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A high-jumper in a red and blue uniform is captured mid-air, performing a high jump over a horizontal bar. The background features a grid pattern with large, semi-transparent numbers (0.0005, 0.0006, 0.0007, 0.0008) floating around, suggesting data or performance metrics.

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ENTERPRISE PERFORMANCE

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LICENSE TO OPERATE

Every day IT administrators face the increasingly difficult task of meeting greater business demands on reduced budgets. Oracle virtualization, database, middleware, and applications running on Linux—backed by Oracle's Unbreakable Linux support program—offer a low-cost and powerful solution for companies that must do more with less. —*David A. Kelly*

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IT Goes Green

Green can be part of larger efficiencies—and an added benefit.

When I first started at Oracle (many years ago), I attended a multiweek class for new employees. The class curriculum included the “derby” project, which challenged teams to build an Oracle-based proof-of-concept application that solved a business problem.

The problem scenario was simple: “This company runs on paper forms, and it runs inefficiently. We need to make our paper forms electronic and available through every computer at the company.” I also remember a comment about an added benefit that the solution would save paper and, therefore, trees.

GREEN IS PRIMARY AND SECONDARY

In 2008, most major IT projects are not compared to their paper-based predecessors. Making the most-efficient use of *all* resources is key to both new and ongoing IT projects. With significant cost increases in energy and paper, among other things, making projects more “green” is not simply an added environmental benefit, but part of the key efficiencies of the project.

Some green technology projects end up providing green benefits in their primary business efficiencies *and* in added Earth benefits. The fact that Pacific Gas and Electric Company (PG&E) will have fewer trucks on the road transporting meter reading and service crews—therefore using less gasoline—as a result of its SmartMeter project isn’t the primary reason for the project (see “Growing Green,” page 38). But the larger efficiency benefit is also green: the SmartMeter project will allow PG&E to better monitor energy usage and communicate with all of its customers about their usage, enabling them to cut consumption and costs.

ORACLE TECHNOLOGY AND GREEN

IT products and features are also focusing on green benefits. Oracle is making software more efficient in specifically green ways in several products and features, including the Oracle

Advanced Compression option of Oracle Database 11g Enterprise Edition and Oracle VM. Oracle Advanced Compression stores more data in less disk space, and it can also reduce CPU cycles, reduce I/O, improve throughput, and save energy. See “Compress to Impress” (page 55) for information on the use and specific benefits of Oracle Advanced Compression.

Oracle VM is virtualization software that lets you turn an underutilized physical server into multiple logical servers. Oracle On Demand (which gets 25 percent of its energy from renewable resources) expects server power usage to consume up to 25 percent less energy as a result of the use of Oracle VM. See “License to Operate” (page 32) to learn more.

GREEN: A VICTORY FOR INFORMATION TECHNOLOGY

A few years ago there was disagreement about the very existence of the problems of increased greenhouse gases and climate change. But the volume of current information and consistent conclusions of so many different reports have helped create new clarity, at least in identifying the problems.

I consider this clarity a victory—at least in part—for IT. And I firmly believe that IT in general and Oracle in particular will play a significant role in solutions that make the planet greener. In “Growing Green,” Edward Moses of the National Ignition Facility & Photon Science says it well: “Companies like Oracle are key to succeeding in what many consider humankind’s grand challenge mission of clean and plentiful energy.”

GREEN NOTES

Of course, green in IT isn’t just about IT projects and technologies; it’s about IT companies, their events, and their publications.

Oracle and the Environment. In CRO’s *10 Best Corporate Citizens by Industry 2007* report, in the technology software industry, Oracle was ranked No. 1 and No. 2 in the climate change and environment categories, respectively. For more information on this report and on Oracle, the environment, and energy management, check out the links in nextSTEPS.

For those of you attending Oracle OpenWorld 2008 in San Francisco, September 21-25, think green and check out the online agenda, the Green Fair, and the Green Room.

Oracle Magazine and Green. A digital edition of *Oracle Magazine* has been available for two years, and more than 100,000 subscribers receive it. If you’d like to subscribe to the digital edition—and save some trees—see the link in nextSTEPS.

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Puget Sound OracleDays 2008

July 14–18, Bellevue, Washington

The third-largest Oracle conference in the Americas in 2008, this Oracle technology-and applications-focused event features three days of training from Oracle experts including Oracle Chief Security Officer Mary Ann Davidson and Oracle ACEs Tom Kyte, Jonathan Lewis, Richard Foote, Hans Forbrich, and Daniel Morgan. Learn more and register at www.oracledays.com.

Broadband World Forum Asia

July 15–18, Hong Kong

Designed to help service providers meet the challenges of offering revenue-driving, broadband-enabled services while evolving their networks, operations, and business models, this event examines what works, what's profitable, and what's on the horizon. Learn more and sign up at www.iec.org/events/2008/bbwf_asia.

