



## Proceedings of the VLDB Endowment

Volume 5, No. 1 – September 2011

**Proceedings of the 38th International Conference on  
Very Large Data Bases, Istanbul, Turkey**

Editor-in-Chief:

**Z. Meral Özsoyoğlu**

Associate Editors - Research Track:

**Uğur Çetintemel, Nilesh Dalvi, Hank Korth, Anthony Tung**

Associate Editors - Experiments and Analysis Track:

**Gustavo Alonso, Juliana Freire**

Proceedings Editors:

**Ahmet Saçan, Nesime Tatbul**

PVLDB – Proceedings of the VLDB Endowment

Volume 5, No. 1, September 2011.

The 38th International Conference on Very Large Data Bases, Istanbul, Turkey.

## **Copyright 2011 VLDB Endowment**

Permission to make digital or hard copies of portions of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyright for components of this work owned by others than VLDB Endowment must be honored. Abstracting with credit is permitted. To copy otherwise, to republish, to post on servers or to redistribute to lists requires prior specific permission and/or a fee. Request permission to republish from PVLDB under email: [info@vldb.org](mailto:info@vldb.org).

Volume 5, Number 1: VLDB 2011

Pages ii - vii and 1 - 84

ISSN 2150-8097, September 2011.

Additional copies only online at: [portal.acm.org](http://portal.acm.org), [arxiv.org/corr](http://arxiv.org/corr), and [www.vldb.org](http://www.vldb.org)

## TABLE OF CONTENTS

### Front Matter

Copyright Notice .....	ii
Table of Contents .....	iii
PVLDB Review Board .....	iv

### Letters

Letter from Founding Editor-in-Chief .....	<i>H. V. Jagadish</i>	vii
--	-----------------------	-----

### Research Track Papers

Explanation-Based Auditing .....		1
.....	<i>Daniel Fabbri, Kristen LeFevre</i>	
Human-powered Sorts and Joins .....		13
.....	<i>Adam Marcus, Eugene Wu, David Karger, Samuel Madden, Robert Miller</i>	
Verifying Computations with Streaming Interactive Proofs .....		25
.....	<i>Graham Cormode, Justin Thaler, Ke Yi</i>	
A MovingObject Index for Efficient Query Processing with Peer-Wise Location Privacy .....		37
.....	<i>Dan Lin, Christian S. Jensen, Rui Zhang, Lu Xiao, Jiaheng Lu</i>	
ERA: Efficient Serial and Parallel Suffix Tree Construction for Very Long Strings .....		49
.....	<i>Essam Mansour, Amin Allam, Spiros Skiadopoulos, Panos Kalnis</i>	
Fast Updates on Read-Optimized Databases Using Multi-Core CPUs .....		61
.....	<i>Jens Krueger, Changkyu Kim, Martin Grund, Nadathur Satish, David Schwalb, Jatin Chhugani, Hasso Plattner, Pradeep Dubey, Alexander Zeier</i>	
A Data-Based Approach to Social Influence Maximization .....		73
.....	<i>Amit Goyal, Francesco Bonchi, Laks V. S. Lakshmanan</i>	

## PVLDB REVIEW BOARD

### VLDB 2012 General PC Chair

Z. Meral Özsoyoğlu, Case Western Reserve University, USA

### VLDB 2012 Research Track PC Co-Chairs

Uğur Çetintemel, Brown University, USA

Nilesh Dalvi, Yahoo Research

Hank Korth, Lehigh University, USA

Anthony Tung, National Univ. of Singapore, Singapore

### VLDB 2012 Experiments and Analysis Track PC Co-Chairs

Gustavo Alonso, ETH Zurich, Switzerland

Juliana Freire, NYU Poly, USA

### VLDB 2012 Research Track Reviewers

Ashraf Aboulnaga (University of Waterloo)

Yanif Ahmad (Johns Hopkins University)

Shivnath Babu (Duke University)

Magdalena Balazinska (University of Washington)

Elisa Bertino (Purdue University)

Sourav Bhowmick (Nanyang Technological University)

Angela Bonifati (Icar-CNR)

Randal Burns (Johns Hopkins University)

Michael Cafarella (Michigan)

Kevin Chang (Univ. of Illinois at Urbana-Champaign)

Gang Chen (Zhejiang University, China)

Lei Chen (Hong Kong University of SaT, China)

Reynold Cheng (University of Hong Kong)

Jan Chomicki (University of Buffalo)

Chris Clifton (Purdue University)

Gao Cong (Nanyang Technological University)

Brian Cooper (Google, USA)

Graham Cormode (AT&T)

Bin Cui (Peking University)

Carlo Curino (MIT)

Anish Das Sharma (Yahoo)

Amr El Abbadi (UC Santa Barbara)

Alan Fekete (University of Sydney)

Hakan Ferhatosmanoğlu (Ohio State University)

Johann-Christoph Freytag (Humboldt-Universität Berlin)

Minos Garofalakis (TU Creta, Greece)

Gabriel Ghinita (Purdue University)

Goetz Graefe (HP)

Todd Green (University of California, Davis)

Haryadi Gunawi (University of California, Berkeley)

