Expert PL/SQL Practices

for Oracle Developers and DBAs

John Beresniewicz, Adrian Billington, Martin Büchi, Melanie Caffrey, Ron Crisco, Lewis Cunningham, Dominic Delmolino, Sue Harper, Torben Holm, Connor McDonald, Arup Nanda, Stephan Petit, Michael Rosenblum, Robyn Sands, Riyaj Shamsudeen

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About the Authors

John Beresniewicz is a consulting member of the technical staff at Oracle headquarters in Redwood Shores, CA. He joined Oracle in 2002 to work on Enterprise Manager in the database performance area and has played significant role in the design of Diagnostic and Tuning packs, Real Application Testing, Support Workbench, and Exadata. He has been a frequent speaker on database performance and PL/SQL programming over many years at Oracle Openworld and other conferences. He is co-author of *Oracle Built-in Packages* (O'Reilly & Associates, 1998) with Steven Feuerstein and is a founding member of the OakTable network.

Adrian Billington is a consultant in application design, development, and performance tuning who has been working with Oracle databases since 1999. He is the man behind `www.oracle-developer.net`, a web site full of SQL and PL/SQL features, utilities, and techniques for Oracle developers. Adrian is also an Oracle ACE and a member of the OakTable Network. He lives in the UK with his wife Anji and three children Georgia, Oliver, and Isabella.

Martin Büchi has worked since 2004 as Lead Software Architect for Avaloq, a provider of a standardized banking software built on the Oracle RDBMS with 11 million lines of PL/SQL code. Together with two colleagues he defines the system architecture and reviews the designs and code of 170 full-time PL/SQL developers, looking for simplicity, efficiency, and robustness. Martin regularly speaks at Oracle conferences. In 2009 he was named PL/SQL Developer of the Year by *Oracle Magazine*. Before getting into the Oracle database, Martin worked in object-oriented systems, formal methods, and approximate record matching. He holds an MSc from the Swiss Federal Institute of Technology and a PhD from the Turku Center for Computer Science in Finland. In his spare time, Martin enjoys various outdoor sports with his family.

Melanie Caffrey is a Senior Development Manager for Oracle Corporation, providing front-end and back-end Oracle solutions for the business needs of various clients. She is co-author of several technical publications including *Oracle Web Application Programming for PL/SQL Developers, Oracle DBA Interactive Workbook,* and *Oracle Database Administration: The Complete Video Course*, all published by Prentice Hall. She has instructed students in Columbia University's Computer Technology and Applications program in New York City, teaching advanced Oracle database administration and PL/SQL development. She is a frequent Oracle conference speaker.

Ron Crisco has been a software designer, developer, and project leader for 28 years and has worked with Oracle databases for 21 years. He works at Method R Corporation, designing and developing software, managing software products (like Method R Profiler, MR Tools, and MR Trace), consulting, and teaching courses. His specialty is simplifying complex work, which is especially valuable in helping the people around him accomplish extraordinary things.

Lewis Cunningham has been working in IT for over 20 years and has worked with Oracle databases since 1993. His specialties are application design, database design, and coding of high volume, VLDB databases. He is currently a Senior Database Architect at a financial services company in St Petersburg, FL working on very large, high transaction rate analytical databases and applications. He spends an inordinate amount of time keeping up with current technology and trends and speaking at user groups and doing webinars. Lewis is also an Oracle ACE Director and Oracle Certified Professional. He has written several articles for the Oracle Technology Network and maintains an Oracle technology blog at `http://it.toolbox.com/blogs/oracle-guide`. Lewis has written two books: *EnterpriseDB: The Definitive Reference* (Rampant Techpress, 2007) and *SQL DML: The SQL Starter Series* (CreateSpace, 2008). He lives in Florida with his wife and two sons. You can contact him at lewisc@databasewisdom.com.