Quest Northeast Conference

July 16–18, Ledyard, Connecticut

Quest and its affiliate user groups combine resources to offer sessions for Oracle's PeopleSoft, JD Edwards, Hyperion, and utilities communities; roundtable and enhancement paper sessions for key industries; and vendor product demonstrations. Learn more at www.questdirect.org/QuestDirect/Events/Quest+Northeast.

2008 ESRI International User Conference (ESRI UC)

August 4–8, San Diego, California

As the largest geographic information system conference in the world, this annual event offers users from more than 120 countries the chance to learn new skills, share information, and discover best practices and valuable tips and tricks. Learn more at www.esri.com/events/uc.

O'Reilly Open Source Convention (OSCON)

July 21–25, Portland, Oregon

OSCON brings together more than 2,500 open source developers, hackers, experts, IT managers, and users to explore and champion the cause of open principles and open source adoption across the computing industry. Sign up at en.oreilly.com/oscon2008.

Agile 2008 Conference

August 4–8, Toronto, Canada

This event covers techniques and technologies, attitudes and policies, research and experience, and the management and development sides of agile software development, which emphasizes rich communication channels and frequent delivery of tested systems, while attending to the human aspect of software development. Get information at www.agile2008.org.

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www.ausoug.org.au

U.K. Oracle User Group DBMS SIG Meeting

July 8, London

www.ukoug.org

Georgia Oracle Users Group Meeting

July 10 and August 14, Dunwoody, Georgia

www.gouser.org

Nashville Oracle Users Group Meeting

July 16 and August 20, Nashville, Tennessee

www.nouug.net

Twin Cities Oracle User Group Meeting

July 24, Minneapolis-Saint Paul, Minnesota area

www.tcoug.org

Dallas Oracle Users Business Intelligence and Fusion Middleware Group Meeting

August 7, Las Colinas, Texas

www.doug.org

Australian Oracle User Group Tasmania Branch Meeting

August 12, Hobart, Tasmania, Australia

www.ausoug.org.au

JD Edwards Southern California User Group Meeting

August 13, Long Beach, California

www.jdescug.org

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www.atloaug.org

Northern California Oracle Users Group Conference

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www.nocoug.org

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August 21, Columbus, Ohio

ohiorug.blogspot.com

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August 26, Portland, Oregon

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Noel Yuhanna, principal analyst at Forrester Research, presents a study on the potential return on investment that enterprises may realize by adopting Oracle Enterprise Manager—specifically Oracle Diagnostics and Oracle Tuning management packs.

Information Sharing Doesn't Have to Mean

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oracle.com/goto/IRMseminar

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Sameer Patkar, vice president of technical operations at Oracle, with responsibility for Oracle Advanced Customer Services, talks about the top 10 things customers who are considering an upgrade from Oracle9i Database can do to ensure that they are poised for success.

Oracle Database Development Tools Optimize Business Processes

oracle.com/database/podcasts.html

James Hughes, manager of software engineering at Development Dimensions International, a provider of human resource consulting services, discusses how his

company automates business processes in custom applications developed using Oracle Data Provider for .NET and Oracle SQL Developer.

Deriving Value from Spatial Information in the Enterprise

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Learn how Oracle partner Leica Geosystems uses Oracle Database, Oracle Spatial, and Oracle Application Server MapViewer to help customers consolidate spatial and business information in the database, capture and update data in the field, and build location intelligence into business processes.

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OVERHEARD

"With the introduction of Web services, both on the corporate intranet and increasingly on the public internet, there is a real opportunity to build applications that drive value, insight, and opportunity for the end users of the applications at the edge of an organization."

— Anthony Lye, Senior Vice President, Oracle CRM, in the *Applications at the Edge of the Enterprise* podcast (oracle.com/profit/audiocasts.html)

president of database product marketing, about Oracle's leadership in security. Find out about the various security programs that have allowed Oracle to deliver significant database security innovations and to provide customers with an unparalleled security posture.

IT Integration and the Fight Against Cancer
oracle.com/magcasts

For two years, Dr. John Quackenbush, professor of computational biology at Harvard's School of Public Health, has used a grant from Oracle to integrate clinical and research data to improve diagnosis and therapy for cancer.

Streamline Paper-Intensive Business Processes with Oracle Document Capture
oracle.com/products/middleware/ofmradio.html

Ken Peterka, vice president of software development at Oracle, talks about Oracle Document Capture and Oracle Distributed Document Capture and how these new solutions enable the streamlining of paper-intensive business processes.

The Imperative for Risk-Based Authentication and Fraud Prevention
oracle.com/products/middleware/ofmradio.html

Thomas Varghese, vice president of product management at Oracle, discusses the prevalence of online identity theft, phishing, and banking fraud and how you can protect your customers and your enterprise assets.