Rahul Gupta (IIT Bombay)	Dan Olteanu (Oxford)
Stavros Harizopoulos (HP)	M. Tamer Özsu (University of Waterloo)
Howard Ho (IBM)	Olga Papaemmanouil (Brandeis University)
Vagelis Hristidis (Florida International University)	Srinivasan Parthasarathy (The Ohio State University)
Meichun Hsu (HP)	Jian Pei (Simon Fraser University)
Jeong-Hyon Hwang (SUNY, Albany)	Peter Pietzuch (Imperial College)
Ihab Ilyas (University of Waterloo)	Lucian Popa (IBM)
Zachary Ives (University of Pennsylvania)	Rachael Pottenger (University of Washington)
Dean Jacobs (SAP)	Sunil Prabhakar (Purdue University)
Hans-Arno Jacobsen (University of Toronto)	Vijayshankar Raman (IBM, USA)
Theodore Johnson (AT&T)	Vibhar Rastogi (Yahoo)
Vana Kalogeraki (Athens U of Econ. and Business)	Christopher Re (University of Wisconsin, Madison)
Raghav Kaushik (Microsoft Research)	Ken Ross (Columbia University)
Eamonn Keogh (University of California, Riverside)	Elke Rundensteiner (Worcester Polytechnic Institute)
Martin Kersten (CWI)	Yücel Saygın (Sabanci University)
Benny Kimelfeld (IBM)	Kyuseok Shim (Seoul National University)
George Kollios (Boston University)	Lidan Shou (Zhejiang University, China)
Donald Kossman (ETH Zurich)	Adam Silberstein (Yahoo!, USA)
Mong-Li Lee (National University of Singapore)	Yannis Sismanis (IBM, USA)
Wang-Chien Lee (Penn State University)	Richard Snodgrass (University of Arizona)
Cuiping Li (Renmin University of China)	Divesh Srivastava (AT&T)
Guoliang Li (Tsinghua University, China)	Dan Suciu (University of Washington)
Lipyeow Lim (University of Hawaii at Manoa)	S Sudarshan (IIT Bombay)
Boon Thau Loo (University of Pennsylvania)	Egemen Tanin (University of Melbourne)
Qiong Luo (Hong Kong University of SaT, China)	Yufei Tao (Chinese University of Hong Kong, China)
Ashwin Machanavajhala (Yahoo)	Martin Theobald (Max Planck Institute, Germany)
Sanjay Madria (University of Missouri-Rolla)	Frank Tompa (University of Waterloo)
Stefan Manegold (CWI, Netherlands)	Wei Wang (University of North Carolina)
Sharad Mehrotra (University of California, Irvine)	Gerhard Weikum (Max Planck Institute, Germany)
Gerome Miklau (Univ. of Massachusetts, Amherst)	Dong Xin (Google)
Bongki Moon (University of Arizona)	Jiong Yang (Case Western Reserve University)
Kyriakos Mouratidis (Singapore Management Univ.)	Jun Yang (Duke)
Suman Nath (MSR)	Ge Yu (Northeastern University, China)
Sylvia Nittel (University of Maine)	Aoying Zhou (East China Normal University, China)

### **VLDB 2012 Experiments and Analysis Track Reviewers**

Cristiana Amza (U. Toronto, Canada)

Phil Bernstein Microsoft Research (USA)

Peter Boncz (CWI, The Netherlands)

Philippe Bonnet (IT U. of Copenhagen, Denmark)

Michael Carey (UC Irvine, USA)

Jens Dittrich (Uni. Saarland, Germany)

Bettina Kemme (McGill Uni., Canada)

Whang Kyu-Young (KAIST, Korea)

Ioana Manolescu (INRIA, France)

Dimitris Papadias (Hong Kong University of SaT, China)

Hamid Pirahesh (IBM Almaden, USA)

Maya Ramanath (IIT Delhi, India)

Uwe Roehm (University of Sydney, Australia)

Peter Triantafillou (U. Patras, Greece)

Cong Yu (Google, USA)

### **PVLDB Information Director**

Gerald Weber (University of Auckland)

### **VLDB 2012 Proceedings Co-Chairs**

Ahmet Saçan (Drexel University)

Nesime Tatbul (ETH Zurich, Switzerland)

### **Steering Committee**

Serge Abiteboul, Peter Apers, Philip Bernstein, Elisa Bertino, Peter Buneman, Martin Kersten, Z. Meral Özsoyoğlu

## LETTER FROM THE FOUNDING EDITOR-IN-CHIEF

The annual VLDB Conference has gradually been transitioning to journal style reviewing with year-round submissions. Associated with this transition has been the creation of the PVLDB journal, of which you are perusing the first issue of the fifth volume. As of last year (Volume 4), all papers for the VLDB Conference were reviewed and accepted through a year-round review process, with no traditional conference PC review option. In conjunction with this change, PVLDB also transitioned to a year-round publication cycle, with 12 issues last year, approximately monthly. There were many transients as we made this big change last year, which we hope to smooth out over the next several months.

This issue is the first one of Vol. 5, and the papers included here will be presented at the VLDB conference in Istanbul in summer 2012. The reviewing of all papers in this volume is being undertaken by a review board appointed and managed by the Editor-in-Chief of this Volume of PVLDB, Z. Meral Özsoyoğlu, and several Editors working with her, namely Uğur Çetintemel, Nilesh Dalvi, Hank Korth, Anthony Tung, Gustavo Alonso, and Juliana Freire. I am deeply appreciative of their efforts, as I hope you are too. I am also grateful to members of the PVLDB Advisory Committee for their support and guidance. Gerald Weber, as Information Director for PVLDB, has worked hard behind the scenes to smooth the transition to the new production processes. Uwe Roehm as the Proceedings Editor for the previous Volume of PVLDB, worked out many production issues. He has now passed on the torch to Ahmet Saçan and Nesime Tatbul. I thank all four for their efforts.

Hope you enjoy these papers.

---

H. V. Jagadish, Univ. of Michigan  
Founding Editor-in-Chief, Proceedings of the VLDB Endowment