Hotspot mitigation for the masses

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Entreprise cloud company

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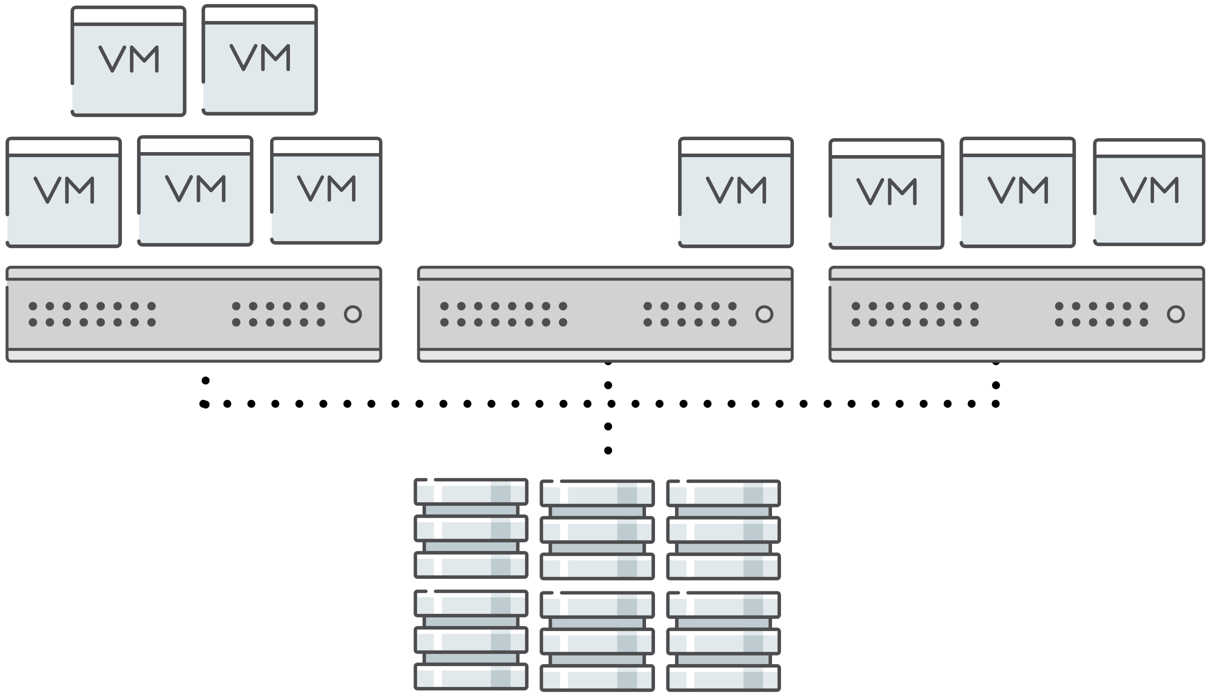
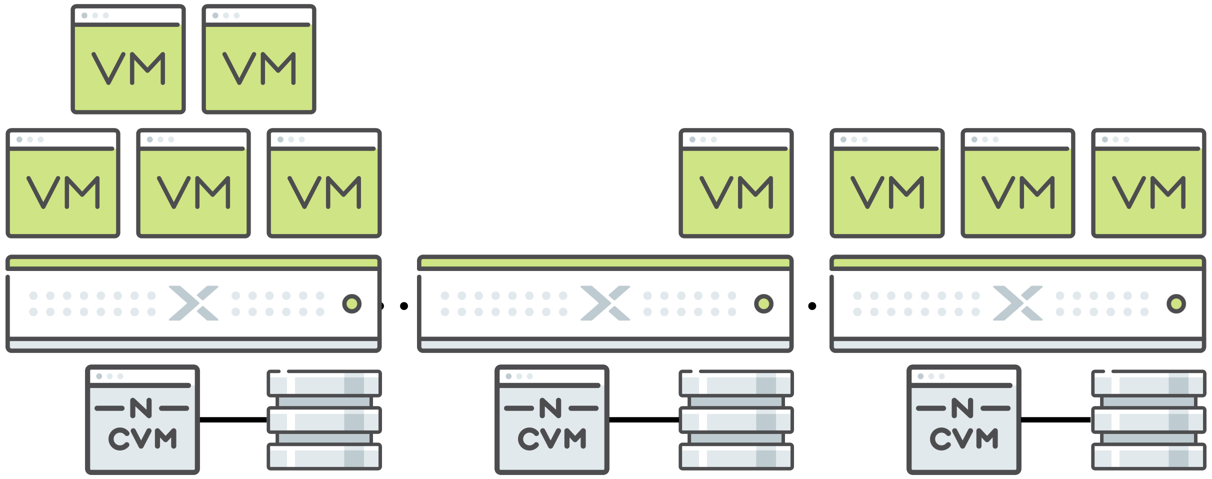
Private clouds



