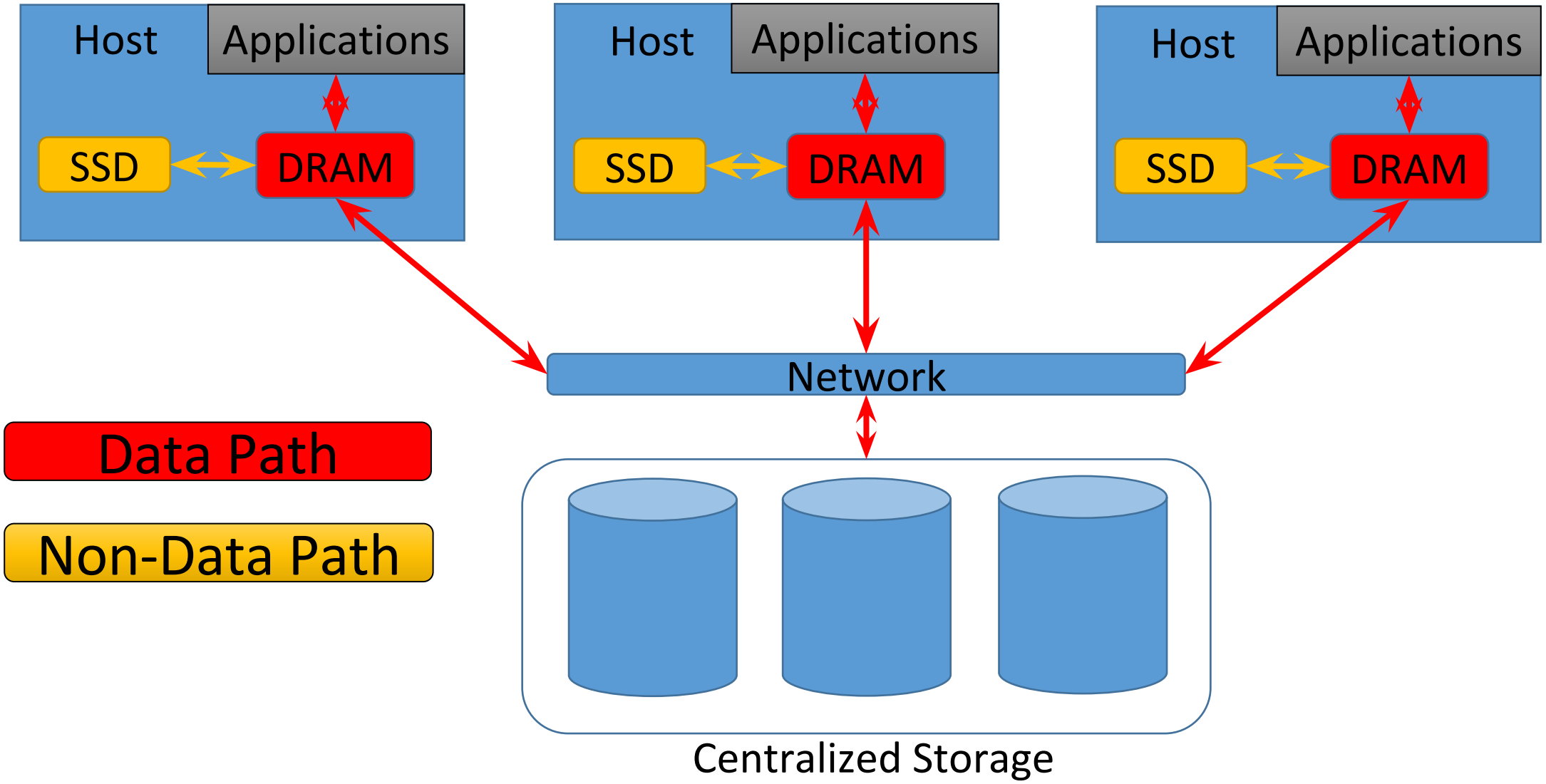
To ARC or not to ARC

Ricardo A. Santana, Steven Lyons, Ricardo Koller*,
Raju Rangaswami, Jason Liu

Florida International University *** IBM TJ Watson**

Host-side Caching



Benefits of Selective Caching

Extend the lifetime of the SSD

Improve hit-rate

Reduce system latency

Traditional Caching Algorithms

