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Manage flash storage efficiently in a multi-tenant cloud environment using QoS and adaptive throttling

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Agenda

- ❑ Multi-tier storage
- ❑ Challenges
- ❑ Need for QoS in multi-tenant environment
- ❑ Integrating QoS in multi-tier storage

Multi-tier storage

□ Architecture – Write back log

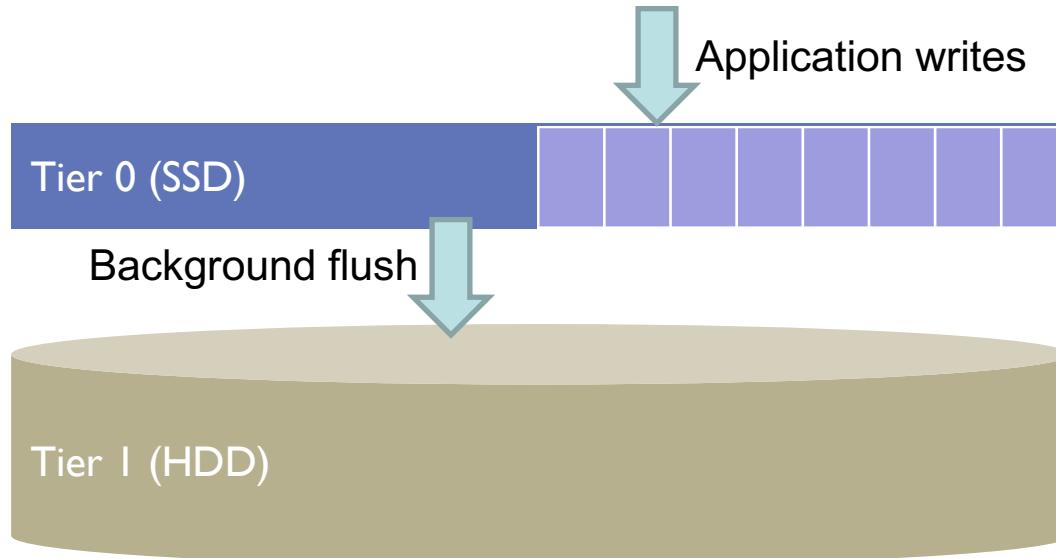


Fig. 1: Example of multi-tier storage using write log

Multi-tier storage – Write back log

- Advantages
 - Low write IO latencies
 - Merging of writes
 - Versioning

Challenges

- Limited capacity of higher tiers

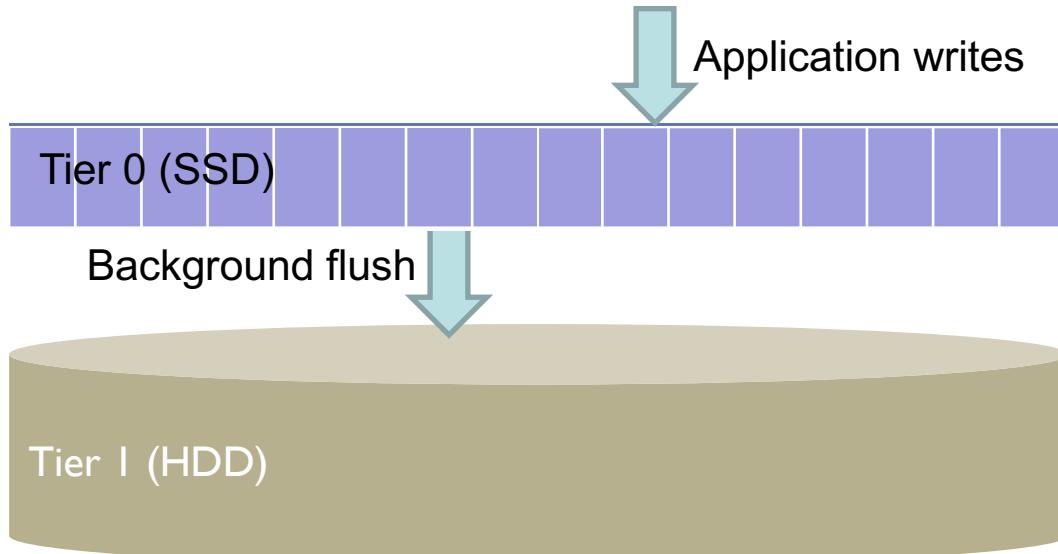


Fig. 2: Example of tier 0 full

Challenges (contd.)