From converged

SAN based, remote I/Os



to hyper-converged infrastructures (HCI)

Distributed file-system favouring local I/Os,
one controller VM per node

602 private clouds

small clusters and beefy nodes fit SMB needs

~ 4 node clusters, 13 VMs per node
long tail distribution

oversubscribed cores

~ 1.31:1 vCPU/thread, up to 9:1

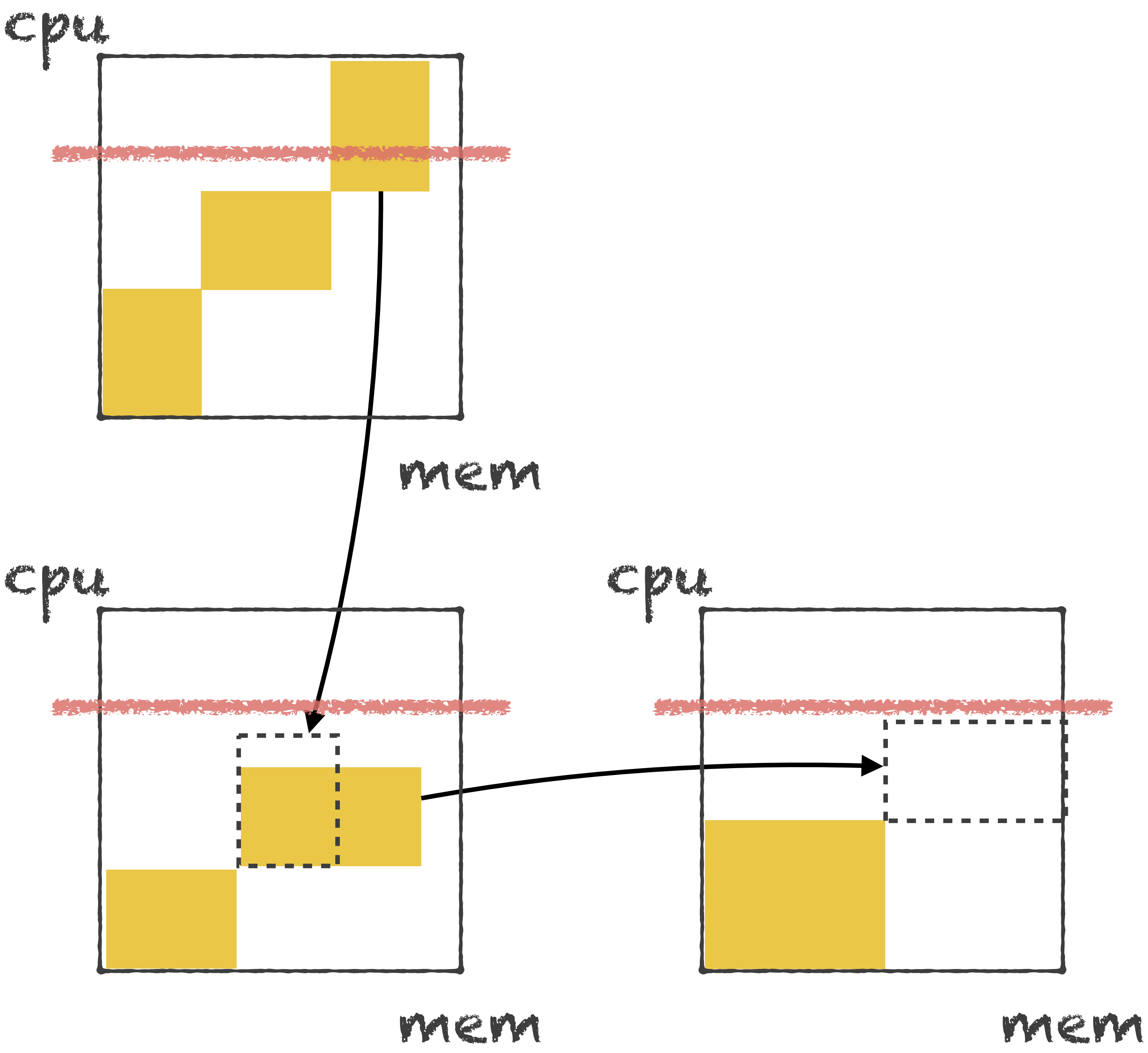
moderate load

~25% CPU, ~2% I/Os (dynamic allocation)
~44% memory (static allocation)

no relationship between dimensions

see the distributions in the paper

Acropolis Dynamic Scheduler (ADS)

