Proceedings of the VLDB Endowment

Volume 7, No. 6 – February 2014

Proceedings of the 40th International Conference on Very Large Data Bases, Hangzhou, China

Copyright 2014 VLDB Endowment

Additional copies only online at: portal.acm.org, arxiv.org/corr, and www.vldb.org

TABLE OF CONTENTS

Front Matter

Letters

Research Papers

VLDB 2014 ORGANIZATION AND REVIEW BOARD

Honorary Chair

Yunhe Pan, Chinese Academy of Engineering

General Chairs

Chun Chen, Zhejiang University

Sharad Mehrotra, University of California, Irvine

Program Chairs and Editors-in-Chief of PVLDB 7

H. V. Jagadish, University of Michigan

Aoying Zhou, East Normal University, China

Research and Innovative Systems Tracks Associate Editors

Shivnath Babu, Duke University

Lei Chen, Hong Kong University of Science and Technology

Graham Cormode, University of Warwick

Bin Cui, Peking University, China

Wynne Hsu, NUS

Martin Kersten, CWI

Donald Kossman, ETH

Elke Rundensteiner, WPI

Kyuseok Shim, Seoul National University

Wang-Chiew Tan, University of California, Santa Cruz

Letizia Tanca, Poli Milano

Jeffrey Yu, Chinese University of Hong Kong

Experiments and Analysis Track Associate Editors

Gao Cong, Nanyang Technology University

Jens Dittrich, Saarland

Visions Track Associate Editor

Zachary Ives, University of Pennsylvania

Industrial and Applications Track Associate Editors

Umeshwar Dayal, HP

C. Mohan, IBM

Ge Yu, Northeastern University, China

Demonstration Chairs

Mong-Li Lee, NUS

Feifei Li, University of Utah

Sunil Prabhakar, Purdue

Tutorial Chairs

Xiaoyong Du, Renmin University

Murat Kantarcioglu, University of Texas, Dallas

Divesh Srivastava, AT&T Labs

Workshop Chairs

Anastasia Ailamaki, EPFL

Kaushik Chakrabarti, Microsoft

Panel Chairs

Hakan Hacigumus, NEC Labs

Jignesh Patel, University of Wisconsin

Xiaoyang Sean Wang, Fudan University

Research Track Review Board

Sibel Adali, Rensselear Polytechnic Institute

Foto Afrati, NTU Athens

Yanif Ahmad, JHU

Jose Luis Ambite, ISI - USC

Walid Aref, Purdue University

Claudia Bauzer Medeiros, University of Campinas

Srikanta Bedathur, IIIT Delhi

Michael Benedikt, Oxford University

Sonia Bergamaschi, Universita Modena

Laure Berti-Equille, IRD, France

Leopoldo Bertossi, Carleton University, Ottawa

Subhash Bhalla, University of Aizu, Japan

Peter Boncz, CWI

Angela Bonifati, University of Lille 1

Rajesh Bordawekar, IBM Watson Research Center

Omar Boucelma, Aix-Marseille University

Nico Bruno, Microsoft Research

Andrea Cali, University of London, Birkbeck College

Malu Castellanos, HP Labs