□ Unpredictable performance

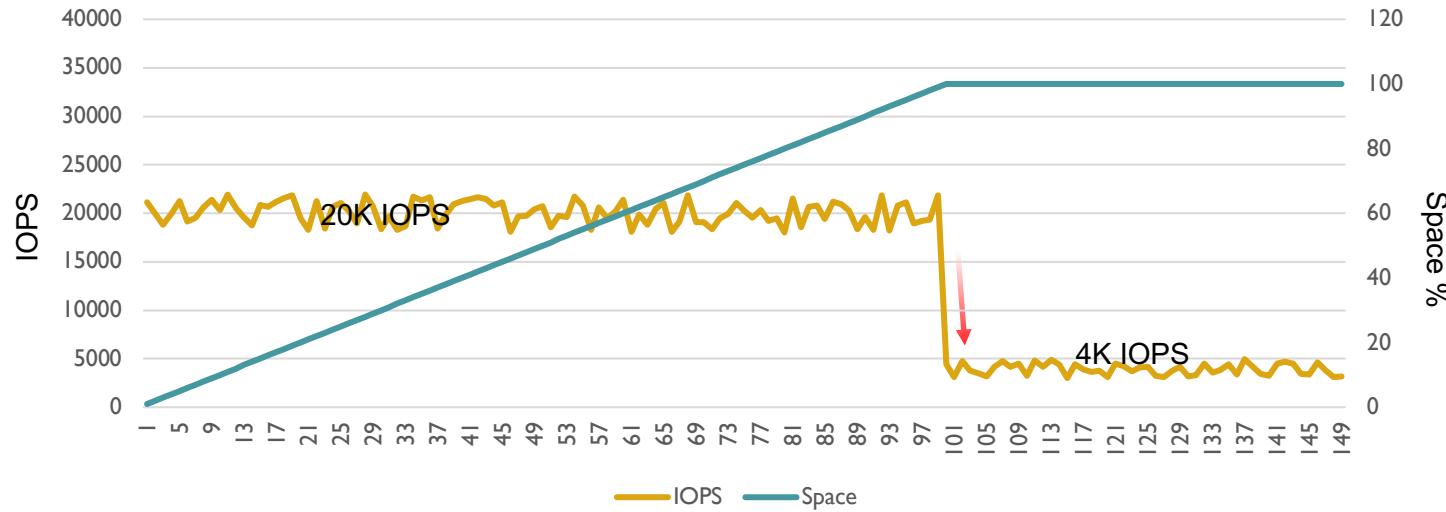


Fig. 3: Performance degradation
vs. space

Need for QoS in multi-tenant environment

❑ Noisy neighbor problem

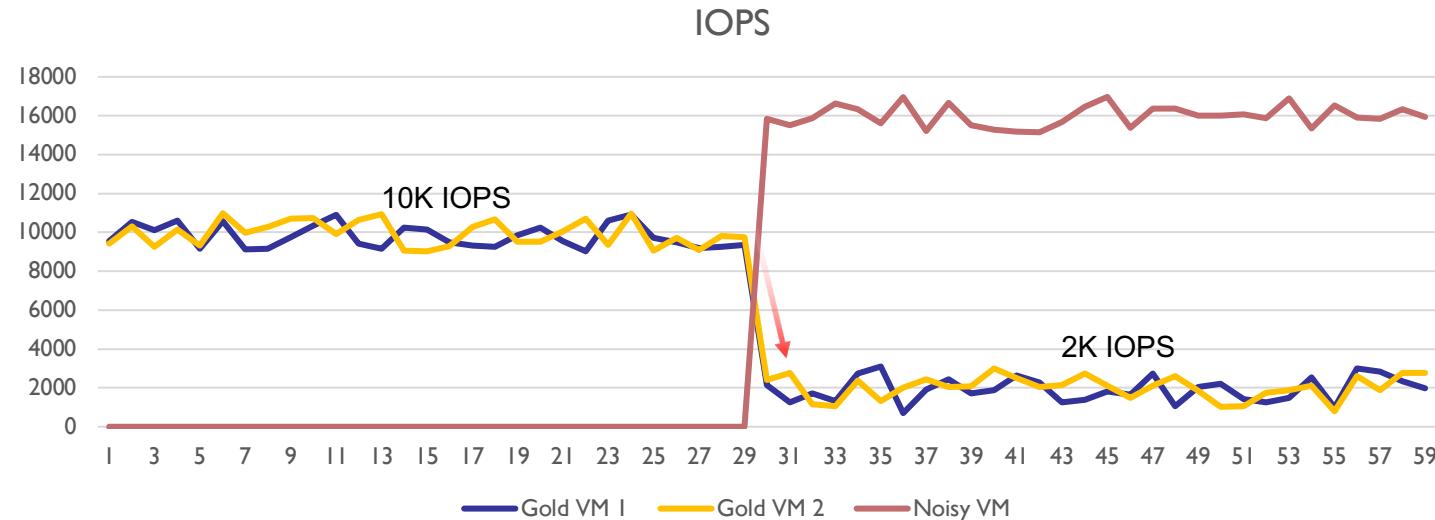


Fig. 4: Noisy neighbor problem

Need for QoS in multi-tenant environment