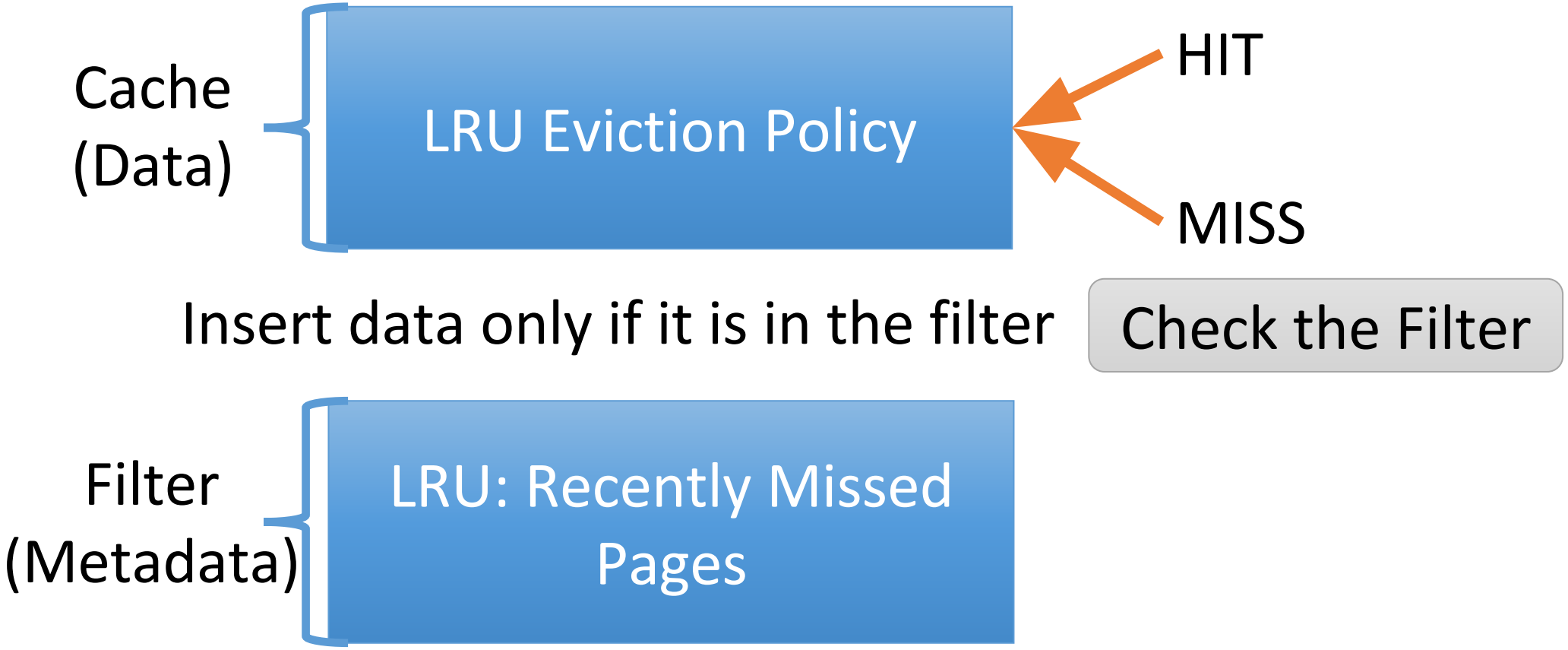
Designed to optimize hit-rate

Always perform cache replacement on a miss

Performance can be penalized

Adversary workloads for SSD caching

LARC - Previous Solutions



LARC - Observations

Avoids cache pollution

Maintains working set in cache

Slow to renew working set

mARC

Cache
(Data)

