Flash Hypervisor: The Savior to Storage I/O Bottlenecks?

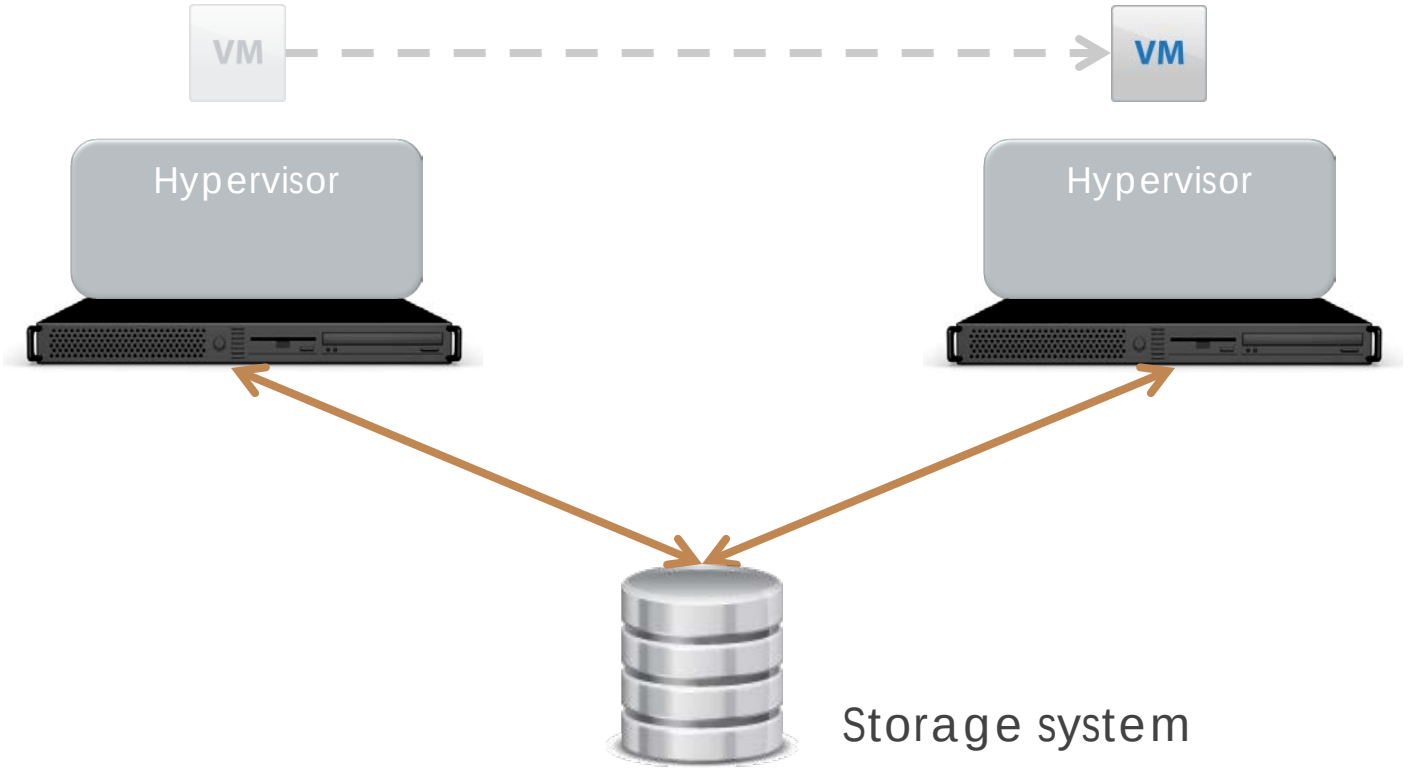
pernixdata

Bala Narasimhan

Agenda

- Case for server flash in SDDC
- Technology implications of marrying hypervisors with server flash
  - Empirical data
- Conclusion and open issues

Reference setup



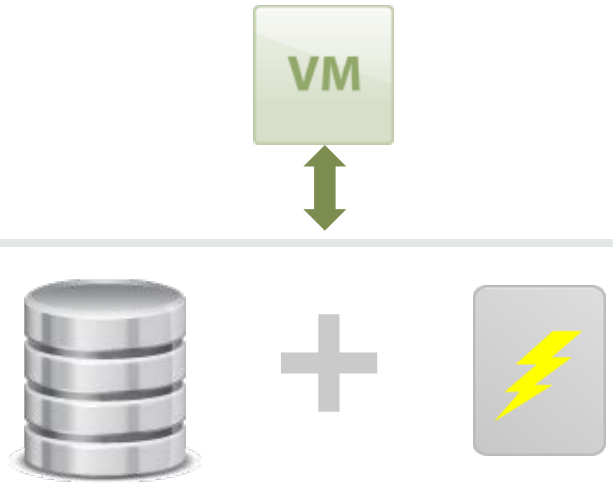
Performance or capacity?