□ With QoS

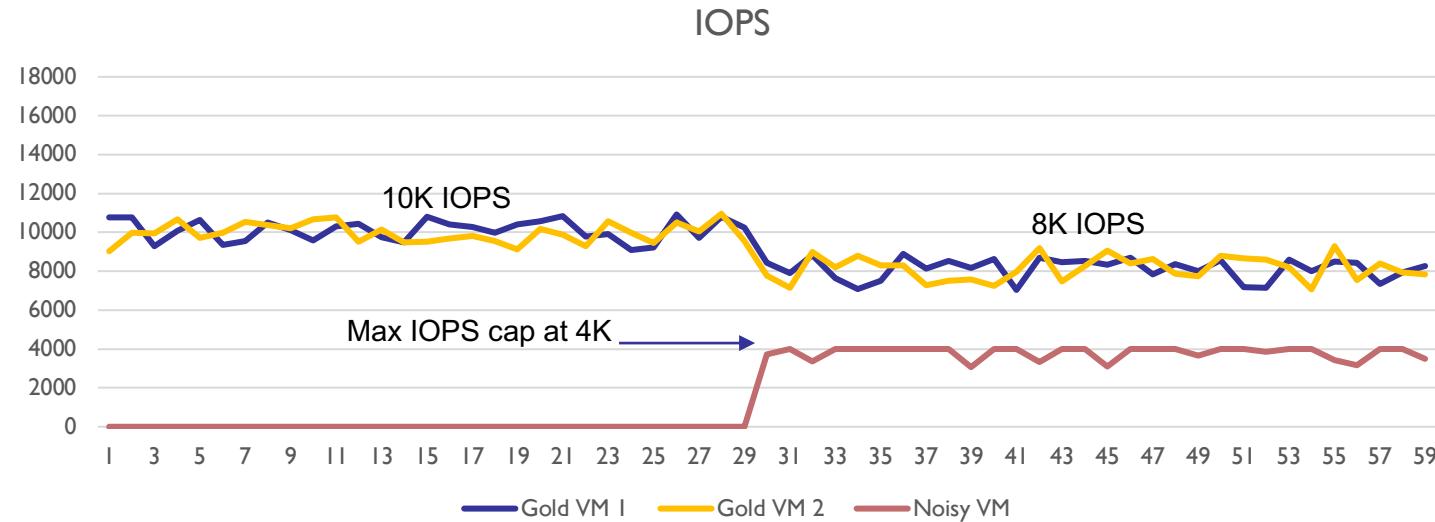


Fig. 5: Solving noisy neighbor problem with QoS

Integrating QoS in multi-tier storage

- Space fill rate = External write rate
 - Internal flush rate
- Goals:
 - Space fill rate → 0
 - External write rate → No sudden drop

