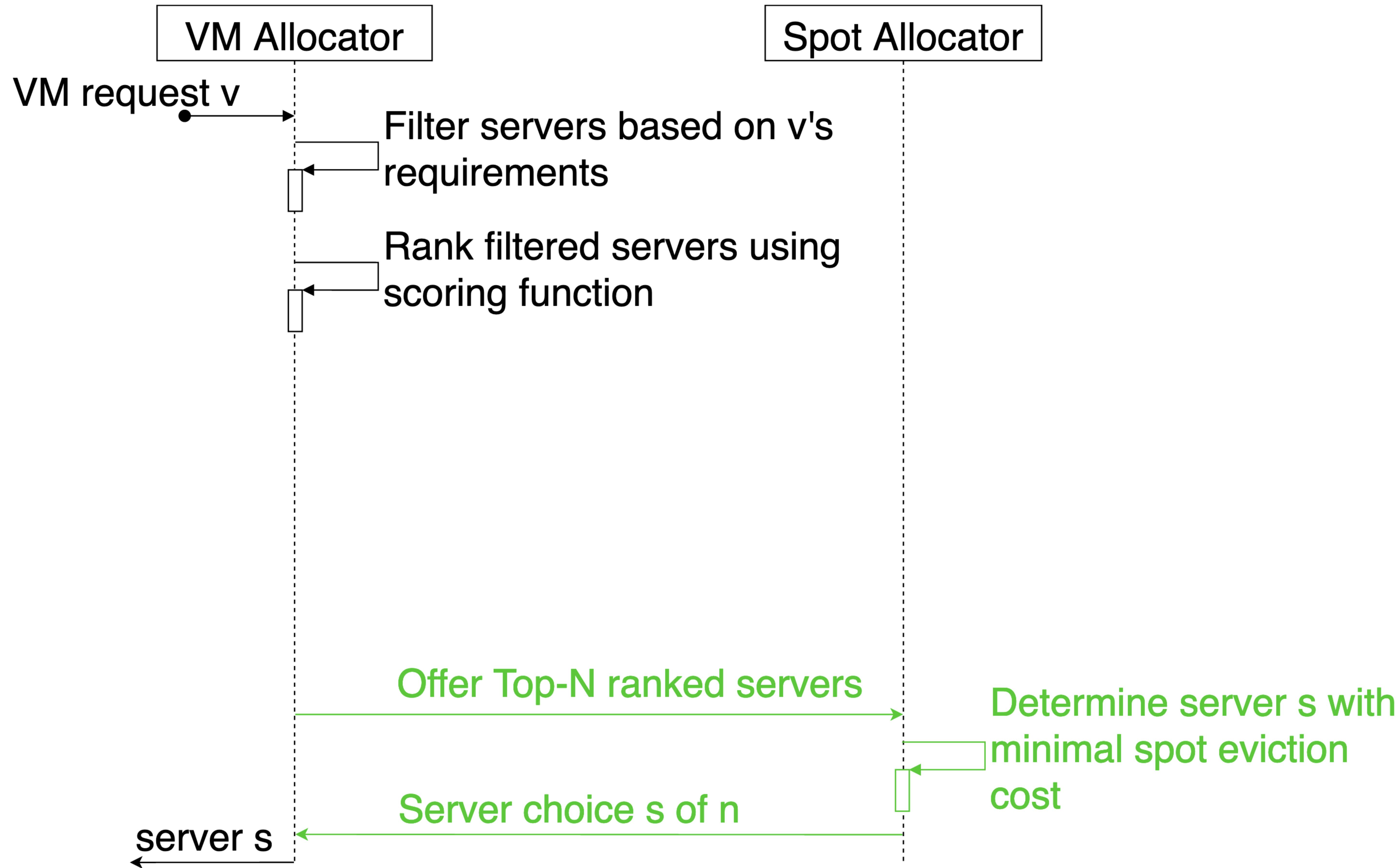
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