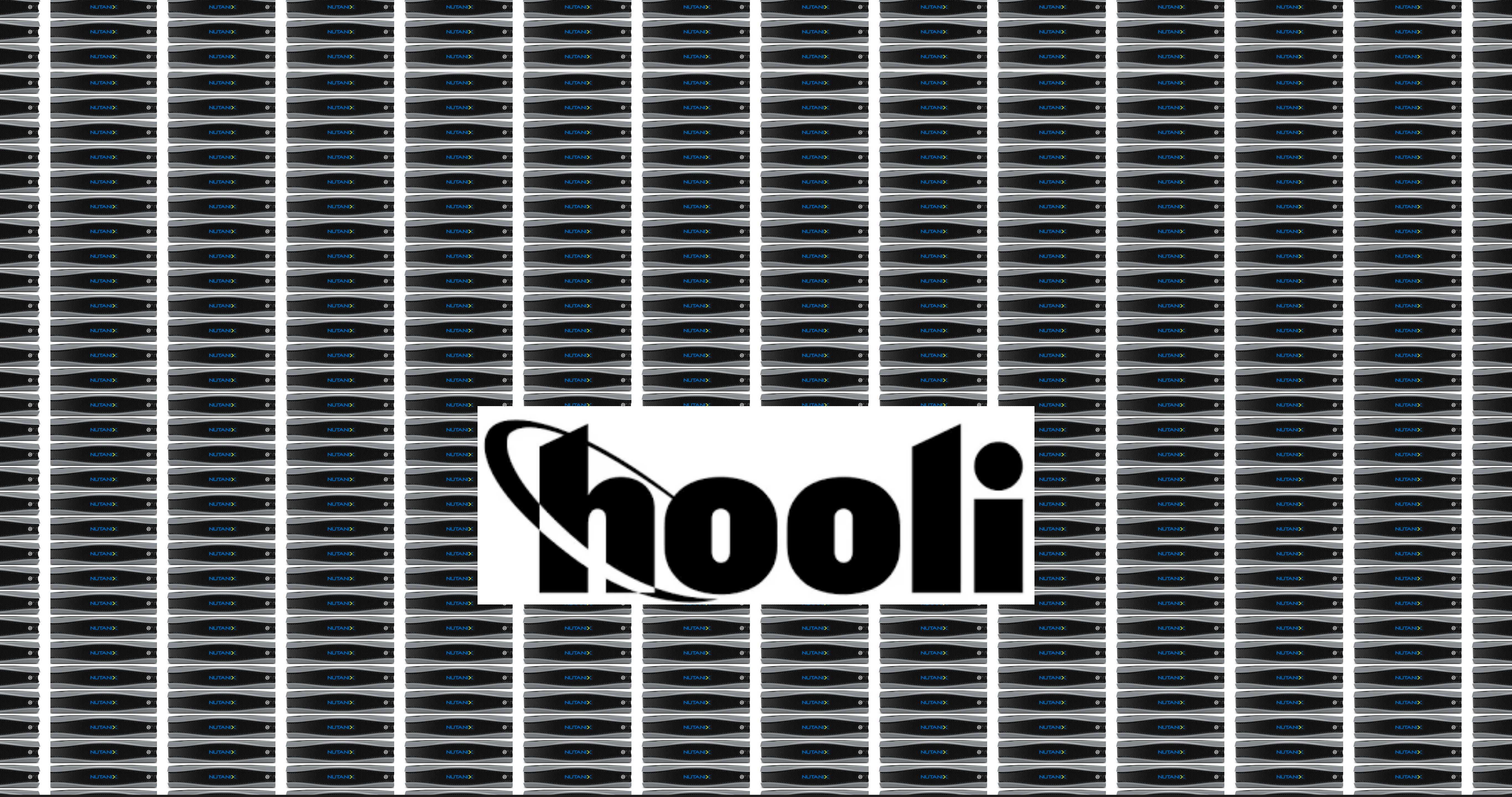


Fix hotspots induced by dynamic resources allocation

Cron based
Threshold based

NP-hard
No holy grail

Scheduler specialisation may alter its applicability



hooli

Doing great for the 1%

Doing ok for the 99%

Inside ADS

Exact approach on top of BtrPlace

