

Differentiated Storage Services Gen-2: Enabling Storage QoS for Virtual Machines

Rachata Ausavarungrun[†], Paul Brett[‡], Scott Hahn[‡], Michael Mesnier[‡], Onur Mutlu[†]
[†]ECE, Carnegie Mellon University [‡]Systems Architecture Lab, Intel Labs

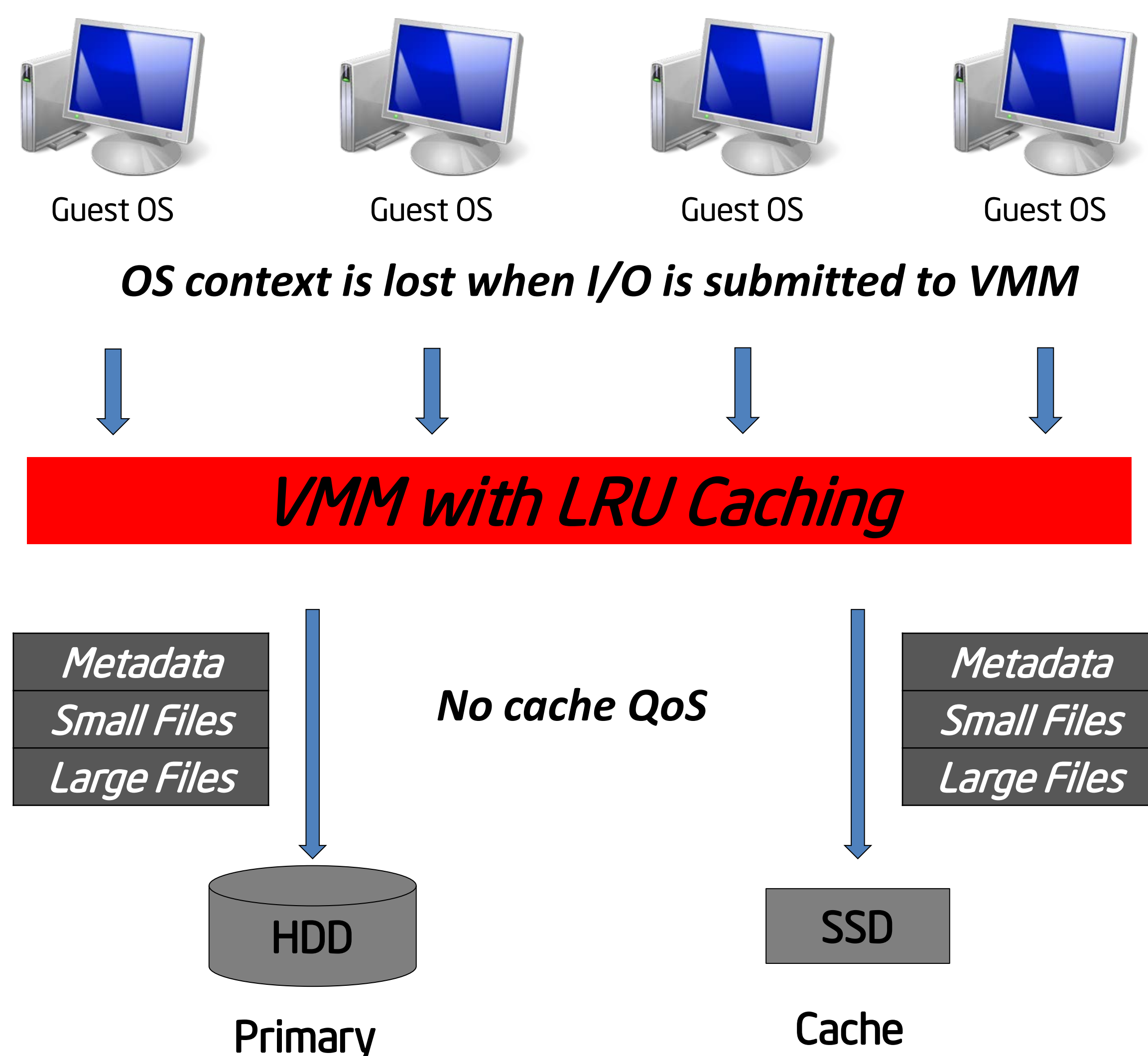
The Problem: No context for VM storage I/O

- No OS context is preserved between the VM and VMM
- Delivering end-to-end QoS is becoming increasingly difficult
- E.g., SSD caching in the VMM is inefficient (and ineffective)