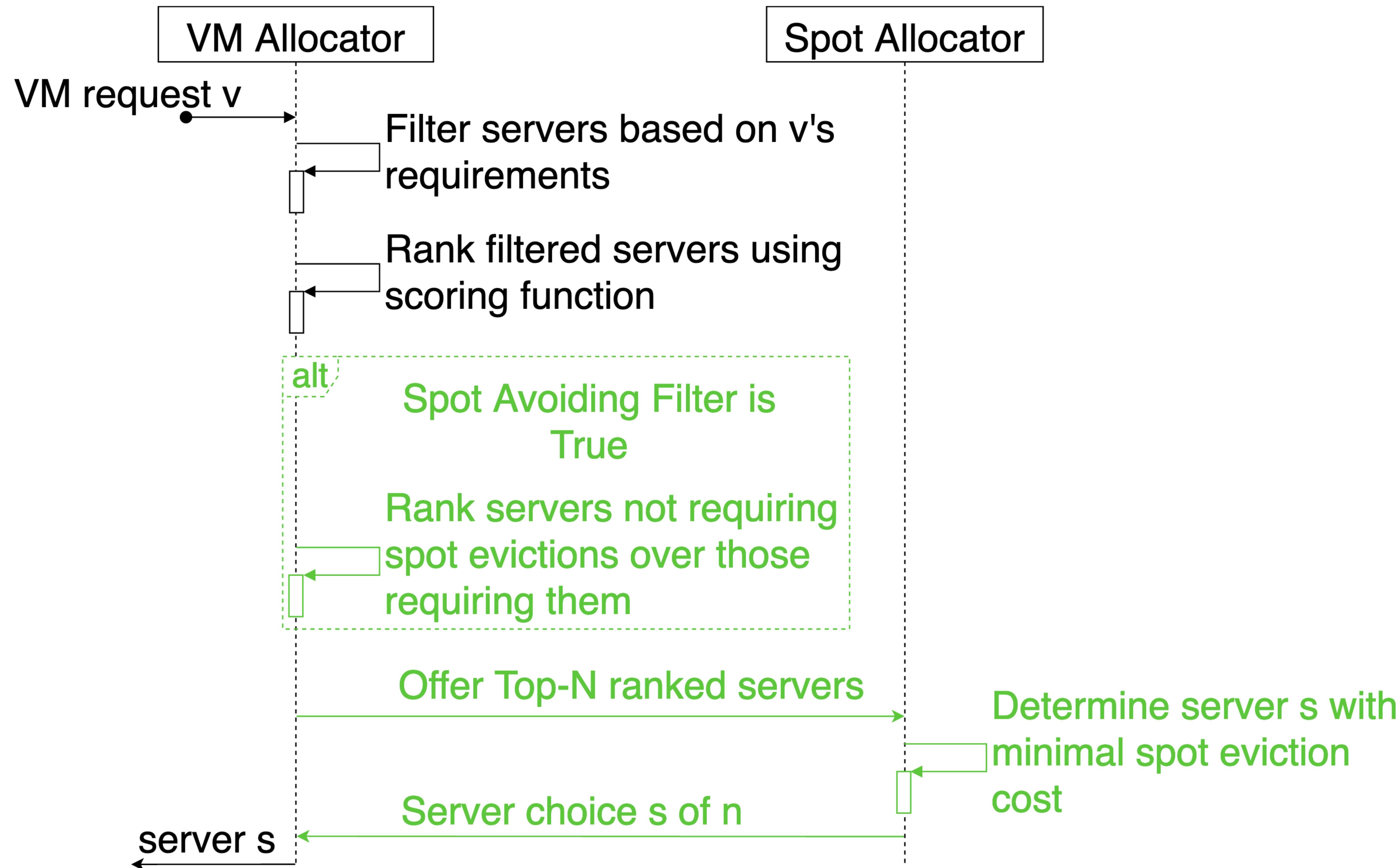
# CoSpot VM Allocation