Dominic Delmolino is the Lead Oracle and Database Technologist for Agilex Technologies, a consulting firm specializing in assisting government and private enterprises to realize the value of their information. Dominic has over 24 years of database experience, including more than 20 years as an Oracle Database Engineering and Development professional. He is a member of the Oak Table Network and regularly presents at conferences, seminars, and user group meetings in Europe and the US. He also maintains `www.oraclemusings.com`, a site focused on database coding and design practices related to database application development. Dominic holds a Bachelor of Science degree in computer science from Cornell University, Ithaca, NY.

Sue Harper is a Product Manager for Oracle SQL Developer and SQL Developer Data Modeler in the Database Development Tools group. She has been at Oracle since 1992 and is currently based in London. Sue is a regular contributor to magazines, maintains a technical blog, and speaks at many conferences around the world. She has authored the technical book *Oracle SQL Developer 2.1* (Packt Publishing, 2009) When not at work, Sue is a keen walker and photographer. Sue takes time out to work with a charity in the slums of New Delhi, where she works with the women and children.

Torben Holm has been in the computer business as a developer since 1987. He has been working with Oracle since 1992; his first four years as system analyst and application developer (Oracle 7 and Forms 4.0/Reports 2.0 and DBA), then two years as developer (Oracle6/7, Forms 3.0 and RPT, and DBA). He spent several years working for Oracle Denmark in the Premium Services group as a Senior Principal Consultant performing application development and DBA tasks. He also worked as an instructor in PL/SQL, SQL, and DBA courses. Torben now works for Miracle A/S (`www.miracleas.dk`) as a consultant with a focus in application development (PLSQL, mod_plsql, Forms, ADF) and database administration. He has been at Miracle A/S 10 years. He is an Oracle Certified Developer and a member of `OakTable.net.`

Connor McDonald has worked with Oracle since the early 1990s, cutting his teeth on Oracle versions 6.0.36 and 7.0.12. Over the past 11 years, Connor has worked with systems in Australia, the U.K., Southeast Asia, Western Europe, and the United States. He has come to realize that although the systems and methodologies around the world are very diverse, there tend to be two common themes in the development of systems running on Oracle: either to steer away from the Oracle-specific functions or to use them in a haphazard or less-than-optimal fashion. It was this observation that led to the creation of a personal hints and tips web site (`www.oracledba.co.uk`) and more presenting on the Oracle speaker circuit in an endeavor to improve the perception and usage of PL/SQL in the industry.

Arup Nanda has been an Oracle DBA since 1993, which has exposed him to all facets of database administration, from modeling to disaster recovery. He currently leads the global DBA team at Starwood Hotels, the parent of chains such as Sheraton and Westin, in White Plains, NY. He serves as a contributing editor of *SELECT Journal*, the publication of Independent Oracle Users Group (IOUG); speaks at many Oracle Technology events such as Oracle World and local user groups such as New York Oracle User Group; and has written many articles for both print publications such as *Oracle Magazine* and online publications such as *Oracle Technology Network*. Arup has coauthored two books: *Oracle Privacy Security Auditing* (Rampant, 2003) and *Oracle PL/SQL for DBAs* (O'Reilly, 2005). Recognizing his professional accomplishments and contributions to user community, Oracle chose him as the DBA of the Year in 2003. Arup lives in Danbury, Connecticut, with his wife Anindita and son Anish. He can be reached at arup@proligence.com.

Stephan Petit began his career in 1995 at CERN, the European Laboratory for Particle Physics, located in Geneva, Switzerland. He is now in charge of a team of software engineers and students delivering applications and tools to the laboratory and beyond. One of these tools is the Engineering and Equipment Data Management System, also known as the CERN EDMS. Projects like CERN's Large Hadron Collider (LHC) have a lifetime of 40 years or more. The EDMS is the digital engineering memory of the laboratory. More than a million documents relating to more than a million pieces of equipment are stored in the EDMS, which is also used as CERN's Product Lifecycle Management (PLM) and Asset Tracking system. EDMS is based almost entirely on PL/SQL and is intended to have a lifetime at least as long as the LHC.