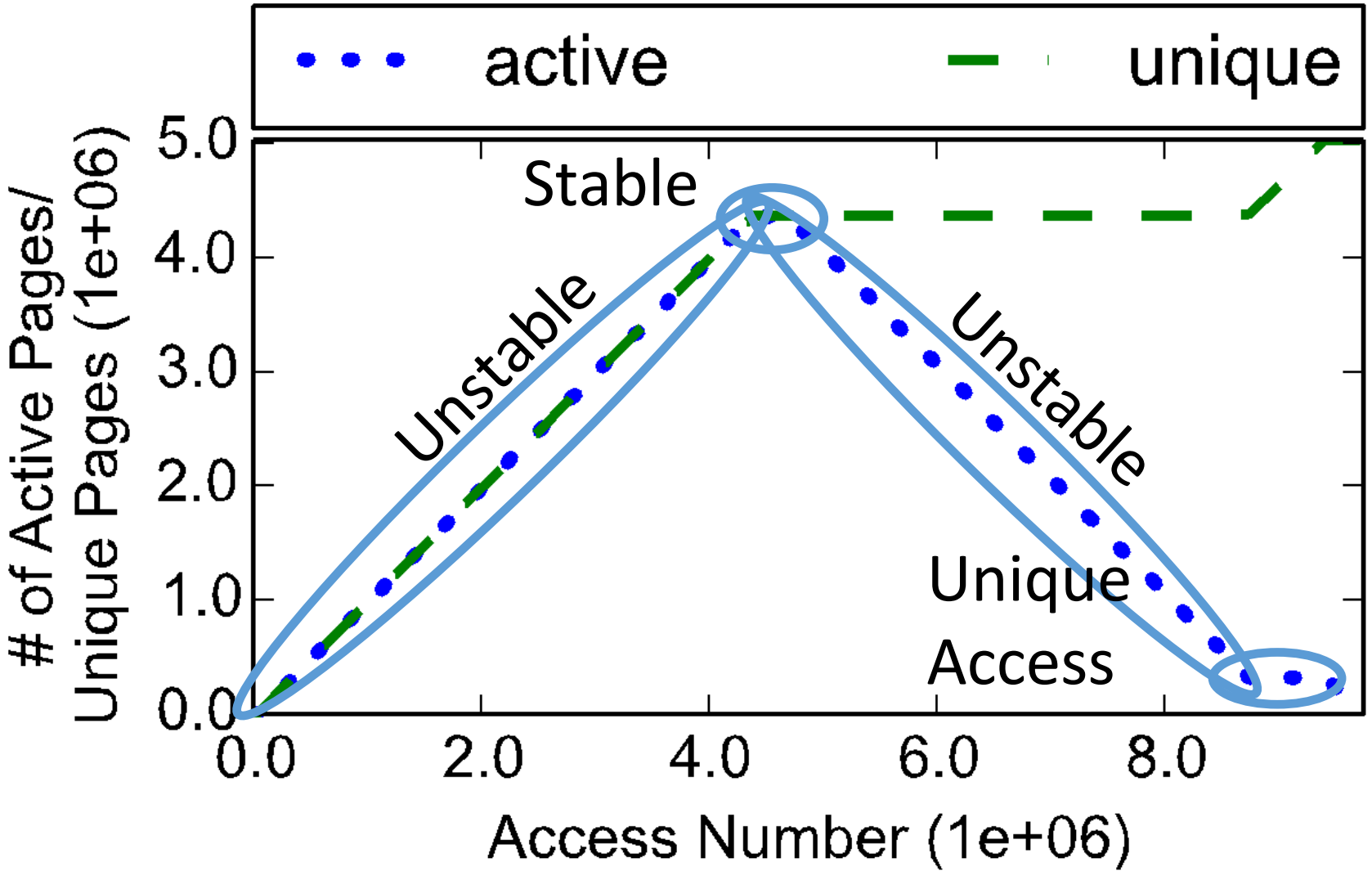
ARC Eviction Policy

Filter is not always used

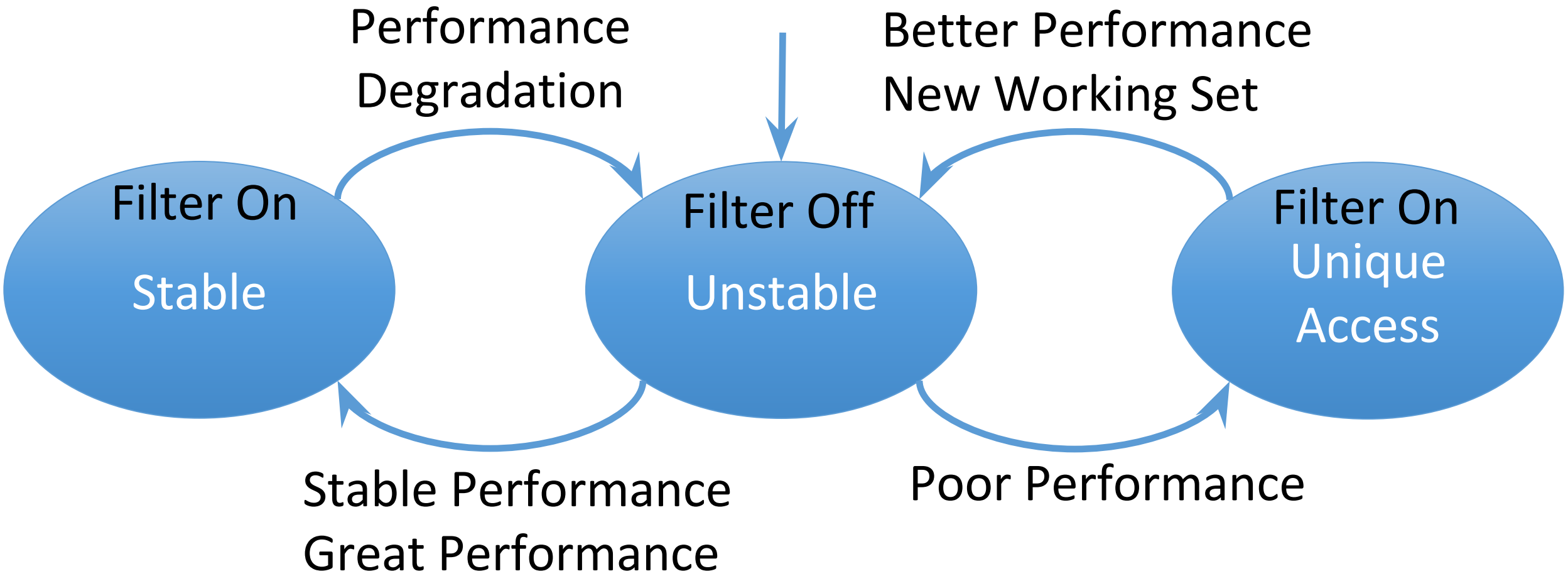
Filter
(Metadata)