Badrish Chandramouli, Microsoft Research

Adriane Chapman, Mitre

Gang Chen, Zhejiang University

Yi Chen, New Jersey Institute of Technology

James Cheng, CUHK

Reynold Cheng, University of Hong Kong

Brian Cooper, Google, USA

Philippe Cudré-Mauroux, University of Fribourg

Carlo Curino, MIT

Gautam Das, UT Arlington and QCRI

Sudipto Das, Microsoft Research

Anish Das Sarma

Atish Das Sarma, eBay Research Labs

Khuzaima Daudjee, University of Waterloo

Antonios Deligiannakis, Technical University of Crete

Daniel Deutch, Ben Gurion University

Yanlei Diao, University of Massachusetts Amherst

Xin (Luna) Dong, Google, USA

Sameh Elnikety, Microsoft Research

Mohamed Eltabakh, Worcester Polytechnic Institute

Ihab F. Ilyas, QCRI

Hakan Ferhatosmanoglu, Bilkent University

Ada Wai-Chee Fu, Chinese University of Hong Kong

Minos Garofalakis, Technical University of Crete

Wolfgang Gatterbauer, Carnegie Mellon University

Tingjian Ge, University of Massachussets, Lowell

Buğra Gedik, Bilkent University

Rainer Gemulla, Max-Plack-Institut Saarbr點ken

Gabriel Ghinita, University of Massachusetts Boston

Parke Godfrey, York University

Lukasz Golab, University of Waterloo

Sergio Greco, University of Calabria

Le Gruenwald, University of Oklahoma

Giovanna Guerrini, Universita Genova

Krishna Gummadi, MPI-SWS

Rahul Gupta, Google Research

Rajeev Gupta, IBM Research

Shyam Gupta, IIT Delhi

Marios Hadjielefhteriou, AT&T labs

Wook-Shin Han, KNU, Korea

Kuno Harumi, HP Labs

Bingsheng He, NTU Singapore

Sven Helmer, Free University of Bozen-Bolzano

Jan Hidders, TUDelft

Wei Hong, Cisco System Inc.

Katja Hose, Aalborg University

Zi Huang, University of Queensland

Jeong-Hyon Hwang, SUNY - Albany

Seung-won Hwang, POSTECH, Korea

Stratos Idreos, CWI

Yoshiharu Ishikawa, Nagoya University

Zachary Ives, University of Pennsylvania

Ricardo Jimenez-Peris, Technical University of Madrid

Cheqing Jin, East China Normal University

Ruoming Jin, Kent State University

Alekh Jindal, Saarland University/MIT

Ryan Johnson, University of Toronto

Dmitri V Kalashnikov, UC Irvine

Panos Kalnis, KAUST, Saudi Arabia

Ben Kao, Hong Kong University

Panagiotis Karras, Rutgers University

Yiping Ke, Institute of High Performance Computing

Bettina Kemme, McGill University

Daniel Kifer, PSU

Benny Kimelfeld, IBM

Hideaki Kimura, Microsoft Jim Gray Systems Lab

George Kollios, Boston University

Christian König, Microsoft Research

Tim Kraska, Brown University

Laks V. S. Lakshmanan, University of British Columbia

Mounia Lalmas, Yahoo Inc.