Virtualization ♥ Flash

Current state

Low perf at high cost
High quality capacity and data services

Desired state



High quality capacity and data services

High perf at low cost

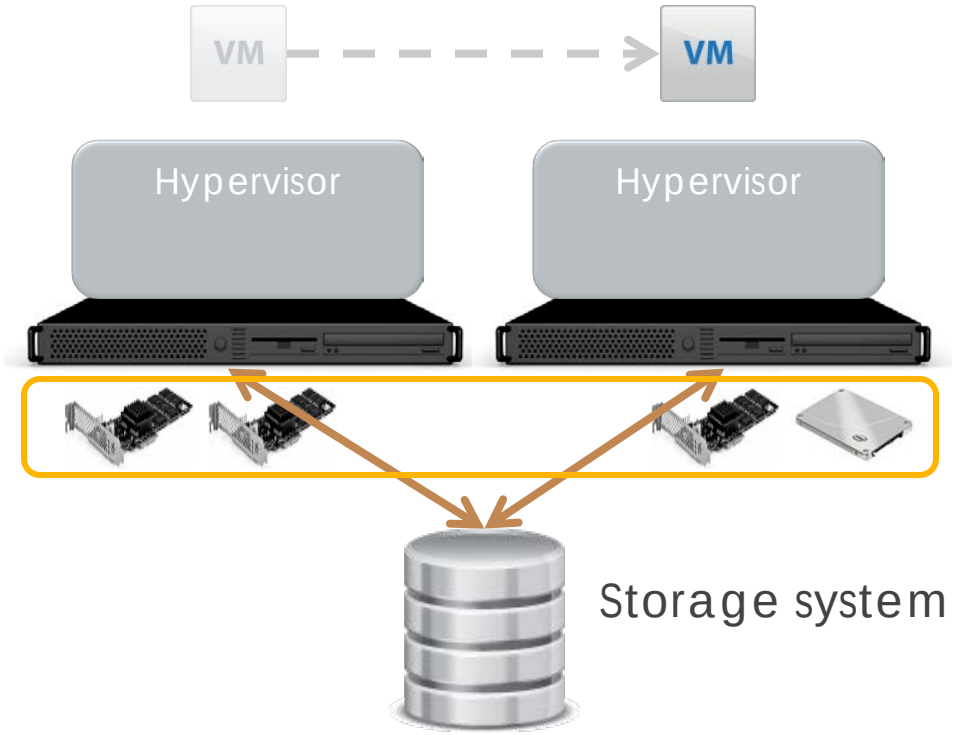
But, how?

Storage system flash has limits

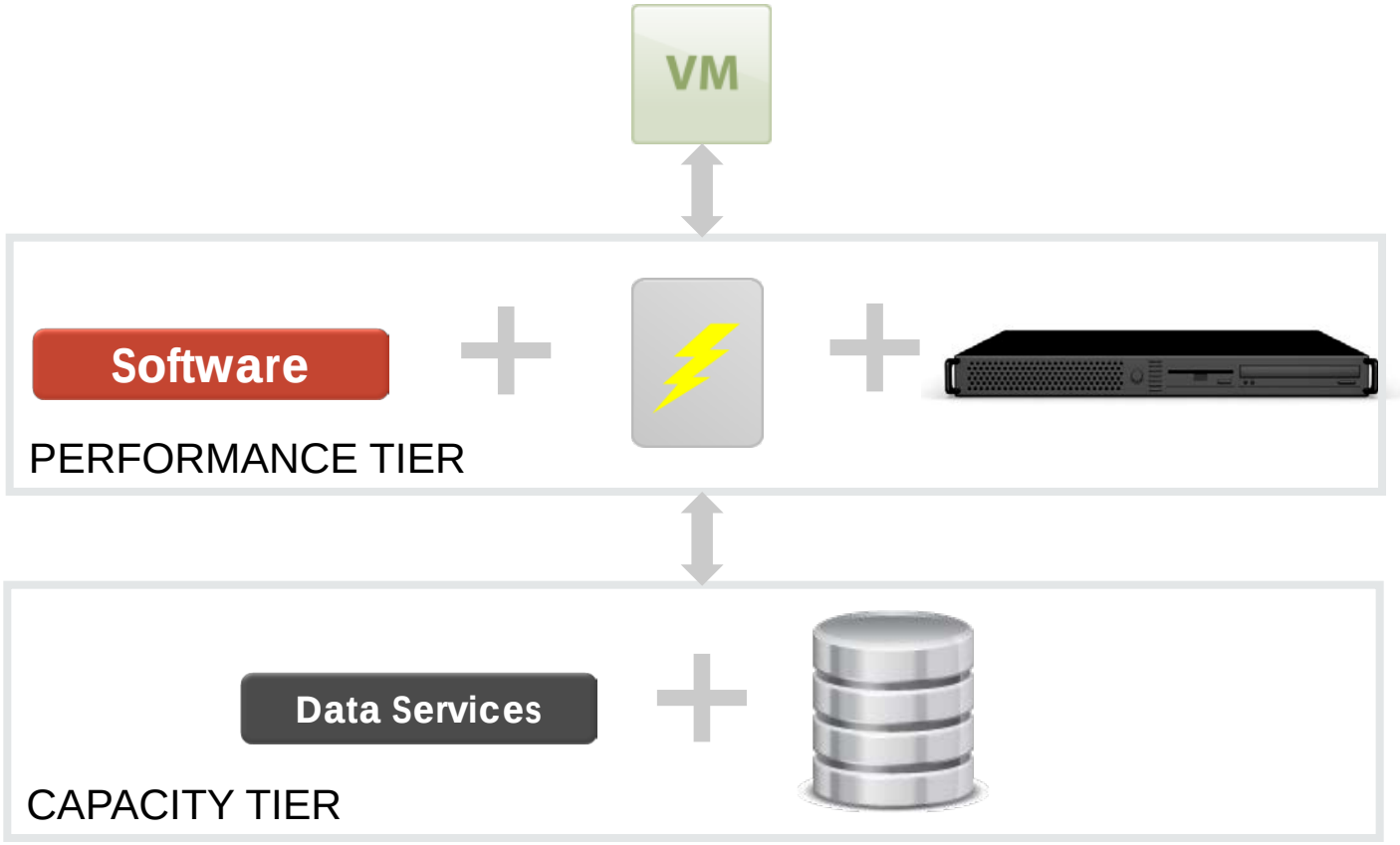
- Using storage system flash
  - Many are rip-and-replace solutions
  - Higher latency: SAN Flash is “too far” across the network
  - Loss of application/VM identity
  - Higher cost, lower scalability, depends on intermediate moving parts