Constraint programming backend to avoid over-filtering CHOCO

Objective

- Minimise data movement
- *Tend* to balance

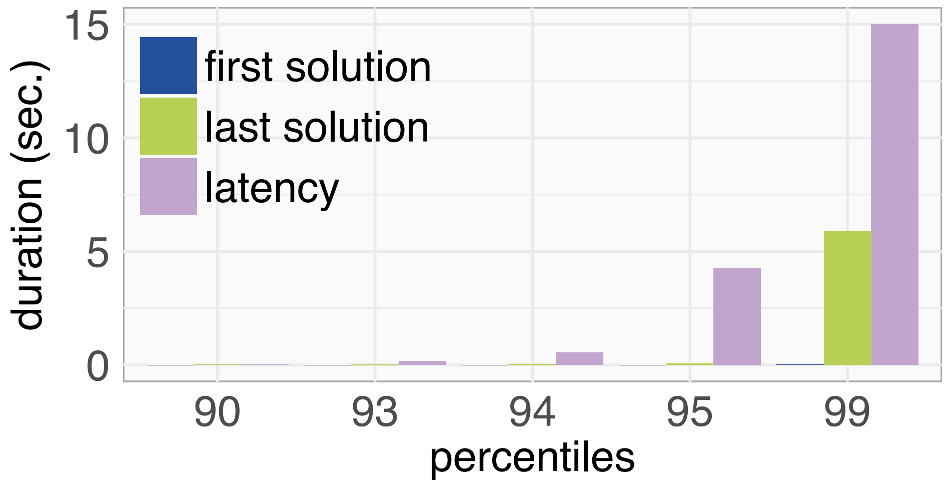
Actuation

- VM migrations (up to 2 in parallel)
- Admin notification upon no solutions

Lessons learnt

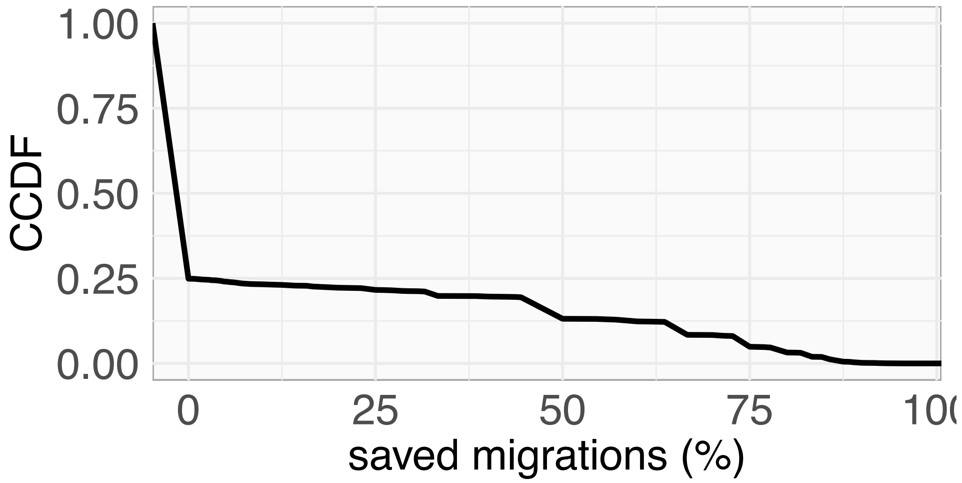
Looking at 2,668 clusters that called ADS at least once