Mong-Li Lee, National University of Singapore

Wolfgang Lehner, Technische University Dresden

Justin Levandoski, Microsoft Research

Chengkai Li, The University of Texas at Arlington

Cuiping Li, Renmin University of China

Feifei Li, University of Utah

Guoliang Li, Tsinghua University

Jianzhong Li, Harbin Institute of Technology

Yunyao Li, IBM Almaden

Zhanhuai Li, Northwestern Polytechnical University

Dan Lin, Missouri S&T, USA

Xuemin Lin, University of New South Wales

Bin Liu, NEC Labs America

Ziyang Liu, NEC Labs America

Eric Lo, The Hong Kong Polytechnic University

Qiong Luo, HKUST

Shuai Ma, Beihang University

Ashwin Machanavajjhala, Duke University

Brad Malin, Duke University

Nikos Mamoulis, University of Hong Kong

Stefan Manegold, CWI

Murali Mani, University of Michigan

Ioana Manolescu, INRIA, France

Amélie Marian, Rutgers University

Volker Markl, TU Berlin

Marta Mattoso, Federal University of Rio de Janeiro

Frank McSherry, Microsoft

Alexandra Meliou, Umass Amherst

Marco Mesiti, University of Milano

Dan Miranker, The University of Texas at Austin

Mohamed Mokbel, University of Minnesota

Bongki Moon, Seoul National University

Yasuhiko Morimoto, Hiroshima University

Mirella Moro, Universidade Federal de Minas Gerais

Kyriakos Mouratidis, SMU, Singapore

Karin Murthy, IBM India

Arnab Nandi, Ohio State University

Wolfgang Nejdl, University of Hannover

Thomas Neumann, Technology University Munchen

Boris Novikov, St Petersburg University

Dan Olteanu, Oxford University

Gultekin Ozsoyoglu, Case Western Reserve University

Tamer Ozsu, University of Waterloo

Esther Pacitti, University of Montpellier

Themis Palpanas, University of Trento

Ippokratis Pandis, IBM Almaden

Stelios Paparizos, Microsoft Research

Aditya Parameswaran, Stanford University

Srinivasan Parthasarathy, The Ohio State University

Jignesh Patel, University of Wisconsin

Andrew Pavlo, Brown University

Peter Pietzuch, Imperial College London

Neoklis Polyzotis, University of California - Santa Cruz

Cecilia M. Procopiuc, AT&T Labs

Li Qian, University of Michigan

Jorge Quiané-Ruiz, QCRI

Elisa Quintarelli, Politecnico di Milano

Maya Ramanath, IIT Delhi

Louiqa Raschid, University of Maryland

Vibhar Rastogi, Yahoo

Matthias Renz, University of Munich

Kenneth Ross, Columbia University

Sourav S Bhowmick, NTU, Singapore

Dimitris Sacharidis, IMIS Athena, Greece

Kenneth Salem, Univesity of Waterloo

Maria Sapino, University of Torino

Kai-Uwe Sattler, TU Ilmenau

Monica Scannapieco, ISTAT

Bernhard Seeger, University of Marburg

Lidan Shou, Zhejiang University

Adam Silberstein, Trifacta

Lisa Singh, Georgetown University

Radu Sion, Stony Brook University

Yufei Tao, Chinese University of Hong Kong

Nesime Tatbul, ETH Zurich

Arash Termehchy, Oregon State University

Evimaria Terzi, University of Boston

Martin Theobald, Max Planck Institute, Germany

Srikanta Tirthapura, Iowa State University

Riccardo Torlone, Roma Tre University

Anthony Tung, National University of Singapore

Kostas Tzoumas, Technical University of Berlin

Sergei Vassilvitskii, Google Research

Marcos Vaz Salles, University of Copenhagen (DIKU)