Server flash with hypervisors

- Limited to niche use cases with
  - Local datastores, or
  - Single host read only cache
- Not clustered, breaks cross-host hypervisor functions
- Need custom applications or in-VM changes
- Low performance, less available virtual appliances



Time for a brand new data tier?

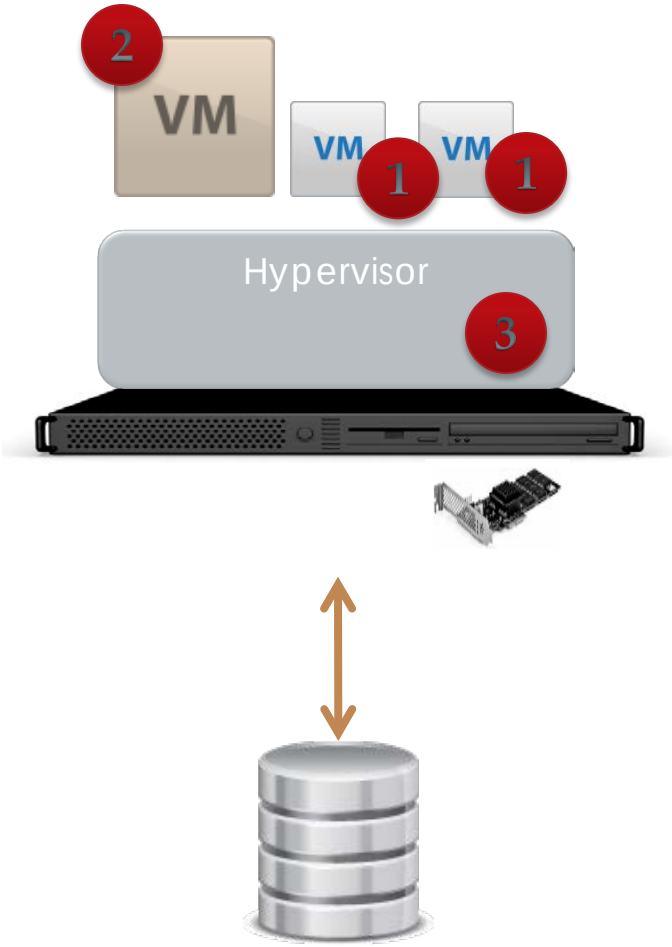


Scope of the problem

- Form factor and placement of software
- Optimal flash format
- Clustering of flash resources
- Expanding beyond niche use cases