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# Does It Work?

- We need to evaluate CoSpot on a realistic workload.
- We need to evaluate CoSpot under a wide variety of operating conditions.

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3	2	0	0.04166666	0.01822916		0.02683813	0.005
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<sup>1</sup>Protean: VM Allocation Service at Scale, O. Hadary, L. Marshall, A. Pan, E. E. Greeff, D. Dion, S. Dorminey, S. Joshi, Y. Chen, M. Russinovich, and T. Moscibroda

# Workload

<b>id</b>	<b>vmTypeId</b>	<b>machineId</b>	<b>core</b>	<b>memory</b>	<b>hdd</b>	<b>ssd</b>	<b>nic</b>
1	0	0	0.02083333	0.00390625		0.01006429	0.000125
2	1	0	0.02083333	0.00911458		0.01341906	0.0025
3	2	0	0.04166666	0.01822916		0.02683813	0.005
...	...	...	...	...	...	...	...
16	15	1	0.00104166	0.00088888		0.00687138	0.0025
...	...	...	...	...	...	...	...

- We constructed an ILP with constraints based on fractional resource requirement information.
- The full system was infeasible. We had to exclude 18 (out of 265) flavors to force feasibility.
- The excluded flavors corresponded to less than 6% of the entire trace.

# Does It Work?

- We need to evaluate CoSpot on a realistic workload. ✓
- We need to evaluate CoSpot under a wide variety of operating conditions.

# Experimental Setup

64,800 experiments in total:

Parameter	Values
Workload	2 Sampling Methodologies * 10 Samples Each
Datacenter	0%, 1%, 2%, 3%, 4% Headroom
VM Allocation	3 Policies
Spot Allocation	6 Policies
Spot Eviction	3 Policies
Spot Avoiding Filter	False, True
Offer Top-N	1, 2, 4, 8, 16, 32