Working with an exact approach

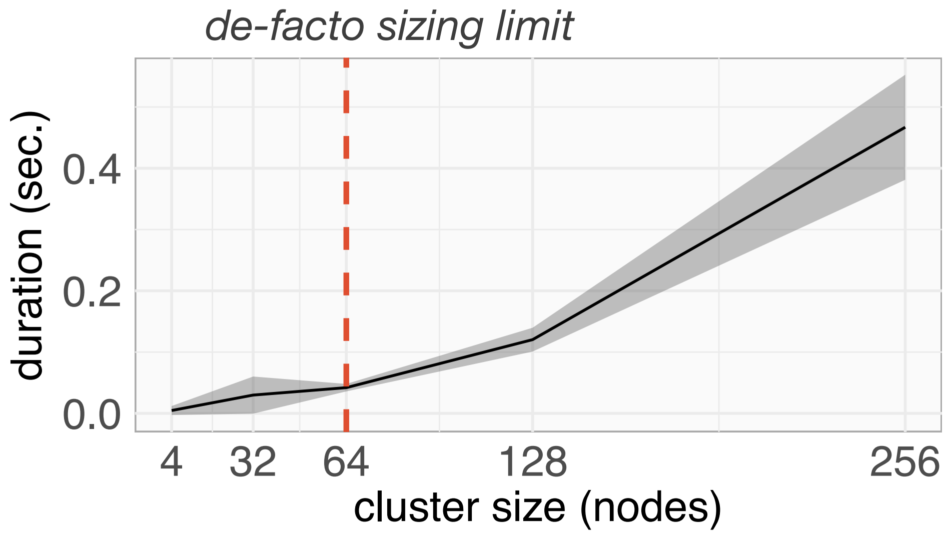


Service latency is good enough

0.5% undecidable problems



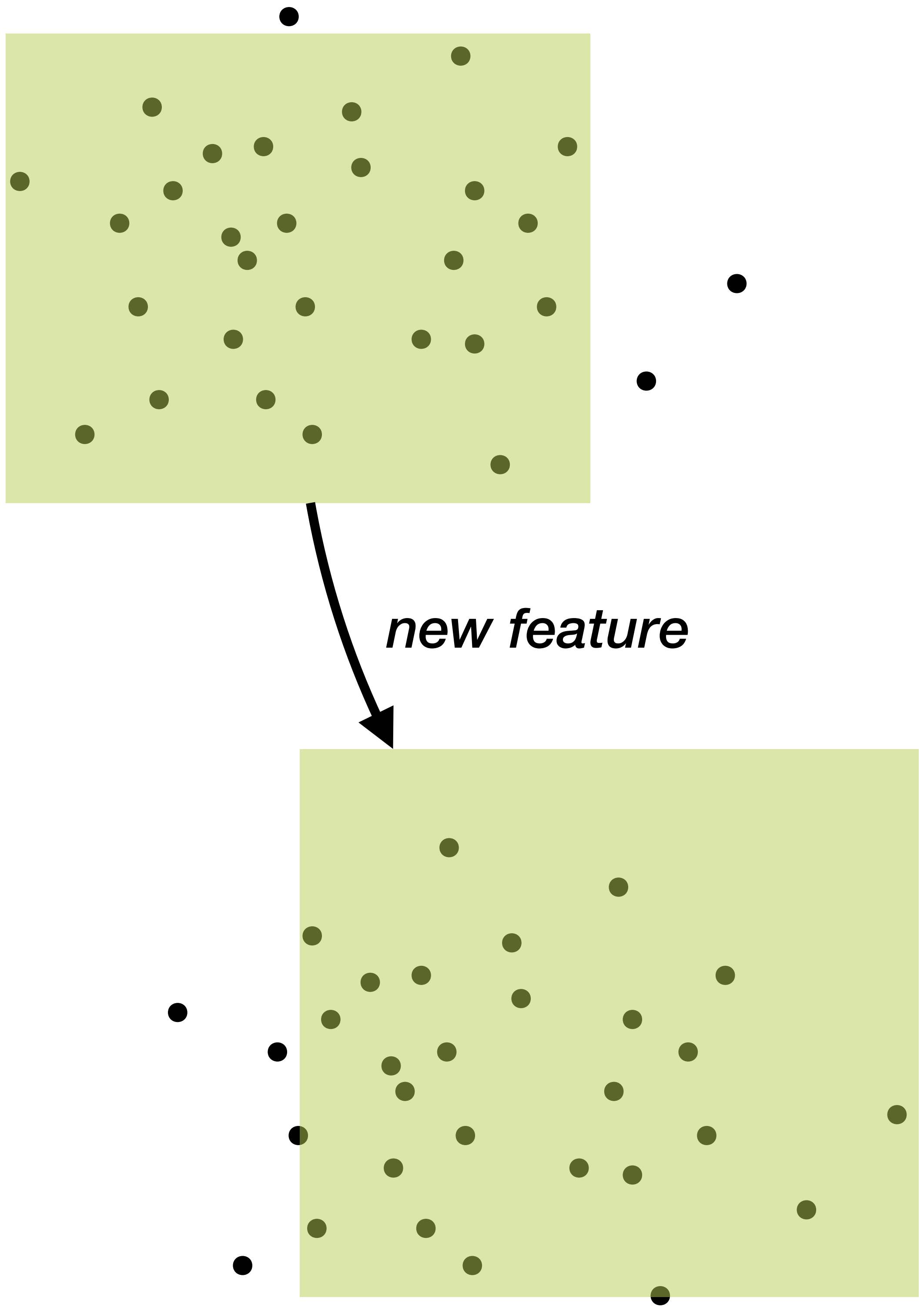
Continuous search helps yield better mitigation plans



