

**USENIX ATC '13:**  
**2013 USENIX Annual Technical Conference**  
**June 26–28, 2013**  
**San Jose, CA**

Message from the Program Co-Chairs.....	vi
---	----

## Wednesday, June 26, 2013

### Virtual Machine Implementation

<b>Optimizing VM Checkpointing for Restore Performance in VMware ESXi .....</b>	<b>1</b>
Irene Zhang, <i>University of Washington and VMware</i> ; Tyler Denniston, <i>MIT CSAIL and VMware</i> ; Yury Baskakov, <i>VMware</i> ; Alex Garthwaite, <i>CloudPhysics and VMware</i>	

<b>Hyper-Switch: A Scalable Software Virtual Switching Architecture .....</b>	<b>13</b>
Kaushik Kumar Ram, Alan L. Cox, Mehul Chadha, and Scott Rixner, <i>Rice University</i>	

<b>MiG: Efficient Migration of Desktop VMs Using Semantic Compression .....</b>	<b>25</b>
Anshul Rai and Ram Ramjee, <i>Microsoft Research India</i> ; Ashok Anand, <i>Bell Labs India</i> ; Venkata N. Padmanabhan, <i>Microsoft Research India</i> ; George Varghese, <i>Microsoft Research US</i>	

### Computing in the Cloud

<b>Copysets: Reducing the Frequency of Data Loss in Cloud Storage .....</b>	<b>37</b>
Asaf Cidon, Stephen Rumble, Ryan Stutsman, Sachin Katti, John Ousterhout, and Mendel Rosenblum, <i>Stanford University</i>	

<b>TAO: Facebook's Distributed Data Store for the Social Graph .....</b>	<b>49</b>
Nathan Bronson, Zach Amsden, George Cabrera, Prasad Chakka, Peter Dimov, Hui Ding, Jack Ferris, Anthony Giardullo, Sachin Kulkarni, Harry Li, Mark Marchukov, Dmitri Petrov, Lovro Puzar, Yee Jun Song, and Venkat Venkataramani, <i>Facebook, Inc.</i>	

<b>PIKACHU: How to Rebalance Load in Optimizing MapReduce On Heterogeneous Clusters .....</b>	<b>61</b>
Rohan Gandhi, Di Xie, and Y. Charlie Hu, <i>Purdue University</i>	

### Flash-based Storage

<b>FlashFQ: A Fair Queueing I/O Scheduler for Flash-Based SSDs .....</b>	<b>67</b>
Kai Shen and Stan Park, <i>University of Rochester</i>	

<b>The Harey Tortoise: Managing Heterogeneous Write Performance in SSDs .....</b>	<b>79</b>
Laura M. Grupp, <i>University of California, San Diego</i> ; John D. Davis, <i>Microsoft Research</i> ; Steven Swanson, <i>University of California, San Diego</i>	

<b>Janus: Optimal Flash Provisioning for Cloud Storage Workloads .....</b>	<b>91</b>
Christoph Albrecht, Arif Merchant, Murray Stokely, Muhammad Waliji, François Labelle, Nate Coehlo, Xudong Shi, and C. Eric Schrock, <i>Google, Inc.</i>	

(Wednesday, June 26, continues on p. iv)

## Miscellanea #1

<b>Using One-Sided RDMA Reads to Build a Fast, CPU-Efficient Key-Value Store .....</b>	<b>103</b>
Christopher Mitchell, <i>New York University</i> ; Yifeng Geng, <i>Tsinghua University</i> ; Jinyang Li, <i>New York University</i>	
<b>Lightweight Memory Tracing .....</b>	<b>115</b>
Mathias Payer, Enrico Kravina, and Thomas R. Gross, <i>ETH Zurich</i>	
<b>Flash Caching on the Storage Client.....</b>	<b>127</b>
David A. Holland, Elaine Angelino, Gideon Wald, and Margo I. Seltzer, <i>Harvard University</i>	
<b>Practical and Effective Sandboxing for Non-root Users .....</b>	<b>139</b>
Taesoo Kim and Nickolai Zeldovich, <i>MIT CSAIL</i>	

## Thursday, June 27, 2013

### Data Storage

<b>TABLEFS: Enhancing Metadata Efficiency in the Local File System .....</b>	<b>145</b>
Kai Ren and Garth Gibson, <i>Carnegie Mellon University</i>	
<b>Characterization of Incremental Data Changes for Efficient Data Protection .....</b>	<b>157</b>
Hyong Shim, Philip Shilane, and Windsor Hsu, <i>EMC Corporation</i>	
<b>On the Efficiency of Durable State Machine Replication .....</b>	<b>169</b>
Alysson Bessani, Marcel Santos, João Felix, and Nuno Neves, <i>FCUL/LaSIGE, University of Lisbon</i> ; Miguel Correia, <i>INESC-ID, IST, University of Lisbon</i>	
<b>Estimating Duplication by Content-based Sampling .....</b>	<b>181</b>
Fei Xie, Michael Condict, and Sandip Shete, <i>NetApp Inc.</i>	