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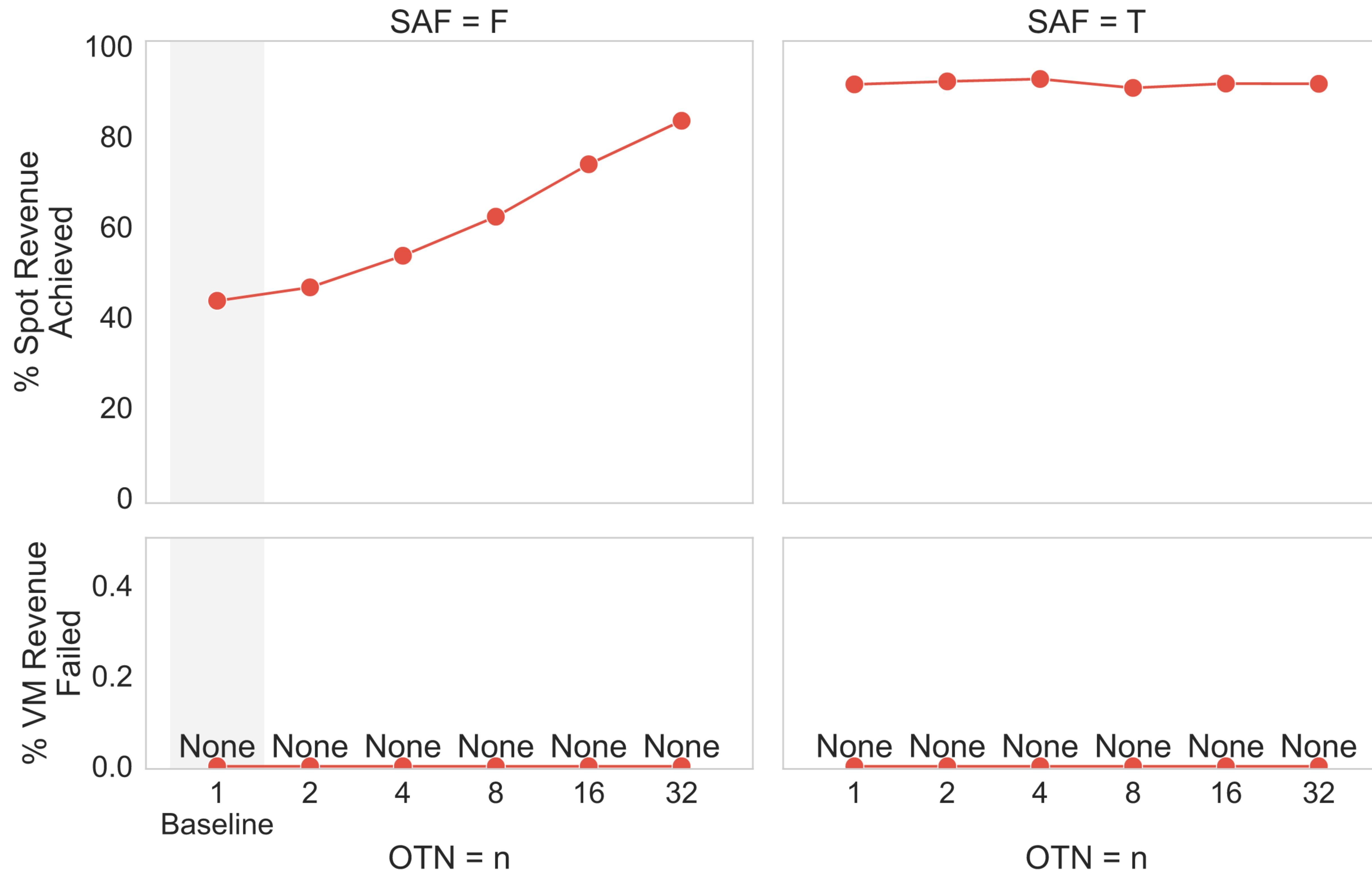
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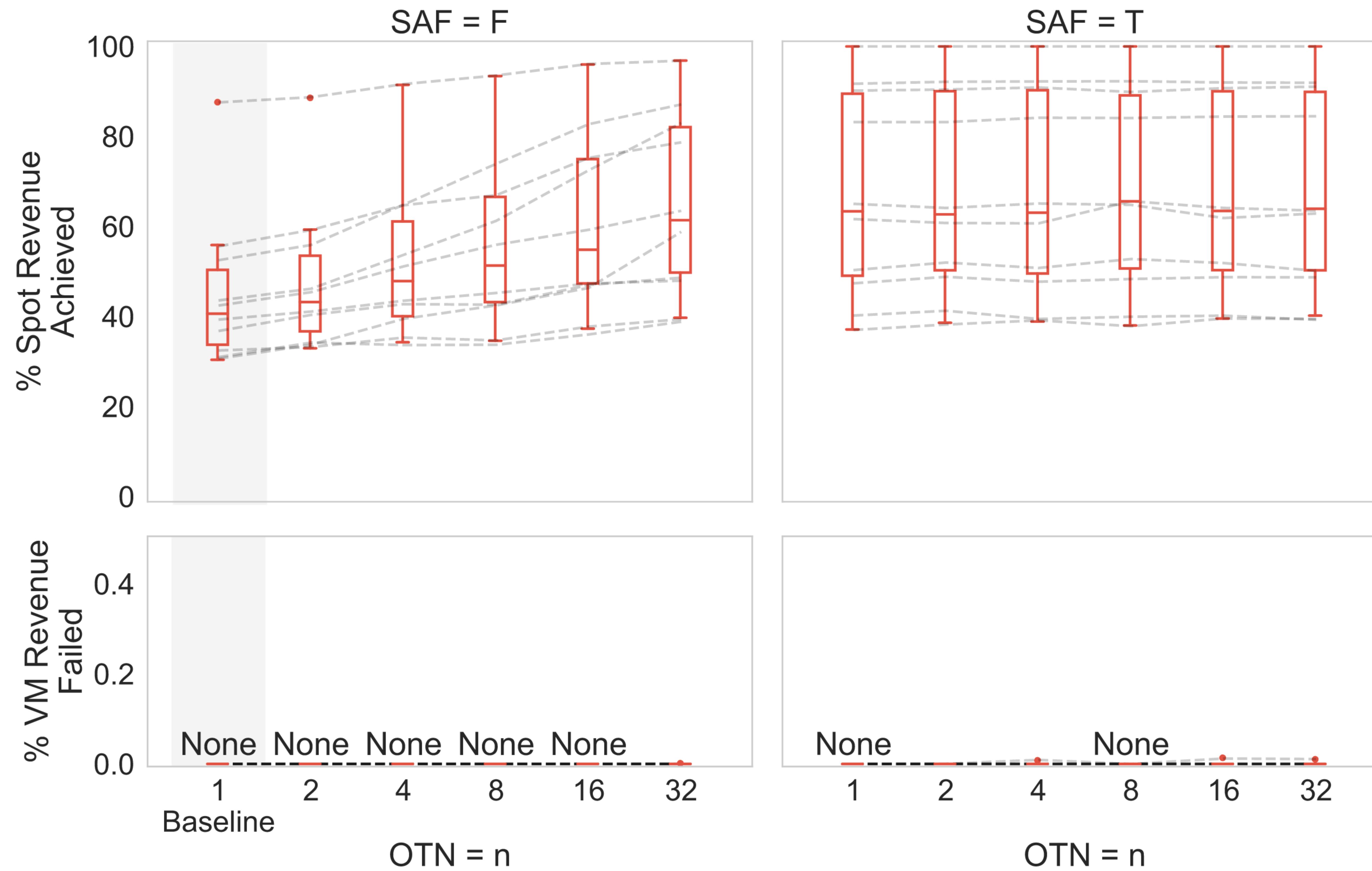
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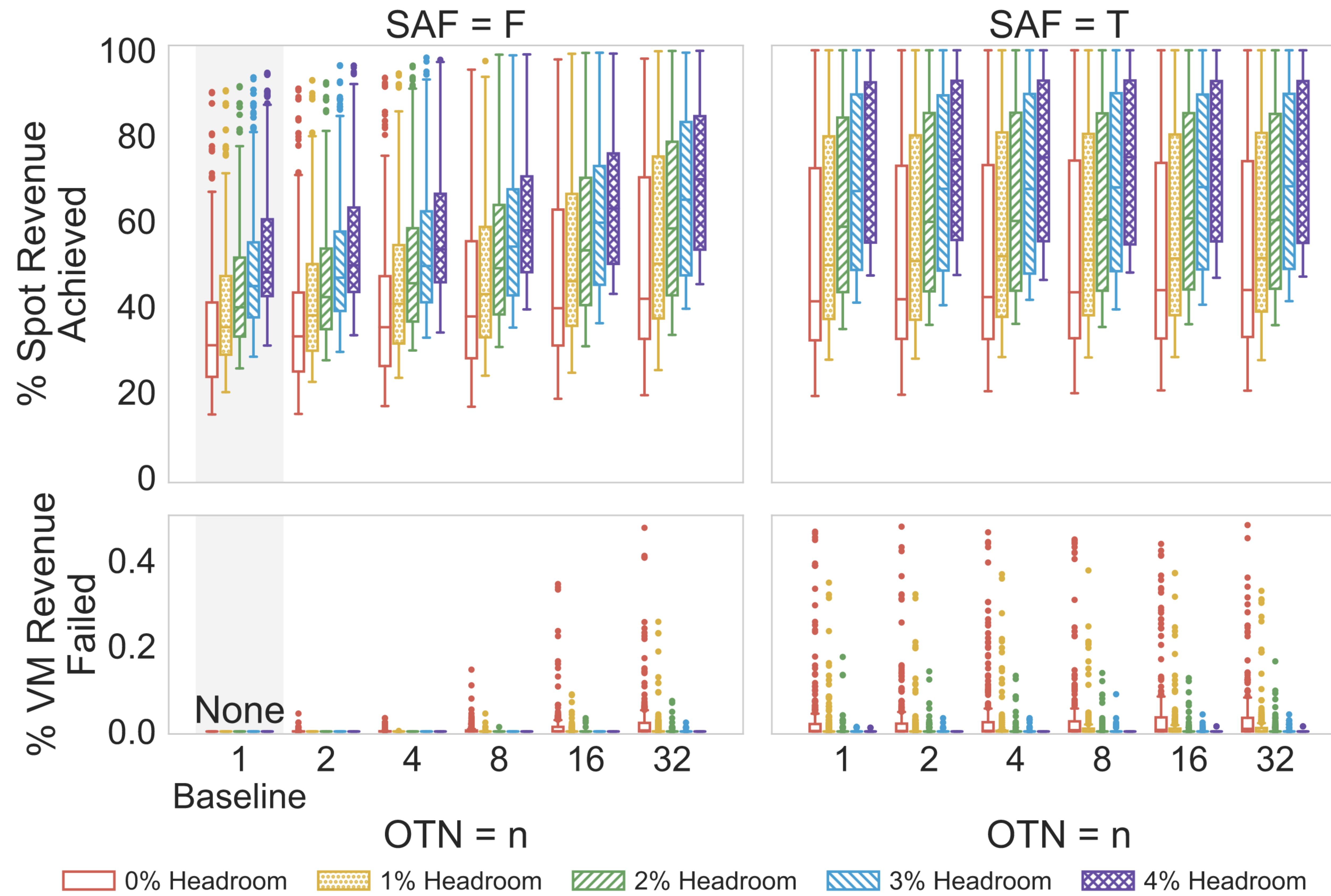
# CoSpot achieves greater spot instance revenues with zero impact on VM revenue



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# CoSpot Results Overview



# Contributions

- CoSpot framework to achieve greater spot instance revenue without impacting VM revenue.
- Reusable VM/spot workloads with consistent concrete core/RAM resource requirements.

Code and workload artifacts for CoSpot can be found at:

<https://github.com/DCResourceManage/cospot-socc2022>