Scale beyond sizing limits

In the paper: engineering particularities

Looking for workload agnostic optimisations



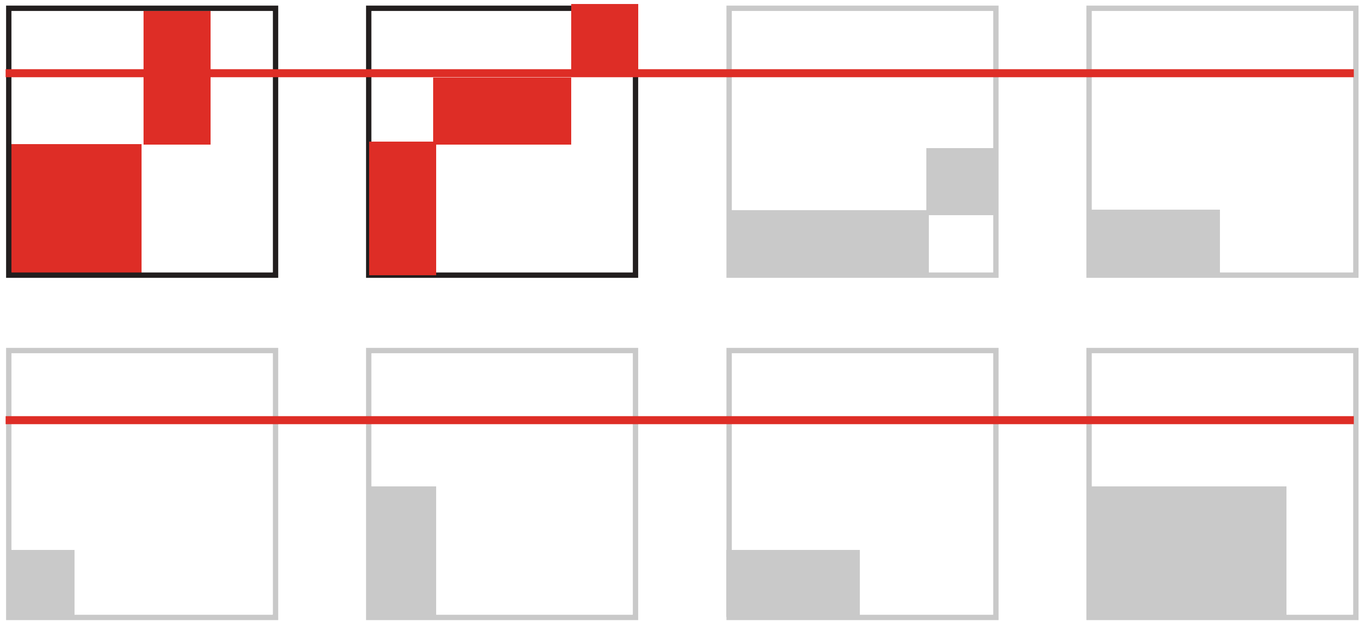
Optimise to reduce undecidable rate, migrations

Beware of false quick wins

The dataset bias dilemma

Chasing outliers requires trade-offs

Local search to reduce the problem size



Low overall load, local hotspots.