LRU: Recently Missed Pages

Workload States A-U Modeling

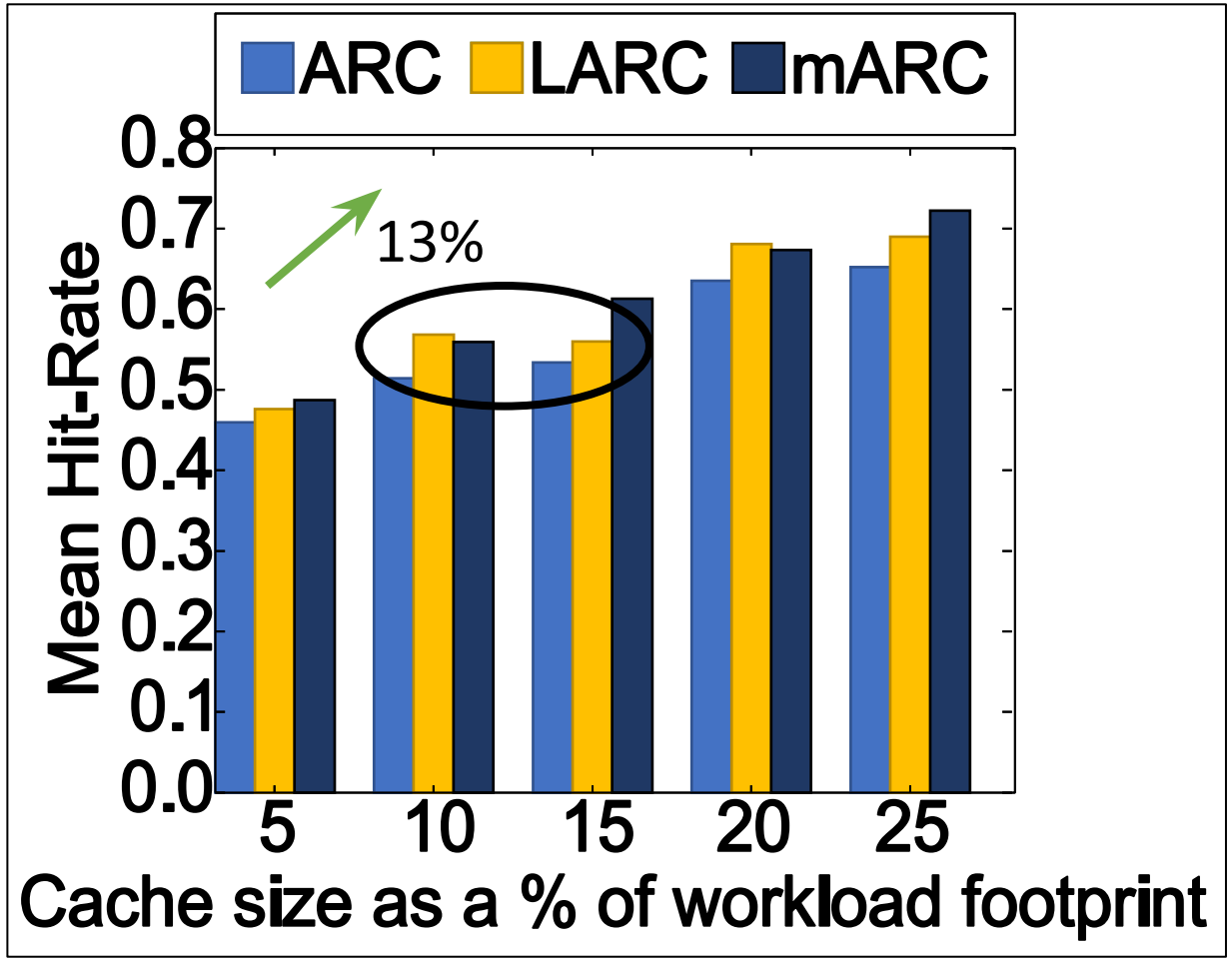


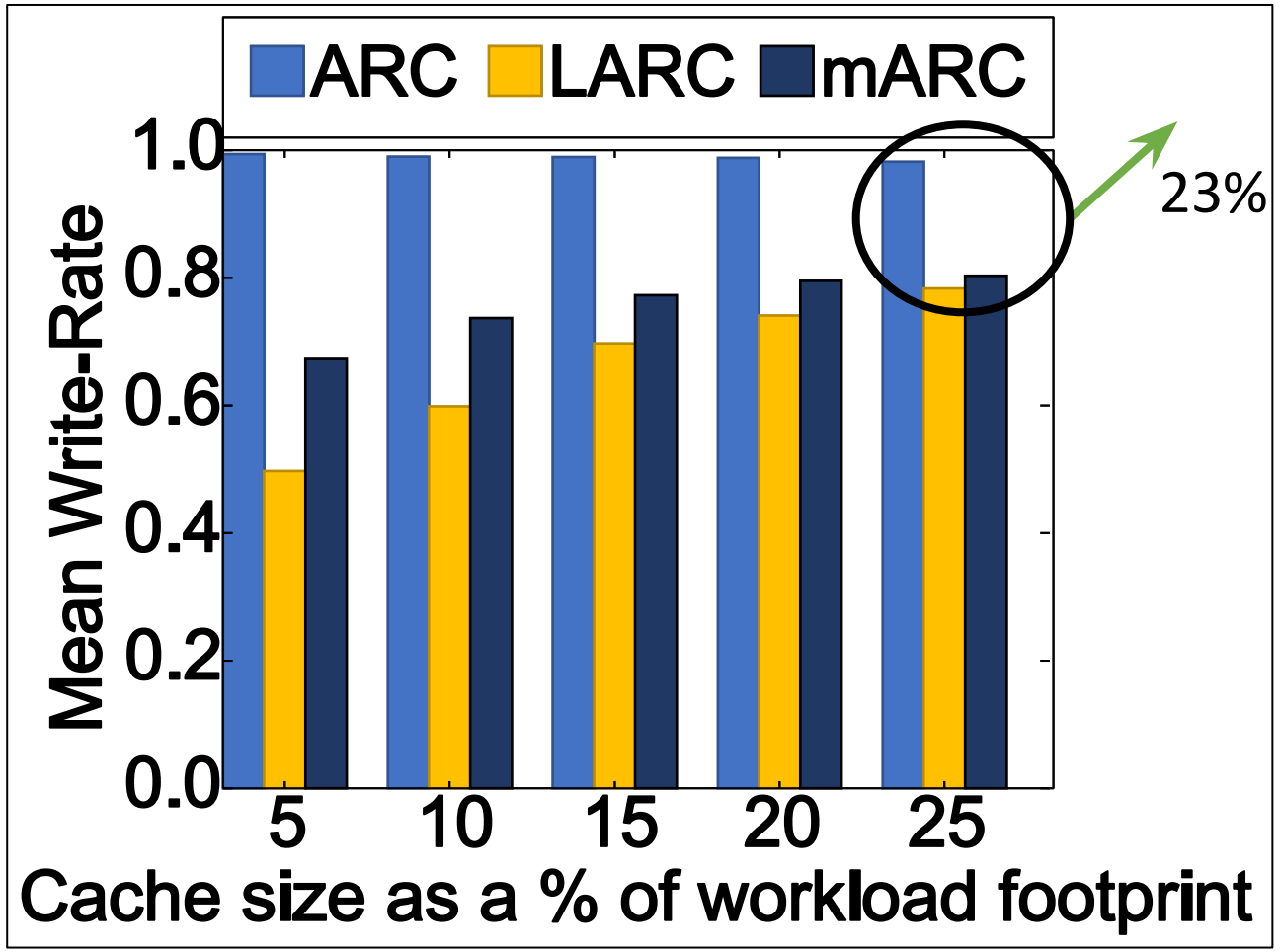
mARC - State Machine



EVALUATION

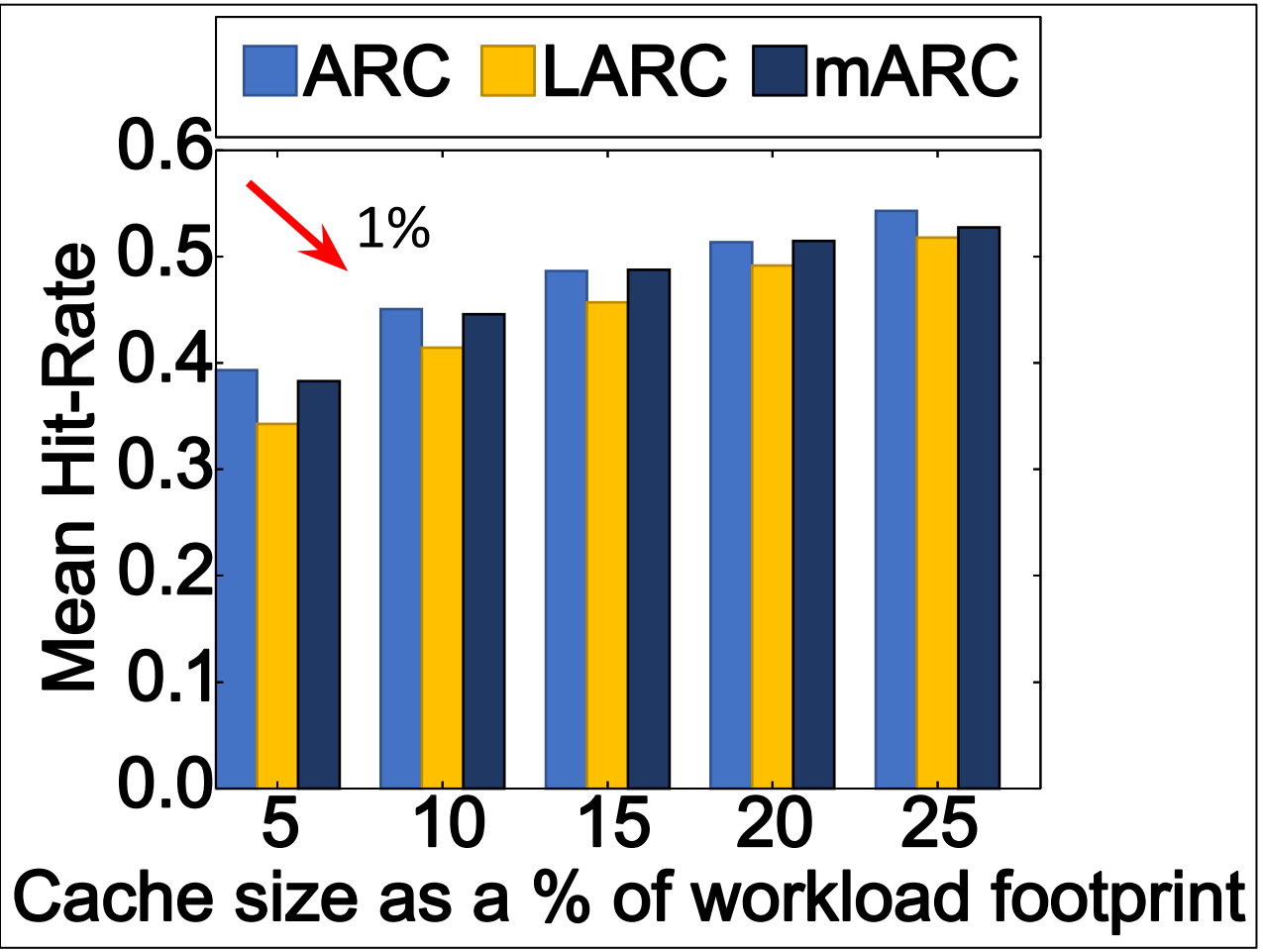
FIU Traces

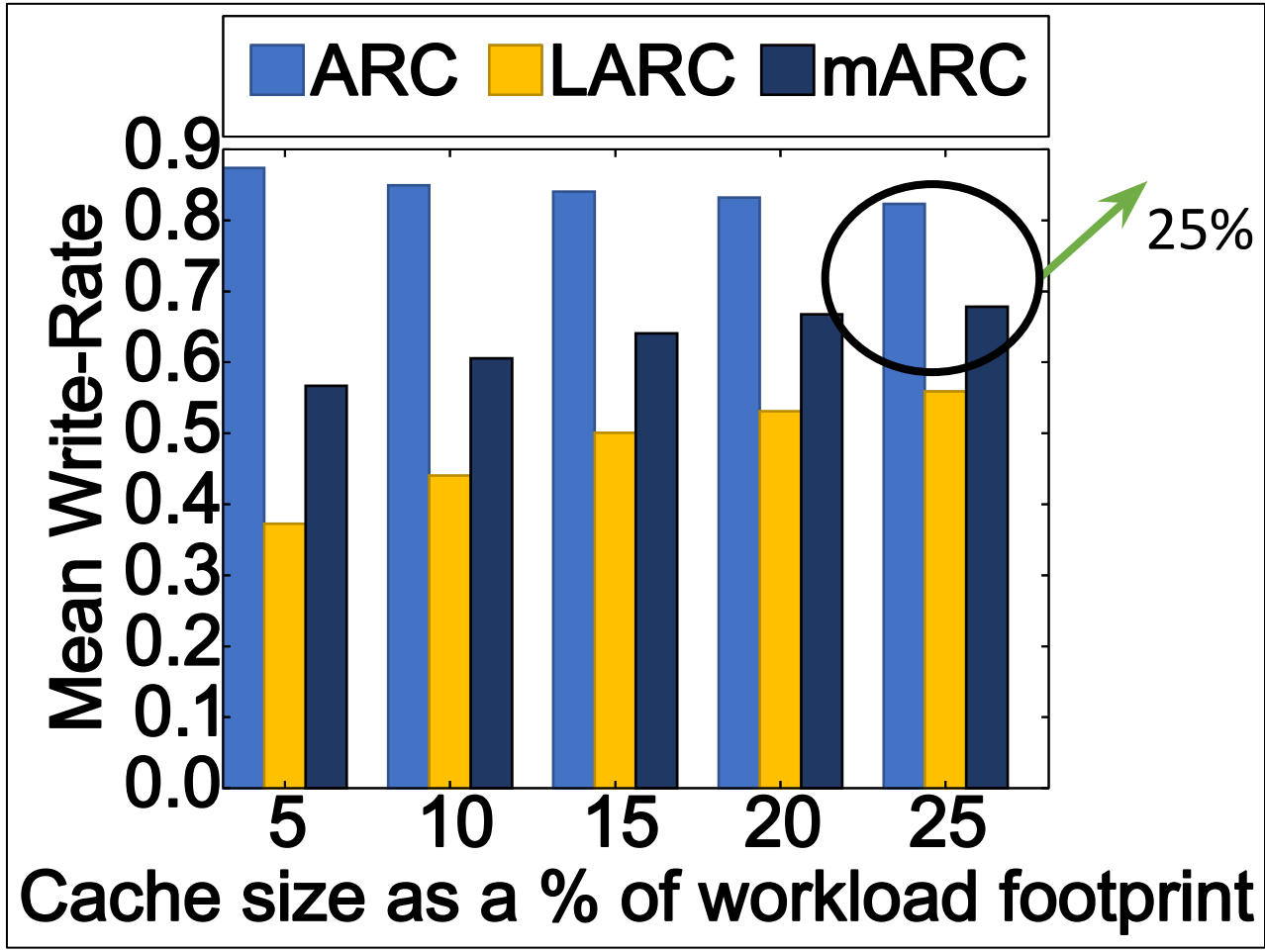