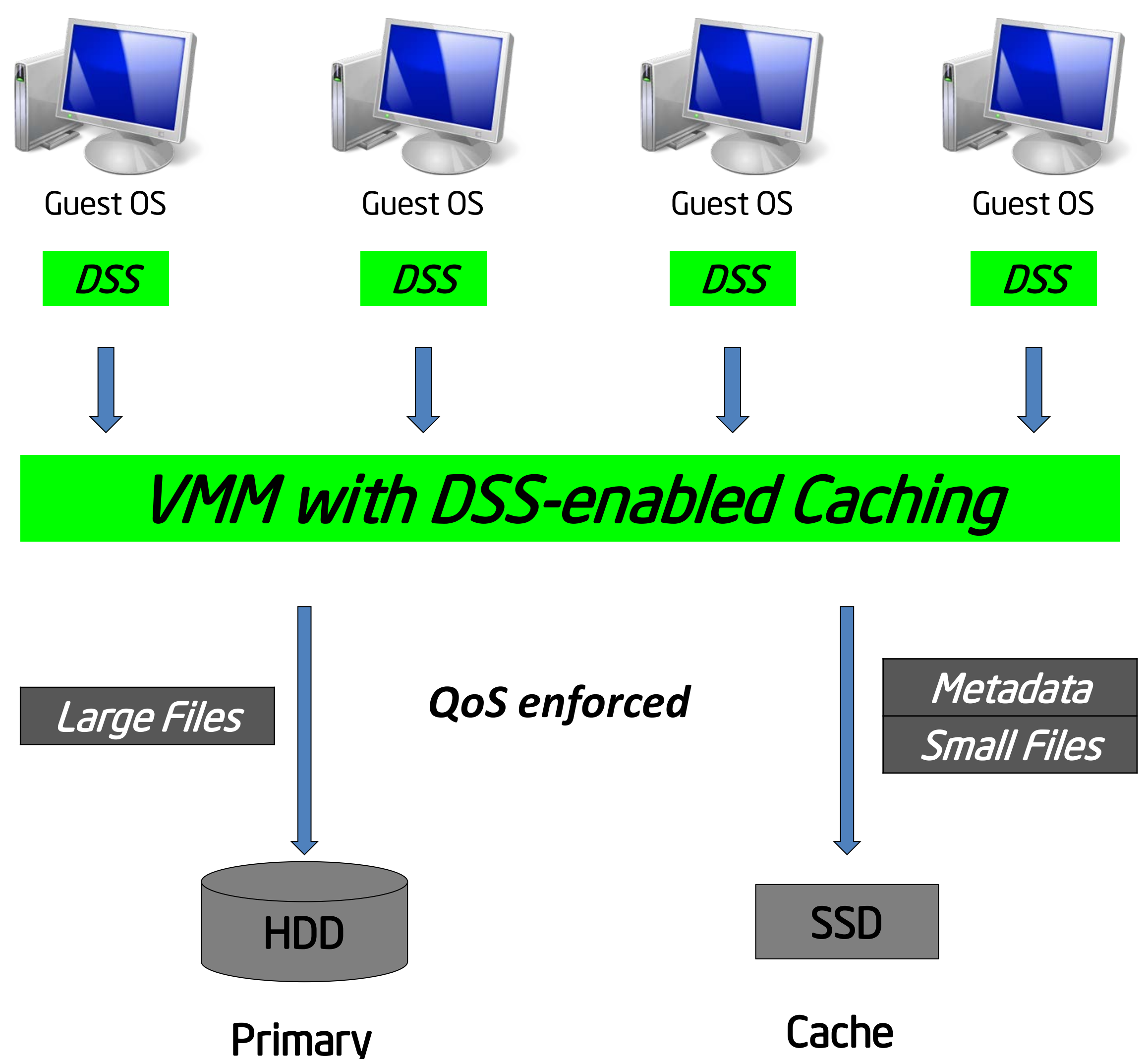
Our Approach: I/O Classifications

1. Classify each VM I/O request (in-band)
2. Assign VMM policies to I/O classes (out-of-band)
3. Enforce policies in the VMM storage system

Traditional VMM Architecture



Classifying I/O with DSS



DSS Gen-2 Prototype for VM

VM guests	<ul style="list-style-type: none"> • 4 VMs • Postmark (180 GB working set size)
VMM	<ul style="list-style-type: none"> • Ext4 • 96 GB SSD Cache • 800 GB HDD
Caching Policy	<ul style="list-style-type: none"> • DSS Cache Metadata + Small files (<16kB) • DSS Cache Metadata + Small files (<256kB) • DSS Cache All • Metadata > Small files > Big files

Bandwidth Improvement