Manage only supposed mis-placed VMs

Pin “well placed VM”

Available in BtrPlace

Enabled in ADS 1.0 during the prototyping phase

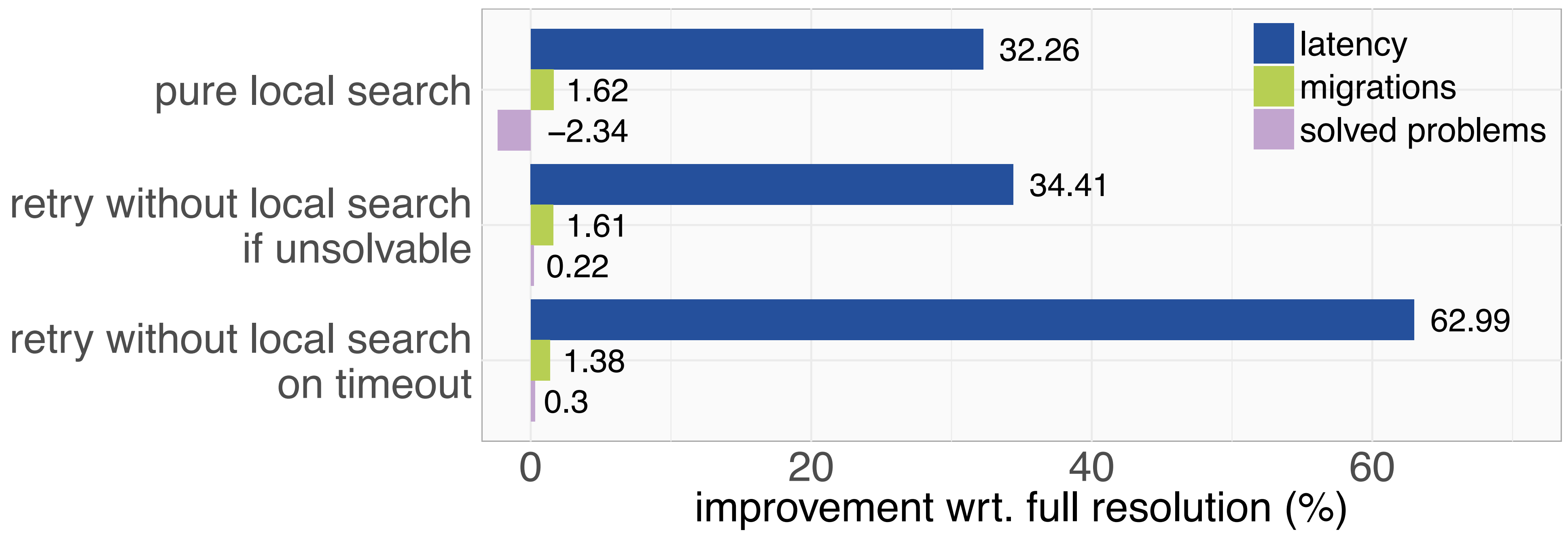
Local search considered useful and harmful

Over-filtering issues reported

Moved to a 2-phases resolution

Local search enabled, then disabled if needed

Trigger reconsidered over time



Practical effectiveness

Complex to analyse without a/b testing

The success rate is a consequence of subjective modelling choices

How many clusters in a clean state after a call to ADS ?

73.28%

if ADS issues a plan

12.24%

If unsolvable

Conclusion

It is about supporting diverse workload

Incremental improvements from observation
small wins matter

Not all enhancements are safe

Trading quality for capability

It is not about developing a new feature,
it is about checking its side effects

Tools and knowledge bases are crucial

Exhibit and characterise outliers
It is about preventing regressions

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