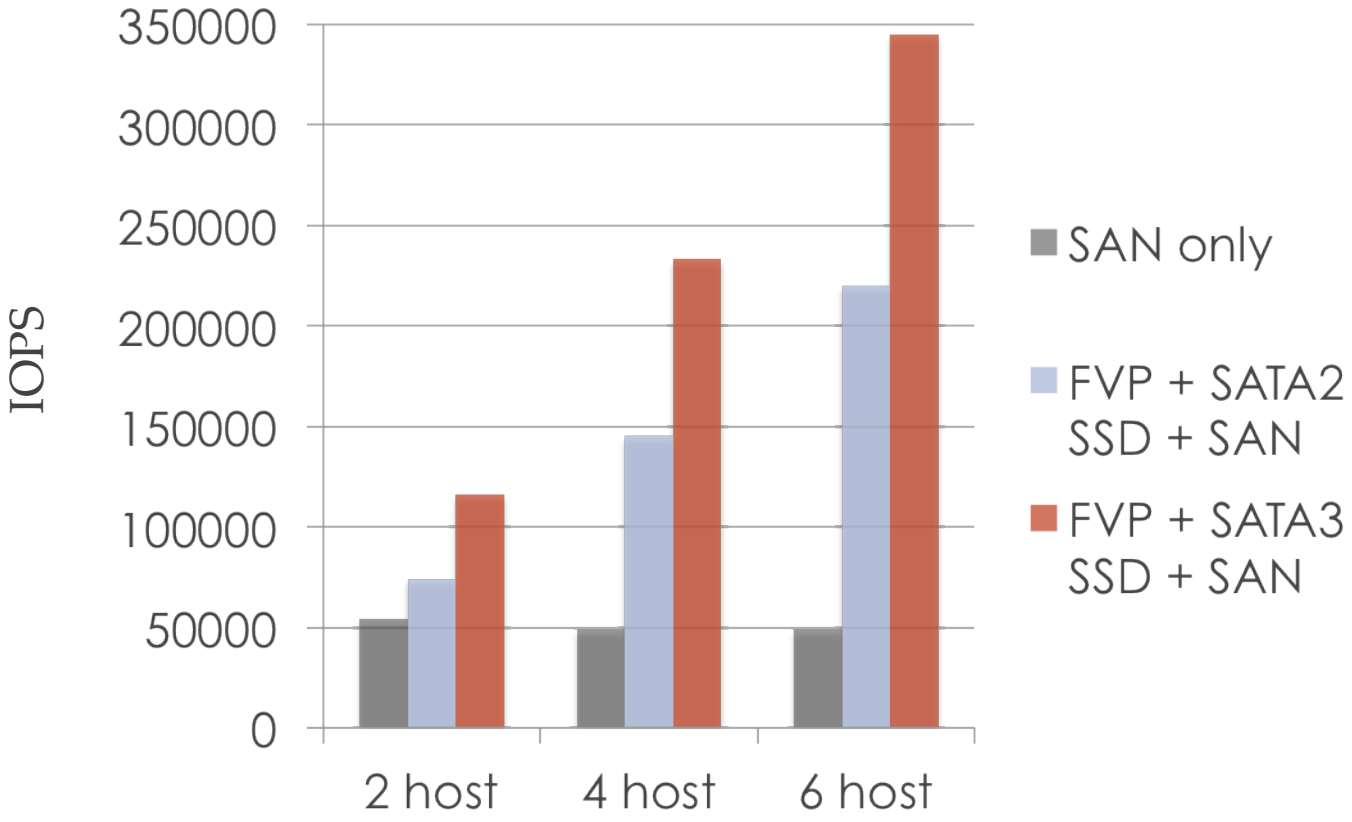
How to leverage server flash

- Form factor
  - Local datastore, or
  - Acceleration tier
- Placement
  1. Inside guest OS
  2. Virtual appliance
  3. Inside hypervisor

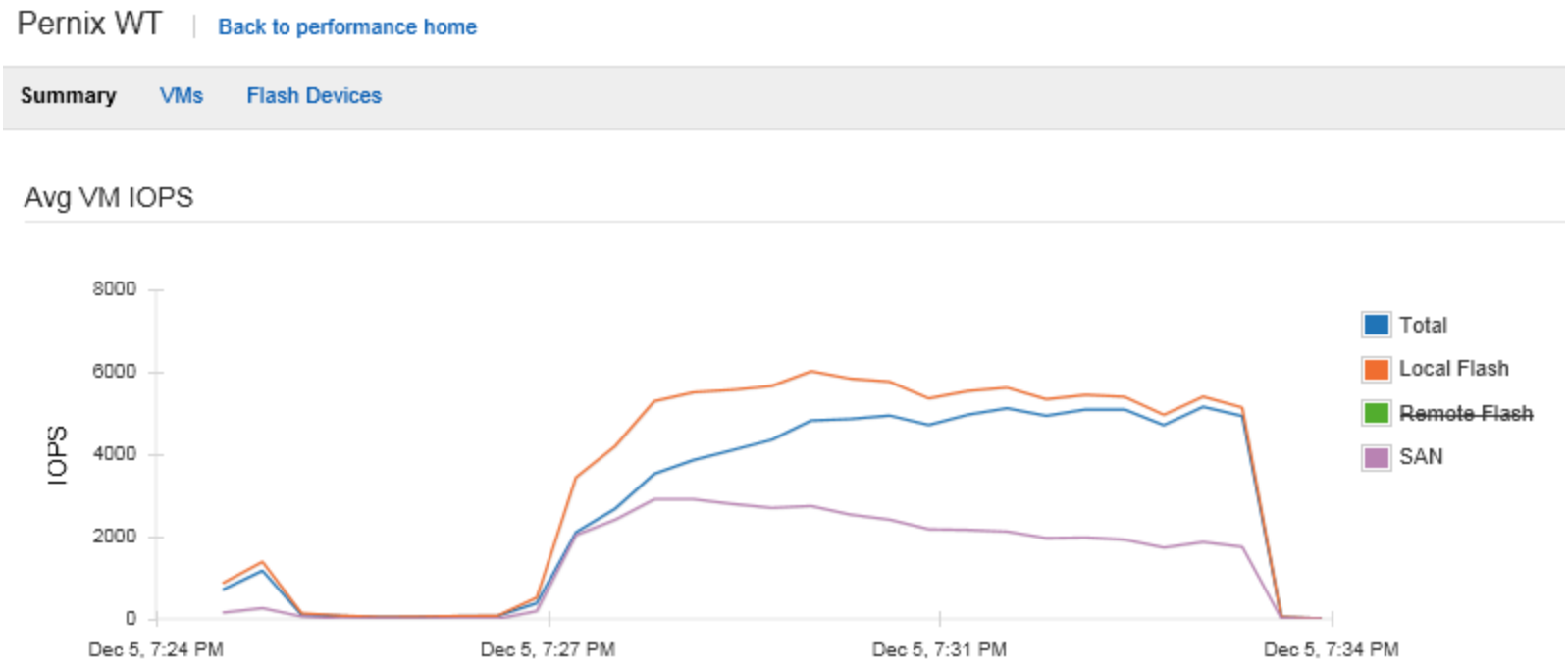


Scale out

Server flash beats SAN IOPS even in small clusters!