A Platform Approach to Managing Multiple Web Sites
oracle.com/products/middleware/ofmradio.html

Michelle Huff, product management director for Oracle Content Management, explains how organizations can use a platform

approach for multisite management.

Build Richer User Interfaces in Java and Get Ajax and Flash for Free
oracle.com/products/middleware/ofmradio.html

Ted Farrell, vice president of development tools at Oracle, describes Oracle's strategy and technologies for building rich internet applications that offer the best of all worlds across Java, Ajax, and Flash.

Why Enterprise Role Management Is a Key Priority This Year
oracle.com/products/middleware/ofmradio.html

Edward Zou, Oracle vice president, product management, discusses why automated enterprise role management has become one of the key IT initiatives this year and how such a solution can ease administrative burdens and improve security and compliance for your organization.

Oracle Presents an Upgrade Tool for Oracle E-Business Suite: Oracle Maintenance Wizard
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Vikki Pickard, product and development manager for Oracle Maintenance Wizard, introduces a tool that guides customers through Oracle E-Business Suite upgrades and the code line maintenance process.

Trends in Today's CRM Marketplace
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The Latest Updates to Oracle's Applications Strategy
oracle.com/appcasts

Ed Abbo, senior vice president of Oracle

Applications, discusses innovations within Oracle Applications, how Oracle is integrating all its new product lines, and why customers should adopt the latest releases.

Applications at the Edge of the Enterprise
oracle.com/profit/audiocasts.html

Anthony Lye, senior vice president for Oracle CRM, sees "consumable" applications bringing significant benefit to the enterprise. These applications include lightweight tools and enterprise mashups that support collaboration and social interaction and rely on Web 2.0 techniques such as social bookmarking and social tagging.

NEW LINUX OFFERINGS

Preconfigured Templates for Oracle VM
otn.oracle.com/software/products/virtualization/vm_templates.html

The first of many preconfigured templates for Oracle VM are now available. The free templates enable customers to quickly create guests and set up full Oracle Database 11g and Oracle Enterprise Linux environments with Oracle VM server virtualization software.

New Oracle Validated Configurations for Linux
otn.oracle.com/tech/linux/validated-configurations

There are now more than 75 Oracle Validated Configurations for Linux available for free download. Oracle Validated Configurations are pretested, validated architectures with software, hardware, storage, and networking components with documented best practices for deployment.

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oracle.com/education



Tech, Meet Apps

The Oracle community gets a new resource for service-enabling Oracle Applications.

This OTN Bulletin update comes from Oracle Publishing Senior Editor Jeff Erickson, who provides a report about COLLABORATE 08.

COLLABORATE 08 offered ample opportunity for Oracle developers and Oracle applications managers to mingle. And no place was the mingling more fruitful than in the hands-on labs.

More than 550 participants over three days took part in the hands-on labs for service-enabling Oracle E-Business Suite and Oracle's PeopleSoft, Siebel, and JD Edwards EnterpriseOne applications. In the hands-on lab for Oracle E-Business Suite, students used Oracle SOA Suite technology to take an order from a legacy system and pass it through to Oracle E-Business Suite. "It was pretty amazing," says Juliana Button, a director of product management at Oracle and an instructor in the labs. "Students came in knowing very little about the technology, and by the end of the class they had used our service-oriented architecture [SOA] tools to build a new process."

The lessons of COLLABORATE 08 will continue in new best-practice centers on Oracle Technology Network (OTN). These centers feature comprehensive hands-on tutorials, relevant blogs, and best practices from community members as they work through their own implementations. Explore the centers at otn.oracle.com/products/middleware.

A PAIR OF ACES DO COLLABORATE

Oracle ACEs (Applications) Ray Payne and Floyd Teter were both busy at COLLABORATE 08, but with very different agendas.

Payne and his team were boning up on grid infrastructure and Oracle E-Business Suite 12. "We've made a

strategic architectural decision that we want to deploy on a grid architecture using commodity hardware and Oracle Enterprise Linux," said Payne at the conference. "We are here looking to find everything we can on the subject area."

In true Oracle ACE fashion, Payne turned the effort into a learning opportunity for Oracle product management and his fellow Oracle customers. "My team is meeting with Oracle product managers so we can share ideas and best practices with Oracle," he said. "It's a two-way street."

Meanwhile, Oracle ACE Floyd Teter kept busy lighting the way for Oracle Applications customers on the road to more-flexible Oracle Applications built on Oracle Fusion Middleware. He led a session based on his road map for getting there from Oracle E-Business Suite 11i. The big question, Teter says, is how you make choices and map out a plan. "Rather than going through a theoretical discussion, I just said, 'This is how we did it at my company and it might work for you as well,'" he explains. Keep up with Teter at orclville.blogspot.com.