Integrating QoS in multi-tier storage

□ Space based adaptive throttling

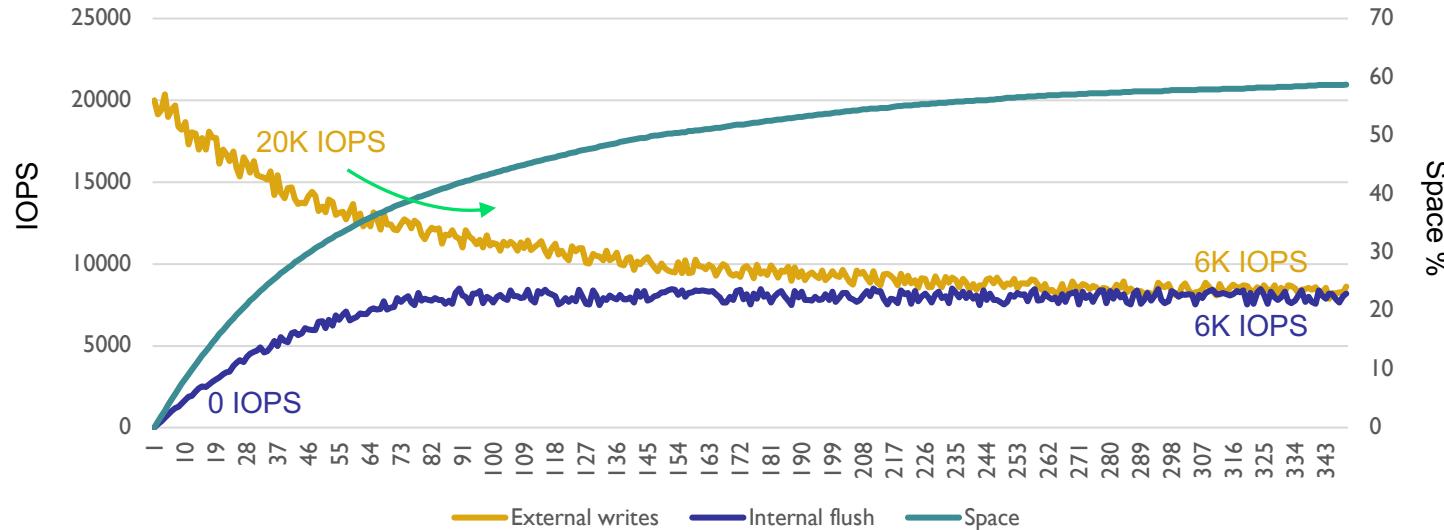


Fig. 6: Gradual performance drop

Integrating QoS in multi-tier storage

□ Multiple workloads

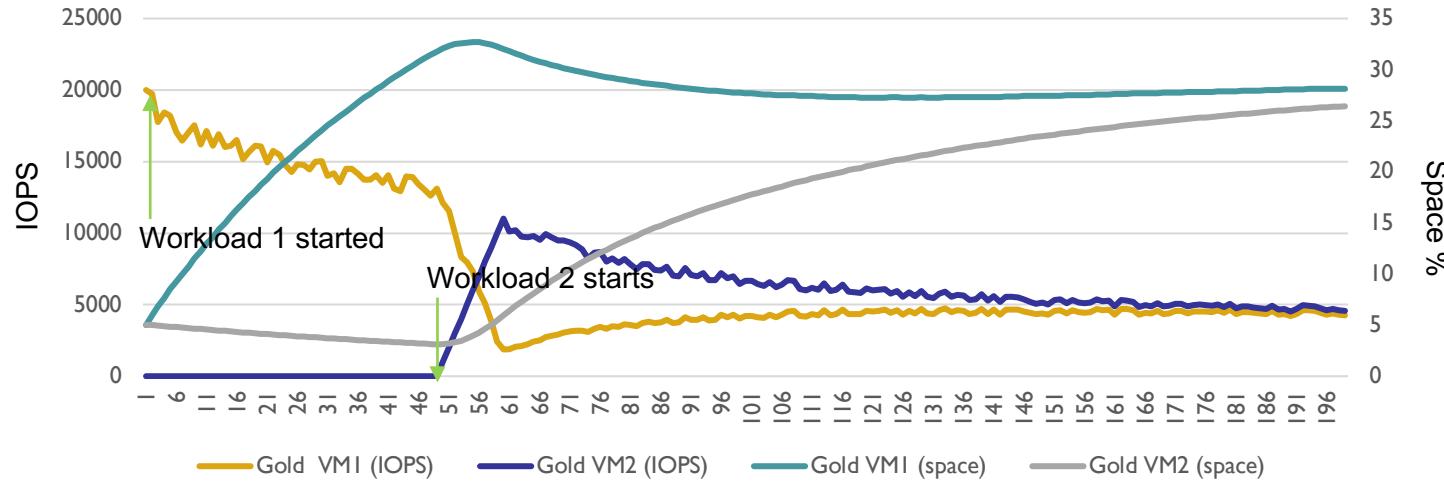


Fig. 7: Performance for multiple workloads

Thank you!