Read heavy (VDI) results



10 write through Win 7 Linked Clones running 80% Read, 80% Random for 6 minutes [including boot up and shut down]

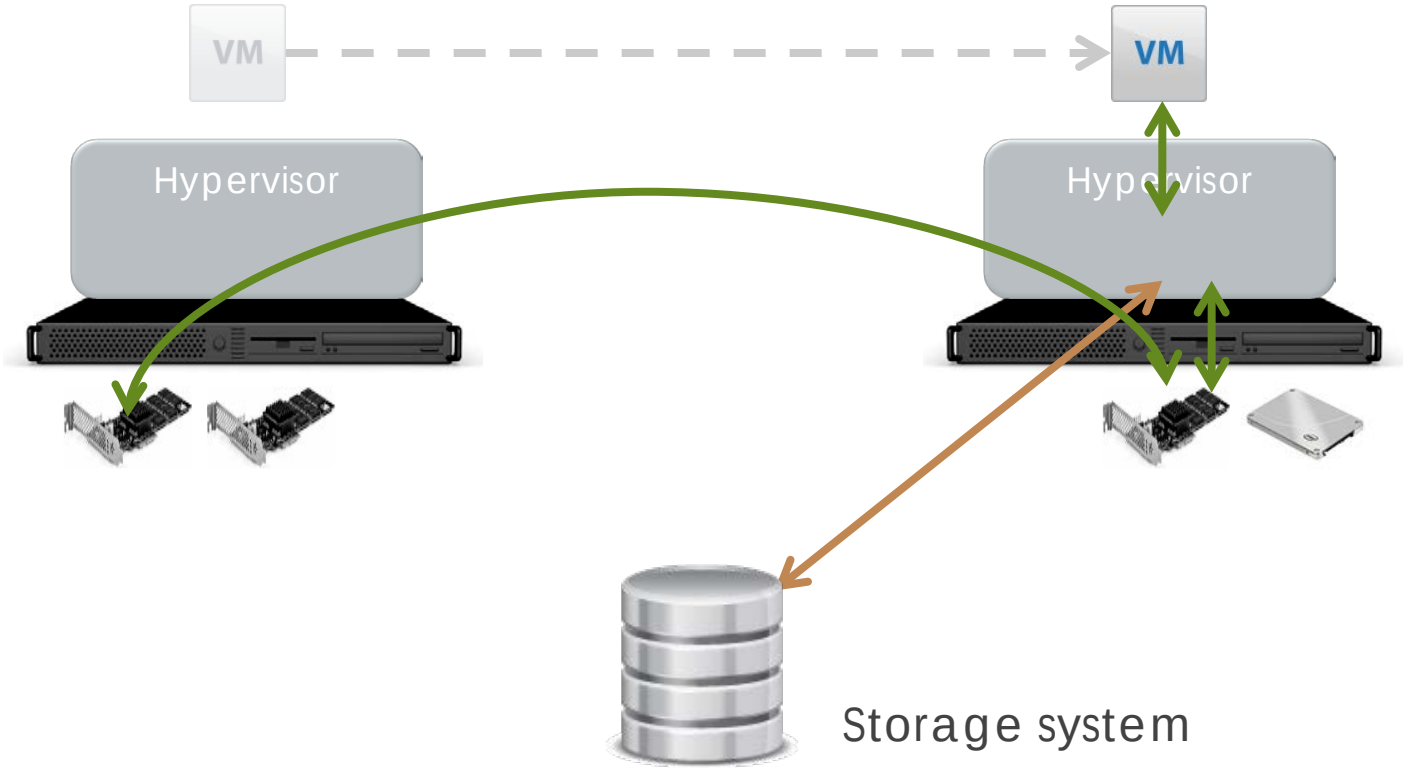
Flash format considerations

- Hypervisors need something else from flash
  - VM QoS management required, not capacity management
  - Performance isolation between VMs
  - Write intensive: even read intensive workloads cause (false) writes. E.g…

4KB workload READ latency sensitive to OIO, presence of WRITES!	
300us	3200us
100% read, 80% random, 16 OIOs	67% read, 80% random, 64 OIOs

Clustering considerations

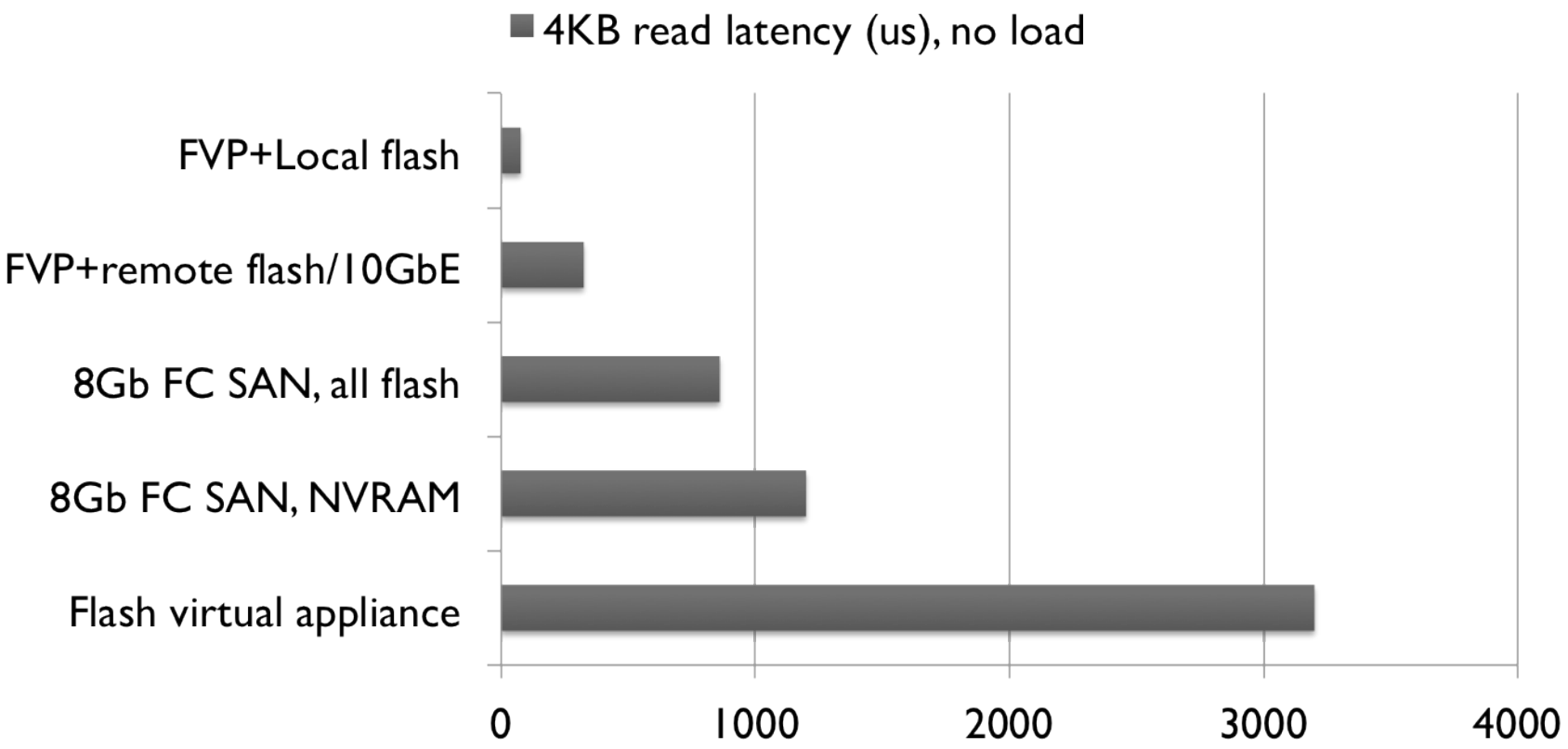
- What: Transparent remote flash footprint access on behalf of VMs