Stratis Viglas, University of Edinburgh

Hoang Tam Vo, National University of Singapore

Daisy Zhe Wang, University of Florida

Haixun Wang, Microsoft Research Asia

Ke Wang, Simon Fraser University

Wei Wang, University of New South Wales

Xiaoling Wang, East China Normal University

Ingmar Weber, Yahoo

Raymond Chi Wing Wong, HKUST

Sai Wu, Zhejiang University

Yuqing Wu, Indiana University

Xiaokui Xiao, NTU

Dong Xin, Google

Jianliang Xu, Hong Kong Baptist University

Jun (Jim) Xu, Georgia Institute of Technology

Xifeng Yan, University of Santa Barbara

Xiaoyan Yang, Advanced Digital Science Center

Ke Yi, HKUST

Ge Yu, Northeastern University, China

Hwanjo Yu, POSTECH, Korea

Meihui Zhang, National University of Singapore

Wenjie Zhang, The University of New South Wales

Ying Zhang, The University of New South Wales

Zhenjie Zhang, Advanced Digital Science Center

Wenzhao Zhou, Georgetown University

Xiaofang Zhou, University of Queensland

PhD Workshop Chairs

Erich Neuhold, University of Vienna

Yunyao Li, IBM

Sponsorship Chairs

Mike Carey, University of California, Irvine

Lizhu Zhou, Tsinghua University

Local Organization Chair

Lidan Shou, Zhejiang University

Web Management Chair

Sai Wu, Zhejiang University

Conference and Registration Chairs

Ke Chen, Zhejiang University

Cuiping Li, Renmin University

Publicity Chairs

Vasilis Vassalos, AUEB, Greece

Dunlu Peng, USST, China

Proceedings Chairs

Li Xiong, Emory University

Cong Yu, Google Research

Treasury Chair

Li (Eric) Qian, University of Michigan

VLDB Endowment Liaison

Kyu-Young Whang, KAIST

PVLDB Managing Editor

Divesh Srivastava, AT&T Labs

PVLDB Information Director

Gerald Weber, University of Auckland

PVLDB Advisory Committee

Philip Bernstein, Michael Böhlen, Peter Buneman, Susan Davidson, Z. Meral Ozsoyoglu, S. Sudarshan, Gerhard Weikum

Logo Design

Guanmin Guo

PLANET OF THE APES

As an experimental hybrid between a conference and a journal, VLDB employs associate editors who operate differently from similar roles in more traditional venues. The VLDB associate editor is akin to an associate editor of a journal, and a meta-reviewer, or area chair in a conference, but different from each. The exact actions have varied over time, as the PVLDB workflow is fine-tuned, and different structures have been tried. The main tasks of the Associate PVLDB Editor (or APE, for short), are to assist in the allocation of reviewers to papers, and to oversee the path from reviews to decision.

Finding a good set of reviewers for a paper means choosing reviewers who are expert on the subject matter, or have a good understanding of related topics, so that they can comment on the novelty and importance of the submission. The compressed timescale of PVLDB denies us the luxury of inviting individual experts, or allowing a large PC the time to bid for papers. The current workflow includes a very small time window for the VLDB PC members to enter preferences (in fact a majority do, up to 75%).

An initial allocation of papers to reviewers is then made by the conference management system, based on the preferences, and the categories that have been used to tag the papers and reviewers. Matching based on categories is quite haphazard, due to the subjectivity of labeling people and papers. The APE, who is assigned a set of papers to oversee, can manually modify this assignment, under some constraints, such as a limit on the number of papers to assign any reviewer each month (typically two). Not every PC member is "on call" each month, so there is sometimes a paper with an ``ideal'' reviewer from the PC list who cannot be assigned. Due to these constraints, authors who strategize over the reviewer list should realize that there is no guarantee that their paper will reach the reviewers they think are best suited to it.

After reviews are in at the end of the month, the APE looks over them. In some cases, the decision is easy -- three accepts or three rejects will inevitably yield the consensus outcome. When the reviews are mixed, the APE tries to stimulate the discussion, much as in typical database conference, but on a much shorter timescale. For the most part, the APE acts as a facilitator of the discussion, trying to help identify on what points there is agreement or dissent, and trying to reach a consensus discussion. The APE is not a "fourth reviewer", and does not read the paper in as much detail as the assigned reviewers. The option of inviting a revision is always on the table, but with the warning that this is not to be used in order to "kick the can down the road": APEs are encouraged to reach firm decisions in the first round if possible. There is still a range of opinions among PVLDB participants over whether to interpret the revision option as equivalent to a minor revision or major revision in the journal context. In my view, it is a different beast. If a revision is requested, the reviews should indicate the main points that need to be addressed to allow acceptance, but then it is up to the authors to decide if they wish to submit a revision within the (again, quite tight) time allowed. Due to the high standards of PVLDB, revision can be a minority outcome: in my sample for the current iteration, about 20-25% of papers received a revision response, while close to 75% were rejected in the first round (acceptances of first submissions are rare).

The last step for the APE is to enter a decision, and prepare a "meta-review" (terminology inherited from the Conference Management Tool used to run the process). The meta-review is usually short, and allows the APE to identify which points from reviews were most significant in reaching the decision, or to highlight where to focus attention if a revision is requested. It can also summarize points raised in the (private) discussion phase that may not have been mentioned in the reviews.

Graham Cormode, University of Warwick
Research Track Associated Editor, VLDB 2014