DISCUSSION FORUMS: BROADENING MINDS

Greg Pike's COLLABORATE session, *ACES in the Hole: Learning Advanced SQL Techniques from OTN Pros*, was a fresh reminder that the discussion forums on OTN are an almost limitless learning resource for OTN members. Pike, a principal consultant at Piocon Technologies and a prodigious poster on the forums, made his case for the value of participating in the discussion forums by following a real-world string of responses to a question on the PL/SQL discussion forum. Respondents solved the problem using a combination of analytic functions, hierarchical query, collection functions, XML functions/operators, pipelined functions, the MODEL clause, and more.

Pike's point was that the discussion forums do more than just answer your questions; they broaden your mind. "There's a huge group of experts and Oracle ACE contributors watching the forums and posting replies," Pike said. "You'll get answers in minutes. And they'll be in a range of types and styles."

With more than 50,000 topics and 300,000 posts, the forums are "the mother lode of SQL and PL/SQL education from recognized experts worldwide," Pike said. "OTN members at all skill levels will find this forum packed with a treasure chest of tips, tricks, and techniques."

Get involved in the discussion forums at forums.oracle.com, and keep up with Pike at www.singlequery.com. ■

Justin Kestelyn (justin.kestelyn@oracle.com) is senior director, Oracle Technology Network and developer programs, as well as OTN editor in chief.

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Blogs
blogs.oracle.com

Discussion forums
forums.oracle.com

Developer Events Calendar
otn.oracle.com/events

Oracle ACE Program
otn.oracle.com/goto/oracle-ace

**FLASH DRIVES POSE SECURITY RISKS**

In a recent survey about flash drive use, 77 percent of corporate end users surveyed have used personal flash drives for work-related purposes. The most-likely datafiles to be copied to a personal flash drive are customer records (25 percent of respondents), financial information (17 percent), business plans (15 percent), employee records (13 percent), marketing plans (13 percent), intellectual property (6 percent), and source code (6 percent). 12 percent of respondents said they had found a flash drive in a public place. The U.S.-based telephone survey was conducted in March 2008.

Source: SanDisk

www.sandisk.com/Corporate/PressRoom/PressReleases/PressRelease.aspx?ID=4179

TECH WORKERS ANXIOUS ABOUT JOBS

In the first quarter of 2008, 62 percent of technology workers in the U.S. expressed confidence in the future of their current employers, down from 66 percent in the last quarter of 2007. 55 percent say that fewer jobs are available (up from 35 percent), but 48 percent are confident in their own ability to find a new job. The online survey was conducted in January to March of 2008 and polled 578 information technology workers.

Source: Spherion Corporation/Technisource IT Employment Report
www.technisource.com/techwebsvc/Upload/news_1208354178737.pdf

MOST CORPORATE PROFESSIONALS UNAWARE OF INFORMATION LEAKS

An online and paper survey of 55 corporate professionals showed that 60 percent of respondents were unaware of the number of unreported information leaks that occur in their companies. 32 percent said they were aware that such leaks had occurred. Nearly 70 percent of companies use shared directories to store sensitive information, and 62 percent cite access control as a major challenge to secure sharing of electronic information.

Source: Thru Annual Information Management and Intellectual Property Benchmark Report
www.thruinc.com/benchmark

ORACLE IN-MEMORY DATABASE CACHE OPTION AVAILABLE

Oracle has released Oracle In-Memory Database Cache, a new option for Oracle Database Enterprise Edition that provides real-time, updatable caching for the database. Based on Oracle TimesTen In-Memory Database, the new option delivers a real-time, dynamic, updatable cache for frequently accessed data in Oracle Database.

"Oracle In-Memory Database Cache can significantly improve the response time and throughput of applications that require real-time performance," says Willie Hardie, vice president of database product marketing, Oracle. "This new option is well-integrated with Oracle Database and will help Oracle Database customers meet their extreme application performance needs as well as reduce development time."

For performance-critical applications in industries such as communications, financial services, and defense, the Oracle In-Memory Database Cache option delivers application response times in the microseconds by bringing frequently accessed data closer to the application and processing queries in memory.

ORACLE ROLE MANAGER RELEASED

Now available, Oracle Role Manager (formerly Bridgestream Role Manager) helps customers define and manage organizational relationships, roles, and associated privileges for improved security and regulatory compliance. The new offering, part of the Oracle Identity Management component of Oracle Fusion Middleware, enables business users to manage business roles accurately and efficiently by using advanced statistical analysis and administrative automation tools. In addition, users can define roles and ownership structure through simplified navigation and a flexible data model.