Clustering considerations - 2

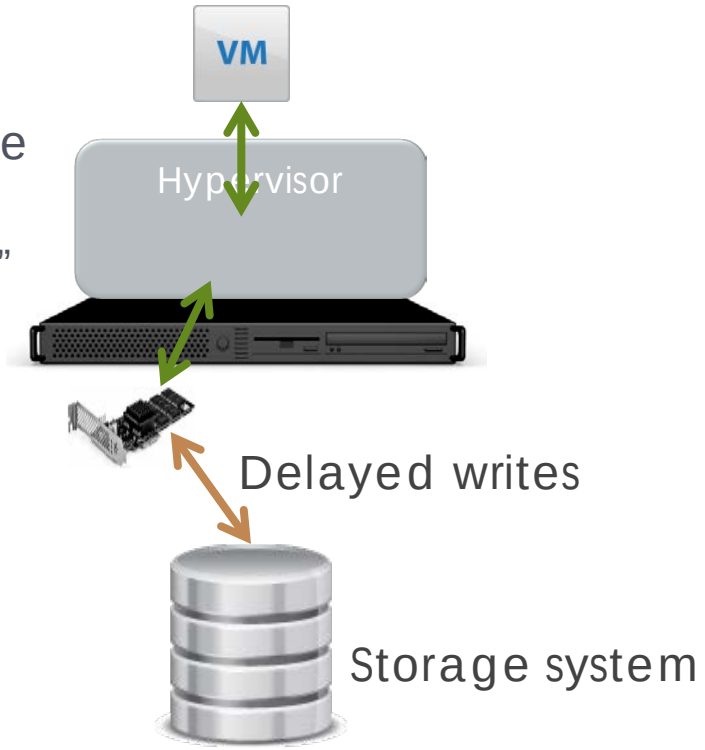
- Why
  - More efficient use of precious flash
  - Server-2-server network more scalable
  - Compatibility with clustered hypervisor features
- Challenges
  - Network cache coherency performance and scale undoes flash performance