### Miscellanea #2

<b>MutantX-S: Scalable Malware Clustering Based on Static Features .....</b>	<b>187</b>
Xin Hu, <i>IBM T.J. Watson Research Center</i> ; Sandeep Bhatkar and Kent Griffin, <i>Symantec Research Labs</i> ; Kang G. Shin, <i>University of Michigan</i>	
<b>Redundant State Detection for Dynamic Symbolic Execution .....</b>	<b>199</b>
Suhabe Bugrara and Dawson Engler, <i>Stanford University</i>	
<b>packetdrill: Scriptable Network Stack Testing, from Sockets to Packets .....</b>	<b>213</b>
Neal Cardwell, Yuchung Cheng, Lawrence Brakmo, Matt Mathis, Barath Raghavan, Nandita Dukkipati, Hsiao-keng Jerry Chu, Andreas Terzis, and Tom Herbert, <i>Google</i>	

### Virtual Machine Performance

<b>DeepDive: Transparently Identifying and Managing Performance Interference in Virtualized Environments .....</b>	<b>219</b>
Dejan Novaković, Nedeljko Vasić, and Stanko Novaković, <i>École Polytechnique Fédérale de Lausanne (EPFL)</i> ; Dejan Kostić, <i>Institute IMDEA Networks</i> ; Ricardo Bianchini, <i>Rutgers University</i>	
<b>Efficient and Scalable Paravirtual I/O System .....</b>	<b>231</b>
Nadav Har'El, Abel Gordon, and Alex Landau, <i>IBM Research–Haifa</i> ; Muli Ben-Yehuda, <i>Technion IIT and Hypervisor Consulting</i> ; Avishay Traeger and Razya Ladelsky, <i>IBM Research–Haifa</i>	
<b>vTurbo: Accelerating Virtual Machine I/O Processing Using Designated Turbo-Sliced Core .....</b>	<b>243</b>
Cong Xu, Sahan Gamage, Hui Lu, Ramana Kompella, and Dongyan Xu, <i>Purdue University</i>	

## **Managing Resources**

<b>When Slower Is Faster: On Heterogeneous Multicores for Reliable Systems.....</b>	<b>.255</b>
Tomas Hruby, Herbert Bos, and Andrew S. Tanenbaum, <i>VU University Amsterdam</i>	
<b>IAMEM: Interaction-Aware Memory Energy Management .....</b>	<b>.267</b>
Mingsong Bi, <i>Intel Corporation</i> ; Srinivasan Chandrasekharan, and Chris Gniady, <i>University of Arizona</i>	
<b>XLH: More Effective Memory Deduplication Scanners Through Cross-layer Hints .....</b>	<b>.279</b>
Konrad Miller, Fabian Franz, Marc Rittinghaus, Marius Hillenbrand, and Frank Bellosa, <i>Karlsruhe Institute of Technology</i>	
<b>Enabling OS Research by Inferring Interactions in the Black-Box GPU Stack.....</b>	<b>.291</b>
Konstantinos Menychtas, Kai Shen, and Michael L. Scott, <i>University of Rochester</i>	

## **Friday, June 28, 2013**

### **Small Applications**

<b>Mantis: Automatic Performance Prediction for Smartphone Applications .....</b>	<b>.297</b>
Yongin Kwon, <i>Seoul National University</i> ; Sangmin Lee, <i>University of Texas at Austin</i> ; Hayoon Yi, Donghyun Kwon, and Seungjun Yang, <i>Seoul National University</i> ; Byung-Gon Chun, <i>Microsoft</i> ; Ling Huang and Petros Maniatis, <i>Intel</i> ; Mayur Naik, <i>Georgia Institute of Technology</i> ; Yunheung Paek, <i>Seoul National University</i>	
<b>IO Stack Optimization for Smartphones .....</b>	<b>.309</b>
Sooman Jeong, <i>Hanyang University</i> ; Kisung Lee, <i>Samsung Electronics</i> ; Seongjin Lee, <i>Hanyang University</i> ; Seoungbum Son, <i>Samsung Electronics</i> ; Youjip Won, <i>Hanyang University</i>	
<b>How to Run POSIX Apps in a Minimal Picoprocess .....</b>	<b>.321</b>
Jon Howell, Bryan Parno, and John R. Douceur, <i>Microsoft Research</i>	

### **Packets**

<b>Network Interface Design for Low Latency Request-Response Protocols .....</b>	<b>.333</b>
Mario Flajslik and Mendel Rosenblum, <i>Stanford University</i>	
<b>DEFINED: Deterministic Execution for Interactive Control-Plane Debugging .....</b>	<b>.347</b>
Chia-Chi Lin, Virajith Jalaparti, and Matthew Caesar, <i>University of Illinois at Urbana-Champaign</i> ; Jacobus Van der Merwe, <i>University of Utah</i>	
<b>Improving Server Application Performance via Pure TCP ACK Receive Optimization .....</b>	<b>.359</b>
Michael Chan and David R. Cheriton, <i>Stanford University</i>	