Stephan and his team have been polishing coding conventions and best practices in PL/SQL in order to meet their very interesting mix of challenges: maintainability over decades, reliability, efficient error handling, scalability, and reusability of the modules. These challenges are compounded by the frequent rotation of team members, most of whom are students only temporarily at CERN. The oldest piece of code was written in 1995 and is still in use — with success! Apart from polishing PL/SQL, Stephan also enjoys being on stage from time to time as rock band singer at the CERN's rock & roll summer festival and as actor in various plays.

Michael Rosenblum is a Software Architect/Development DBA at Dulcian, Inc. where he is responsible for system tuning and application architecture. Michael supports Dulcian developers by writing complex PL/SQL routines and researching new features. He is the co-author of *PL/SQL for Dummies* (Wiley Press, 2006) and author of a number of database-related articles (IOUG Select Journal, ODTUG Tech Journal). Michael is an Oracle ACE, a frequent presenter at various regional and national Oracle user group conferences (Oracle OpenWorld, ODTUG, IOUG Collaborate, RMOUG, NYOUG, etc), and winner of the ODTUG Kaleidoscope 2009 Best Speaker Award. In his native Ukraine, he received the scholarship of the President of Ukraine, a Master of Science degree in Information Systems, and a diploma with honors from the Kiev National University of Economics.

Robyn Sands is a Software Engineer for Cisco Systems, where she designs and develops embedded Oracle database products for Cisco customers. She has been working with Oracle since 1996 and has extensive experience in application development, large system implementations, and performance measurement. Robyn began her work career in industrial and quality engineering, and she has combined her prior education and experience with her love of data by searching for new ways to build database systems with consistent performance and minimal maintenance requirements. She is a member of the OakTable Network and a coauthor of two books on Oracle: *Expert Oracle Practices* and *Pro Oracle SQL* (both Apress, 2010). Robyn occasionally posts random blog entries at `http://adhdocddba.blogspot.com`.

Riyaj Shamsudeen is the Principal Database Administrator and President of OraInternals, a performance/recovery/EBS11i consulting company. He specializes in real application clusters, performance tuning, and database internals. He also frequently blogs about these technology areas in his blog `http://orainternals.wordpress.com`. He is also a regular presenter in many international conferences such as HOTSOS, COLLABORATE, RMOUG, SIOUG, UKOUG, etc. He is a proud member of OakTable Network. He has over 16 years of experience using Oracle technology products and over 15 years as an Oracle/Oracle applications database administrator.

About the Technical Reviewers

Chris Beck has a degree in computer science from Rutgers University and has been working with multiple DBMS's for more than 20 years. He has spent the last 16 years as an Oracle employee where he is currently a Master Principal Technologist focusing on core database technologies. He is a co-inventor of two US Patents on software methodologies that were the basis for what is now known as Oracle Application Express. Chris has reviewed other Oracle books including *Expert One-On-One* (Peer Information Inc., 2001) and *Expert Oracle Database Architecture* (Apress, 2005), both by Tom Kyte and is himself the co-author of two books, *Beginning Oracle Programming* (Wrox Press, 2005) and *Mastering Oracle PL/SQL* (Apress, 2005). He resides in Northern Virginia with his wife Marta and four children; when not spending time with them, he can usually be found wasting time playing video games or watching Series A football.

Mike Gangler is a Database Specialist and Infrastructure Architect with over 30 years of data processing industry experience, primarily as a Database Technical Lead, Systems Analyst, and DBA on large corporate Information Systems projects. As a past President of the Detroit Oracle Users Group and Ann Arbor Oracle User groups, and charter member of the Board of Directors of the International Oracle Users Group, Mike has attained worldwide recognition as an accomplished and Certified Oracle DBA and relational database expert.

Toon Koppelaars is a long-time Oracle technology user, having used the Oracle database and tools software since 1987 (Oracle version 4). During this time, he has been involved in application development and database administration. He is an ACE Director (database development) and frequent speaker at Oracle-related events. He's also the declarer of "The Helsinki Declaration (IT version)" which describes a database-centric approach to modern application development. Together with Lex de Haan, Toon has co-authored *Applied Mathematics for Database Professionals* (Apress, 2007).