Latency advantage



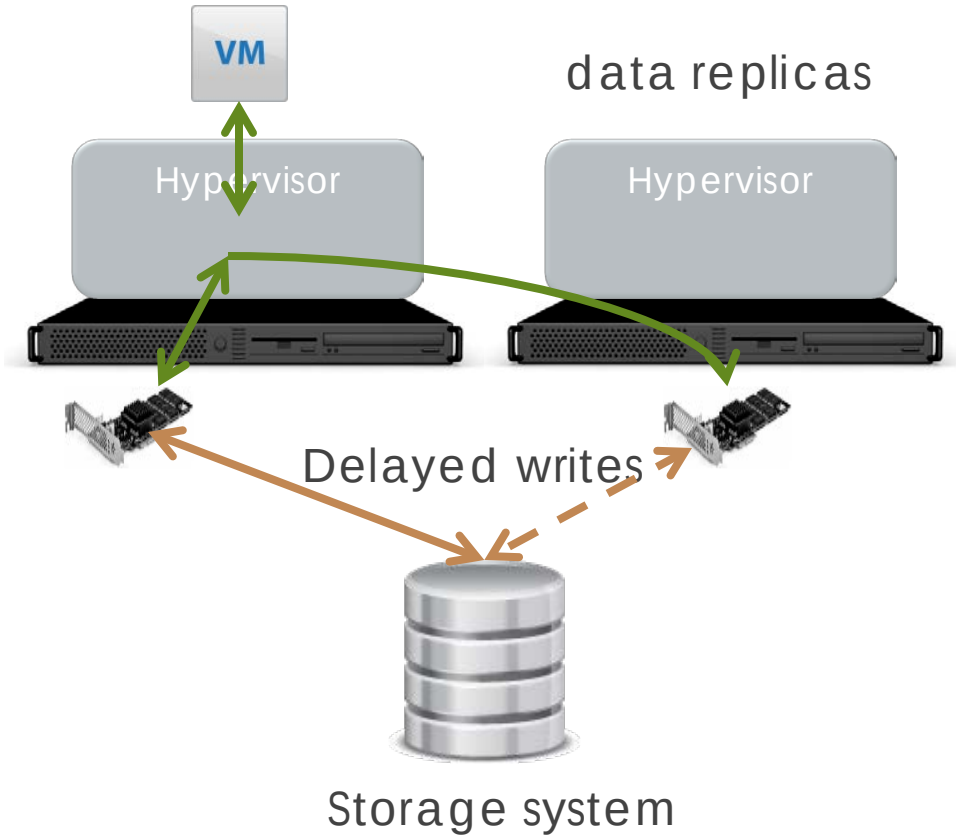
Write problem - 1

- What: Use server flash to accelerate VM writes just like reads
- Why
  - Make this applicable to most workloads
  - Fundamentally change storage infrastructure design
    - Deploy storage systems for new “worst case”