"Historically, organizations have struggled to easily define and manage enterprise user roles that reflect their business structure and are typically left with an overpopulation of roles dis-

persed across their various enterprise systems," says Hasan Rizvi, vice president, identity management and security products, Oracle. "The new release of Oracle Role Manager provides customers with automated tools to mine and model roles and to efficiently manage multiple interrelated hierarchies across diverse IT systems on an ongoing basis."

The new product also features multi-dimensional hierarchies that support enterprise-wide business process automation that reflects real-world organizational structures. In addition, application-centric identity management provides rich role and approver information to heterogeneous applications and automates business process transaction approvals across the enterprise.

ORACLE CONTRIBUTES XQILLA XQUERY ENGINE UNDER APACHE LICENSE

Oracle has contributed the XQilla XQuery engine code, an embeddable XQuery engine for developers building XML-based applications, under the open source Apache 2.0 license.

The XQilla XQuery engine, an implementation of the XQuery 1.0 standard published by the W3C, enables developers to query XML data, similar to using SQL to query relational data. Developers can use the XQilla XQuery engine in commercial and open source applications at no cost and modify and improve it, as well as distribute it in binary and source code form.

For applications requiring XQuery and an XML document repository, Oracle has also integrated the XQilla XQuery engine within Oracle Berkeley DB XML, an embeddable, open source XML database.

"XQuery will play an increasingly important role in the future of information processing," says Dana Florescu, Oracle architect and coauthor of the XQuery specification. "Making XQilla broadly available as a commercial-grade XQuery processor for use by developers is an important enabler in the next generation of XML applications."

ORACLE SQL DEVELOPER 1.5 AVAILABLE

Oracle has released Oracle SQL Developer 1.5, a new version of its free, lightweight, database-browsing tool for Oracle and third-party databases. The tool offers utilities for day-to-day database tasks, such as creating and altering database objects, and an environment for running scripts and doing ad hoc reports.

Oracle SQL Developer 1.5 introduces version control capabilities that allow users to navigate through their repositories of versioned objects and edit their files in Oracle SQL Developer. The new versioning support also includes merge and compare facilities.

"Oracle SQL Developer 1.5 has a multitude of new functionality based on requests from the community," says Sue Harper, senior principal product manager, Oracle. "Our aim is to make Oracle SQL Developer indispensable for the database developer, and who better to ask than the users themselves."

ORACLE GROWS CONTENT MANAGEMENT PORTFOLIO

Oracle has expanded its enterprise content management offering with Oracle Universal Online Archive and Oracle E-Mail Archive Service, two new components of Oracle Fusion Middleware. Oracle Universal Online Archive provides a highly scalable and manageable archiving system that combines the proven infrastructure of Oracle Database and the standards-based hot pluggability of Oracle Fusion Middleware with a high-volume data ingestion engine to simplify archiving, management, and rapid retrieval of multiple content types.

Oracle E-Mail Archive Service works with Oracle Universal Online Archive to provide an optimized e-mail archiving interface for Microsoft Exchange, IBM Lotus Notes, and SMTP-based e-mail systems. Together, these new offerings help organizations decrease storage and IT operations costs, improve e-mail performance and security, and reduce the

cost and risk associated with e-discovery and litigation preparation.

"Oracle has decades of experience in managing huge volumes of data efficiently and securely. Oracle Universal Online Archive takes that deep understanding and brings it to bear on actively archiving multiple types of unstructured content and particularly e-mail," says Frank Radichel, vice president, software development, Oracle. "The result is a uniquely flexible archiving platform that helps lower IT costs, simplify the integration of security and records management policies into the archiving process, and improve end-user access to current and archived information."

ORACLE AUTHENTICATION SERVICES FOR OPERATING SYSTEMS RELEASED

Now available, Oracle Authentication Services for Operating Systems is a new offering within Oracle Identity Management that centralizes user management and authentication in Linux- and UNIX-based environments. While organizations have traditionally had to store and manage access and identity information locally on individual Linux or UNIX servers throughout the enterprise, Oracle Authentication Services for Operating Systems allows IT managers to centralize this information in a single corporate directory. This results in improved management and allows end users to access enterprise applications as well as Linux or UNIX servers through a single sign-on login.

"Business-critical applications are not secure unless the underlying operating system is secure," says Mark Diodati, senior identity and privacy analyst, Burton Group. "Scalable operating system security includes authenticating users, controlling access to resources, and doing these things across multiple, heterogeneous systems."

Organizations with UNIX or Linux servers can also enforce consistent security and compliance policies across these systems with Oracle Authentication Services for Operating Systems. For

example, administrators and auditors can centrally disable accounts or more easily report orphaned accounts, which helps ensure that administrator access is compliant with organizational policies.