Normalized vs. ARC

MSR Cambridge Traces





Normalized vs. ARC

Conclusions

Non-datapath caches are mainstream

Selective caching algorithms help

Improved performance
&
Improved device lifetime

Future Work

Generalizing algorithm

Explore other filtering mechanisms

Adaptive mechanisms

Kernel implementation

Acknowledgments

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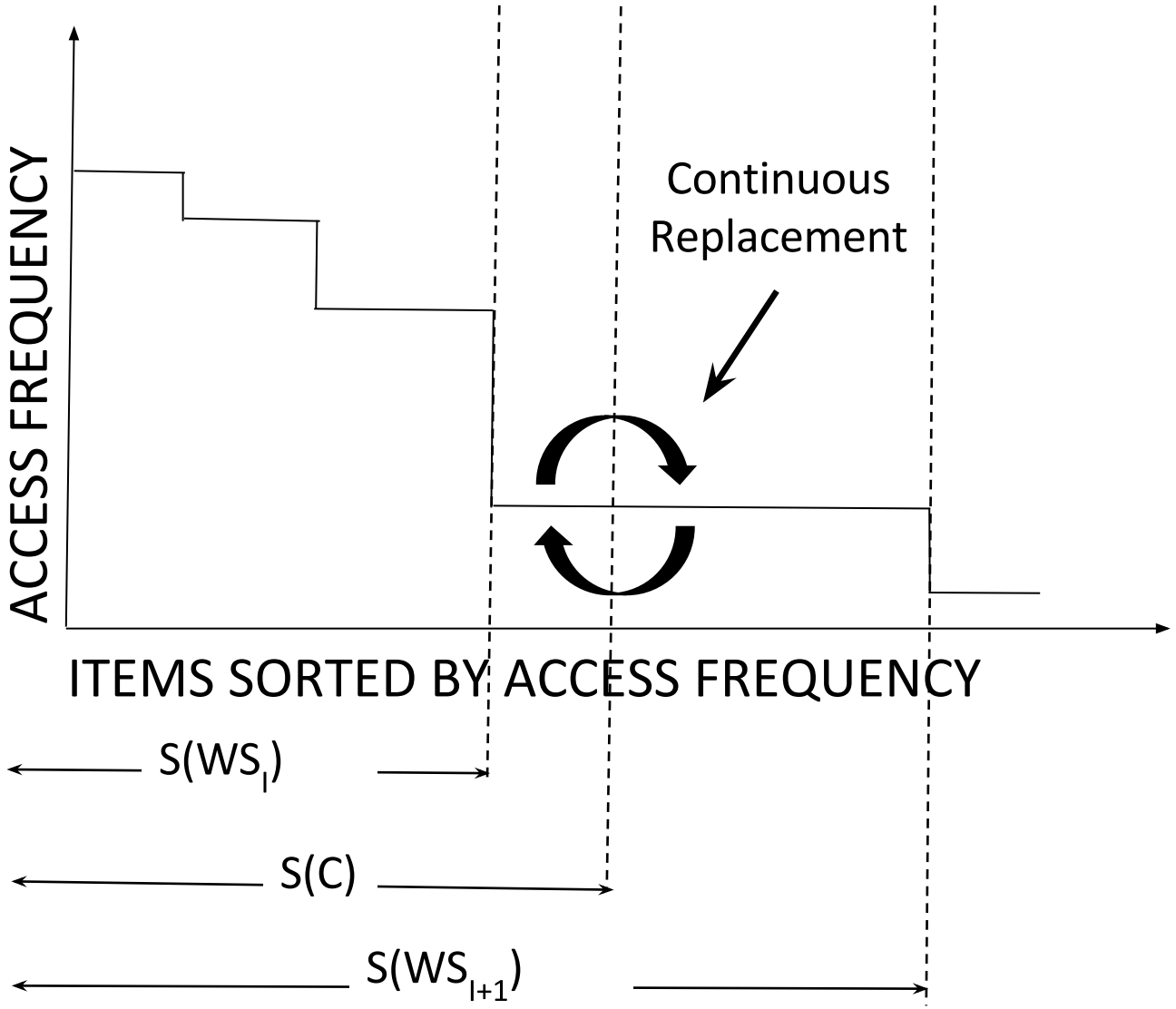
NetApp

Thank you

Questions?

What is Churning?



mARC - State Transition Table

State	Action	Condition
Unstable	Turn Filter On (Go to Stable)	Latest HR_{Sample} is almost the same as the HR_{State}
		Latest HR_{Sample} is much better than the HR_{State}
	Turn Filter On (Go to Stable)	Latest HR_{Sample} is significantly worse than the HR_{State}. (ARC is incurring in high misses lately, possible streaming)
Stable	Turn Filter OFF (Go to Unstable)	Latest Sample hit-rate is much worse than the cache hit-rate (Filtering stopped working)
Unique Access	Turn Filter OFF (Go to Unstable)	Detect a new working set being cached