Introduction

Rarely do I take the opportunity to introduce a book that I've helped create. Normally I am content with my place in the background where book editors rightfully belong. I make an exception this time because the content in this book brings back so many memories from own experiences as a developer in days gone by.

Expert PL/SQL Practices is about wielding PL/SQL effectively. It's not a book about syntax. It's a book about how to apply syntax and features along with good development practices to create applications that are reliable and scalable—and maintainable over the long term.

With any tool, one of the first things to know is when to wield it. Riyaj Shamsudeen deftly tackles the question of when to use PL/SQL in his opening chapter *Do Not Use!* I put that chapter first in the book because of personal experience: My best-ever performance optimization success came in the late 1990s when I replaced a stack of procedural code on a client PC with a single SQL statement, taking a job from over 36 hours to just a couple of minutes. PL/SQL was not the culprit, but the lesson I learned then is that a set-based approach—when one is possible—is often preferable to writing procedural code.

Michael Rosenblum follows with an excellent chapter on dynamic SQL, showing how to write code when you don't know the SQL statements until runtime. He reminded me of a time at Dow Chemical in the early 1990s when I wrote a data-loading application for a medical record system using Rdb's Extended Dynamic Cursor feature set. I still remember that as one of the most fun applications that I ever developed.

Dominic Delmolino tackles parallel processing with PL/SQL. He covers the benefits that you can achieve as well as the candidate workloads. Just be careful, okay? One of my biggest-ever blunders as a DBA was when I once unthinkingly set a degree of parallelism on a key application table in order to make a single report run faster. It was as if the Enter key was connected to my telephone, because my phone rang within about a minute of my change. The manager on the other end of the line was most unpleased. Needless to say, I decided then that implementing parallelism deserved just a tad bit more thought than I had been giving it. Dominic's chapter will help you avoid such embarrassment.

Several chapters in the book cover code hygiene and good programming practices. Stephan Petit presents a set of useful naming and coding conventions. Torben Holm covers PL/SQL Warnings and conditional compilation. Lewis Cunningham presents a thought-provoking chapter on code analysis and the importance of truly understanding the code that you write and how it gets used. Robyn Sands helps you think about flexibility and good design in her chapter on evolutionary data modeling. Melanie Caffrey tours the various cursor types available, helping you to make the right choice of cursor for any given situation.

Other chapters relate to debugging and troubleshooting. Sue Harper covers PL/SQL unit testing, especially the supporting feature set that is now built into SQL Developer. (I remember writing unit test scripts on paper back in the day). Save yourself the embarrassment of regression bugs. Automated unit tests make it easy and convenient to verify that you've not broken two new things while fixing one.

John Beresniewicz follows with a chapter on contract-oriented programming. A key part of John's approach is the use of asserts to validate conditions that should be true at various points within your code. I first learned of the assert technique while doing PowerBuilder programming back in the Stone Age. I've always been happy to see John promote the technique in relation to PL/SQL.

Arup Nanda helps you get control over dependencies and invalidations. Dependency issues can be a source of seemingly random, difficult-to-repeat application errors. Arup shows how to get control over what must inevitably happen, so that you aren't caught out by unexpected errors.

We could hardly leave performance and scalability out of the picture. Ron Crisco talks about profiling your code to find the greatest opportunities for optimization. Adrian Billington talks about the performance aspects of invoking PL/SQL from within SQL statements. Connor McDonald covers the tremendous performance advantages available from bulk SQL operations.

An unusual aspect of scalability not often thought about is that of application size and the number of developers. Is PL/SQL suited for large-scale development involving dozens, perhaps hundreds of programmers? Martin Büchi shows that PL/SQL is very much up to the task in his chapter on PL/SQL programming in the large by recounting his success with an 11-million line application maintained by over 170 developers.

You can probably tell that I'm excited about this book. The authors are top notch. Each has written on an aspect of PL/SQL that they are passionate and especially knowledgeable about. If you're past the point of learning syntax, then sit down, read this book, and step up your game in delivering applications using the full power of PL/SQL and Oracle Database.

Jonathan Gennick
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