"Although the challenge of effectively and efficiently managing access to mission-critical applications deployed on Linux and UNIX is not new to organizations, this is an area that security and identity vendors have failed to address until now," says Hasan Rizvi, vice president, identity management and security products, Oracle. "Oracle is filling the void by delivering Oracle Authentication Services for Operating Systems."

NEW ORACLE ENTERPRISE MANAGER PLUG-INS AVAILABLE

Oracle has released six new Oracle Enterprise Manager system monitoring plug-ins that extend the capabilities of several products beyond the Oracle platform to allow customers to reduce the number of tools administrators need to monitor and manage complex heterogeneous IT environments. New plug-ins are available for Microsoft Exchange, EMC CLARiiON CX, VMware ESX, Apache Tomcat, Sybase Adaptive Server, and SAP applications. Additionally, enhancements to existing plug-ins for IBM DB2, Microsoft SQL Server, Juniper Networks' Netscreen Firewall, and Check Point Firewall are also available.

Developed in conjunction with third-party vendors, the plug-ins leverage Oracle Enterprise Manager's plug-in framework, which uses open, standards-based technologies with published APIs.

"Enterprise IT environments will continue to have complex management requirements as customers look for the best solutions—whether private source or open source—to solve business problems," says Leng Leng Tan, vice president, applications and systems management, Oracle. "With the new Oracle Enterprise Manager system monitoring plug-ins, Oracle is demonstrating its commitment to delivering superior top-down application management and

reducing the complexity of heterogeneous IT environments."

ORACLE APPLICATION ACCESS CONTROLS

GOVERNOR 8.0 AVAILABLE

Oracle is shipping Oracle Application Access Controls Governor 8, the latest release of its application access controls solution that enables compliance, audit, and security officers to automatically enforce authorization policies across Oracle and non-Oracle systems. A key component of the Oracle Governance, Risk, and Compliance applications suite, the latest release provides best-practice segregation of duties policy libraries for Oracle's PeopleSoft Enterprise and Oracle E-Business Suite to natively embed real-time preventive controls within the applications.

The new release also leverages a service-oriented adapter framework and integration templates that extend capabilities to non-Oracle applications. The service-oriented approach is designed to provide end-to-end access control across heterogeneous application environments. Other new features include an access policy engine that supports fine-grained controls authoring and handling, and a central work queue console that includes contextual reports with embedded heat maps, which are reports that rank the level of risk for control failures to allow users to focus their attention on the highest-risk failures.

"Oracle Application Access Controls Governor Release 8 enables organizations to resolve access and authorization pain points on a global level," says Chris Capdevila, vice president of Oracle governance, risk, and compliance strategy. "With the prebuilt library of segregation of duties controls, customers can meet their corporate governance, regulatory compliance, and risk management goals with the greatest assurance."

ORACLE DEAL MANAGEMENT UNVEILED

Now available, Oracle Deal Management enables sales professionals to optimize the deal process, control price erosion, and make better pricing decisions in negotiations. Built

on Oracle Fusion Middleware, Oracle Deal Management supports Oracle Applications including Oracle's Siebel Customer Relationship Management (CRM) 8.0 and Oracle E-Business Suite, and has open APIs for integration with non-Oracle applications.

"Companies are realizing the need to cut costs by increasing margins through pricing initiatives to more fully capture the value of their product offerings to customers," says Anthony Lye, senior vice president of CRM, Oracle. "With Oracle Deal Management, companies can finally equip their sales teams with the essential deal and decision support tools to help achieve maximum profit from every deal."

ORACLE DATABASE VAULT CERTIFIED WITH ORACLE'S SIEBEL CRM

Oracle has certified Oracle Database Vault for use with Oracle's Siebel Customer Relationship Management (CRM) to provide extensible, out-of-the-box policies that prevent unauthorized access to critical application data by privileged users. Oracle Database Vault prevents ad hoc access by Siebel business users to Siebel CRM application data, protecting against application bypass and enforcing access through the Siebel application account.

"Database access control and segregation of duty solutions are key to effective, comprehensive compliance and data protection initiatives in order to limit the potential impact of privileged users," says Trent Henry, vice president and research director, Burton Group.

With its separation of duty feature, Oracle Database Vault enables Siebel CRM application database administrators to bring new business users onboard without giving them the ability to view application data.

"Oracle Database Vault enforces real-time preventive controls and extensible, out-of-the box policies for Siebel CRM, [Oracle's] PeopleSoft Enterprise, and the Oracle E-Business Suite applications to transparently safeguard access to sensitive data within the database and help ensure regulatory compliance," says Vipin Samar, vice president of database security, Oracle.

ORACLE ACQUIRES ASSETS FROM EMPIRIX

Oracle has agreed to acquire the e-TEST suite products from Empirix, a provider of voice and Web application testing and monitoring solutions. Empirix' e-TEST suite is a set of Web application testing solutions that help customers deploy higher-quality applications more efficiently and at lower cost. The e-TEST suite will be incorporated into Oracle Enterprise Manager and Oracle Real Application Testing.