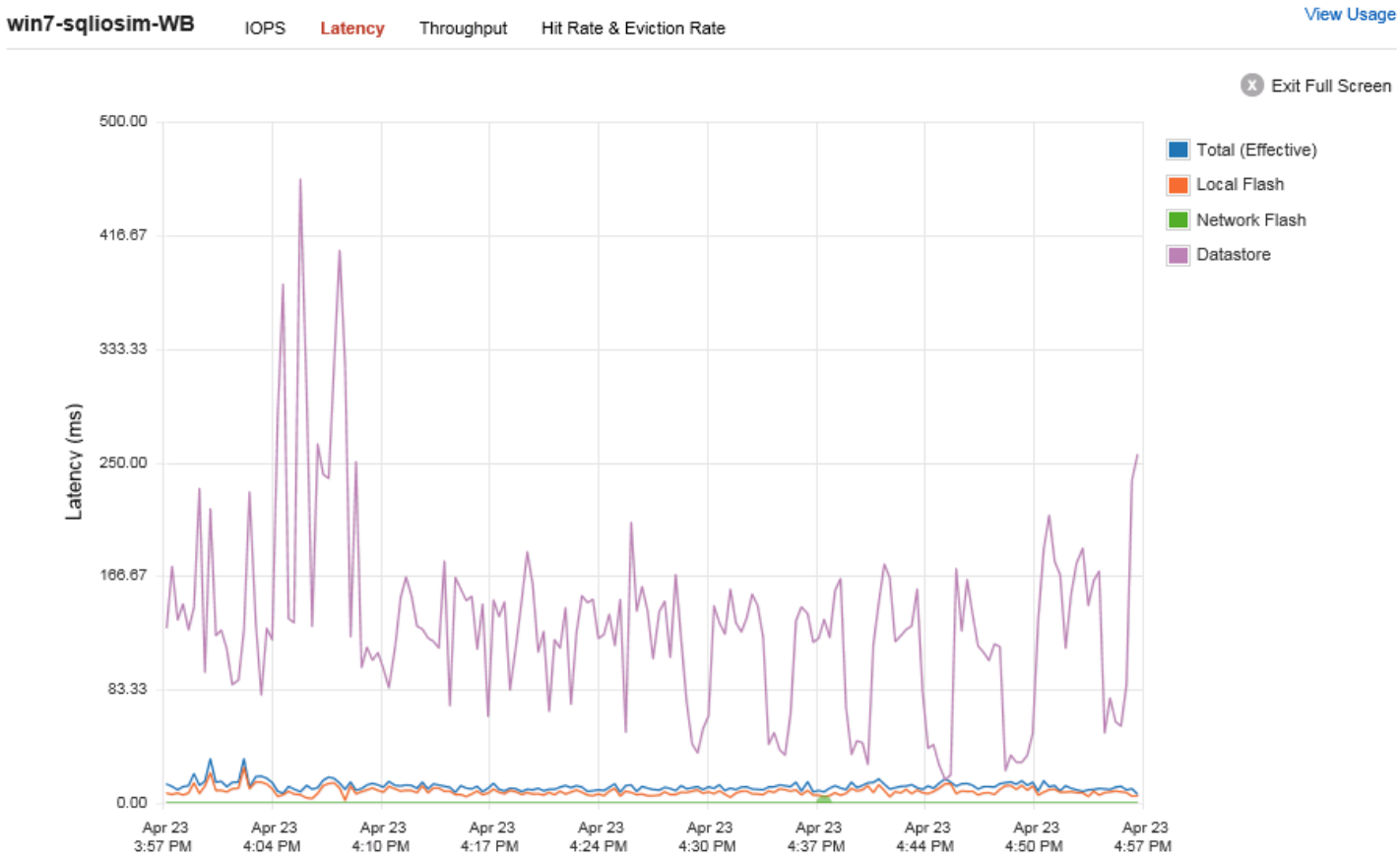


Write problem - 2

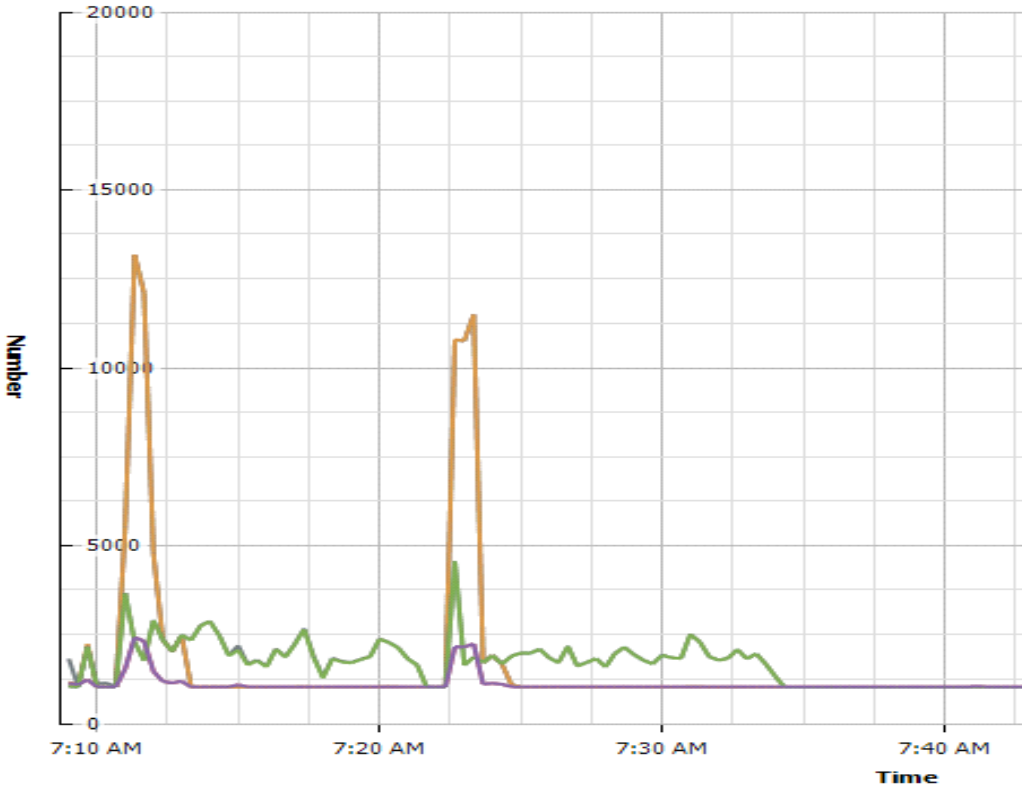
- Challenges
  - Failure handling
  - Crash consistency
  - SAN replication
- Solution
  - Fault tolerant write back acceleration



Effect of writeback on databases



The big deal with write acceleration



Performance Chart Legend

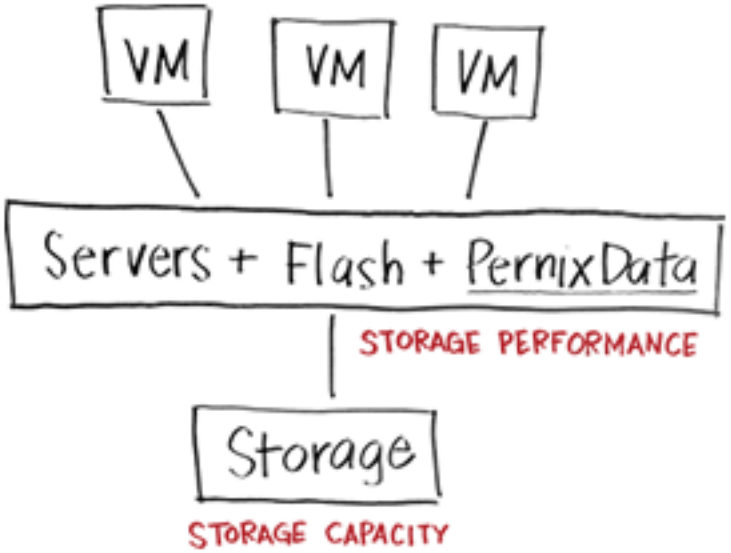
Key	Object	Measurement	Rollup	Units
	pscsi.vmhba38-pscsi.0:0-naa.600601604	per second	average	Number
	pscsi.vmhba38-pscsi.0:0-naa.600601604	per second	average	Number
	block.fio/c0d0:0-block.0:0-mpx.vmhba3:	write requests per second	average	Number
	block.fio/c0d0:0-block.0:0-mpx.vmhba3:	read requests per second	average	Number
	fc.20000000c9dd5c45:10000000c9dd5c45-			
	fc.20000000c9dd5c45:10000000c9dd5c45-			

Summary

- These are the beginnings of a data-in-motion tier via a Flash Hypervisor
- What is that?
  - **Scale-out acceleration:** No disruption to existing VMs and storage systems
  - **Hypervisor-resident resource manager:** Virtualizes flash just like hypervisors virtualize CPU, memory, network
  - **Clustered:** Allows cross-server access of hot data, and support for clustered hypervisor features (e.g. vMotion)
  - **Fault Tolerant:** Solves write acceleration problem for wide (infrastructure-level) applicability

Example: PernixData FVP

- FVP is software to aggregate server-side flash into a scale out data acceleration tier
  - Non-intrusive acceleration
  - Transparent remote flash access
  - Fault tolerant write acceleration



Other open issues

- Storage protocol between data-in-motion tier and data-at-rest tier
- Effect on server hardware architecture
- Storage policy interface for flash hypervisors
- Storage stack changes to accommodate flash
- …and many more

Thank you

 @BalaNarasimhan

bala@pernixdata.com

More resources: www.pernixdata.com