"Application testing is becoming increasingly important as customers seek to deploy applications faster, at a lower cost, and with higher quality of service," says Leng Leng Tan, vice president, applications and systems management, Oracle. "Customers are looking for automated application testing solutions that help prevent costly application performance problems, avoid unplanned outages of business-critical applications, and automate the manual steps involved in application testing." ■

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Oracle In-Memory Database Cache

oracle.com/database/in-memory-database-cache.html

Oracle Role Manager

oracle.com/products/middleware/identity-management/role-manager.html

XQilla XQuery Engine

oss.oracle.com/xqilla-xquery.html

Oracle SQL Developer 1.5

otn.oracle.com/products/database/sql_developer

Oracle Universal Online Archive

oracle.com/goto/uoia

Oracle Authentication Services for Operating Systems

oracle.com/products/middleware/identity-management/authentication-services.html

Oracle Enterprise Manager system monitoring plug-ins

otn.oracle.com/products/oem/extensions

Oracle Application Access Controls Governor

oracle.com/solutions/corporate_governance/application-access-controls-governor.html

Oracle Deal Management

oracle.com/applications/price-management/deal-management.html

Oracle Database Vault

oracle.com/database/database-vault.html

Oracle and Empirix

oracle.com/empirix

High Availability on Linux

Oracle Clusterware protects mission-critical applications from downtime.

Clustering—grouping independent servers to cooperate as a single system—helps prevent downtime caused by system failure by removing the single point of failure inherent with a single server. Cluster management software is integral to clustering, and Oracle Clusterware, cluster management software previously available only with Oracle Real Application Clusters (Oracle RAC), is now available under a separate license to Unbreakable Linux support customers at the basic and premier levels at no additional cost.

“Oracle Clusterware for Unbreakable Linux can be used both for Oracle and non-Oracle applications,” says Sohan DeMel, senior director of product management, Oracle. Oracle Clusterware provides out-of-the-box agents and scripts for select applications; for example, customers can use a prepackaged SAP agent to ensure high availability for their critical SAP resources. This agent alleviates the need for the customer to write scripts for the orchestration of SAP resource failover.

And since all Oracle RAC on Linux customers already use Oracle Clusterware, it makes sense for them to extend that same technology to protect all of their applications from downtime, DeMel says. “Customers shouldn’t have to learn and operate one clustering technology for their database and another for their applications. Why not just use one proven technology?”

CLUSTER MANAGEMENT

As a cluster database technology, Oracle RAC requires a cluster manager for certain management and monitoring functions, and Oracle Clusterware provides these functions. In an Oracle RAC environment, Oracle Clusterware manages all of the Oracle processes automatically, and anything that it manages—



Sohan DeMel, Oracle Senior Director of Product Management

databases, instances, services, listeners, application processes—is known as a cluster resource. If a server fails, Oracle Clusterware automatically restarts all the cluster resources and the application service is restored—often before the administrator notices it was down.

In addition to providing an infrastructure to prevent downtime, Oracle Clusterware provides tools and utilities to easily monitor and manage applications and clusters for high availability.

“Oracle Clusterware leverages the management capabilities of Oracle Enterprise Manager, which includes interfaces for managing both single instance and Oracle RAC database environments,” says DeMel. “Plus, several command-line tools are available to manage Oracle Clusterware environments. These tools handle everything from verifying the health of components such as shared storage and network interfaces and administering resources under cluster management to expanding or shrinking the cluster.”

HIGH-AVAILABILITY GRIDS

Oracle Clusterware provides unique benefits such as support for up to 100 nodes in a single cluster and rolling upgrades of the cluster manager software. Oracle Clusterware is the ideal cluster infrastructure in enterprise grid environments, explains DeMel. “It provides benefits in the areas of high availability, database consolidation, and storage consolidation. In addition to standard application failover technology, Oracle Clusterware provides the capability to model critical resources and their associated dependencies and orchestrate failovers based on those dependencies,” he says.

Increasingly, customers are using Oracle Clusterware as a platform to consolidate their databases and associated storage, managed with Oracle Automatic Storage Management. “Consolidating multiple databases onto a single cluster-wide storage pool managed via Oracle Automatic Storage Management has tremendous benefit with regard to increasing application performance and storage utilization,” DeMel says.

“Oracle Clusterware is by far the most widely deployed cluster manager on Linux today,” concludes DeMel. “It’s the smart choice for customers who need a single high-availability technology to protect all their applications.” ■

Rich Schwerin (rich.schwerin@oracle.com) is the Linux, virtualization, and open source senior product marketing manager with Oracle technology marketing.

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otn.oracle.com/products/database/clusterware

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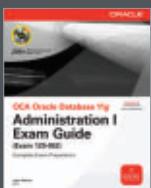


Oracle Enterprise Manager 10g Grid Control Implementation Guide

By Michael New
Oracle Press
www.oraclepress.com
ISBN: 0071492755

This hands-on guide shows Oracle administrators how to build a robust Oracle Enterprise Manager 10g Grid Control infrastructure through practical, jargon-free instruction and real-world examples. Author Michael New, who developed an Oracle Grid Control "Deep Dive" class at Oracle, teaches readers to install, configure, and maintain Oracle Grid Control. The book begins with a high-level look at Oracle Grid Control architecture and then moves to preinstallation requirements and step-by-step installation. Post-installation concerns such as patch installation, configuration, and tuning are also covered.

New is a technical manager with Oracle North America Consulting and a senior information systems architect with 15 years of software industry experience.



OCA Oracle Database 11g Administration I Exam Guide

By John Watson and Roopesh Ramklass
Oracle Press
www.oraclepress.com
ISBN: 0071597867

This Oracle Press certification exam guide offers detailed coverage of all of the official exam objectives on the Oracle Certified Associate, Oracle Database 11g: Administration I exam, including installation, management, administration, programming, networking, performance tuning, backup and recovery, security, and more. Real-world examples, practice questions, and chapter summaries help candidates learn the material. Each chapter provides challenging exercises, practice questions, a two-minute drill, and a summary to highlight what has been covered.

This authoritative guide will help readers pass the test and will also serve as an essential on-the-job reference. It includes a CD-ROM containing a practice exam and an electronic copy of the book. A second bonus exam is available for download with free online registration.

Look for Oracle books at otn.oracle.com/bookstore.

INMAGE SYSTEMS SUPPORTS ORACLE VM

Oracle partner InMage Systems' DR-Scout data replication product now supports Oracle VM, Oracle's server virtualization software.

DR-Scout performs data replication for volume-based structured data and file-based structured and unstructured data. It also provides continuous data protection at both local data centers and remote disaster recovery sites. The combination of InMage DR-Scout and Oracle VM enables customers to achieve continuous data protection and optimal server and storage efficiencies in both Oracle and non-Oracle data center environments. In addition to Oracle VM, InMage supports Linux configurations that are part of the Oracle Unbreakable Linux support program as well as various Windows configurations.

"InMage recognizes that enterprise customers rely on Oracle to run their businesses, and we are excited to extend our long-standing support for Oracle Database and Oracle Applications to include Oracle VM," says John Ferraro, CEO and president of InMage Systems.

TECH MAHINDRA LEVERAGES ORACLE APPLICATION INTEGRATION ARCHITECTURE

Tech Mahindra, an Oracle Certified Partner and an independent IT services provider to the telecom industry, has expanded its relationship with Oracle to deliver Telecom Integrated, a comprehensive software suite for the global communications industry based on Oracle Application Integration Architecture for Communications.

Oracle Application Integration Architecture for Communications is Oracle's platform for delivering end-to-end, integrated business processes, applications, and technology for the communications industry.

Tech Mahindra's software suite helps telecommunications service providers to manage back- and front-office operations and enables them to streamline and manage customer service, service fulfillment, and revenue assurance operations.

"As a result of its relationships with the world's leading operators for the past 18 years, Tech Mahindra is witnessing an explosive increase in demand for next-generation service delivery architectures," says Rohit Gandhi, managing director of Asia Pacific operations at Tech Mahindra. "To capitalize on this demand, we are aggressively expanding our expertise and solutions capabilities in this space. This focused effort with Oracle defines an important milestone toward this desired direction."

TERADATA AND ORACLE EXPAND WORLDWIDE RELATIONSHIP

Teradata, a provider of data warehousing and business intelligence solutions and a member of the Oracle PartnerNetwork, has expanded its worldwide channel relationship with Oracle to include Oracle Business Intelligence Suite Enterprise Edition and Oracle business intelligence analytic applications. These new solutions are in addition to Teradata's current Oracle Data Integrator and Oracle Essbase offerings.

"This announcement has important implications for Teradata and Oracle," says Henry Morris, senior vice president of Worldwide Software and Services Research at independent research firm IDC. "Oracle shows its determination to get maximum value from its BI and data integration acquisitions by exploiting opportunities in heterogeneous database environments."

As part of the expanded agreement, Teradata and Oracle will invest in support products and solutions for both current and prospective customers.

"Teradata and Oracle share a vision that business intelligence and data warehousing together must provide just-in-time insight from vast quantities of detailed customer and enterprise data to drive fact-based actions and interactions, helping leading companies achieve competitive advantage and operational excellence," adds Darryl McDonald, chief marketing officer of Teradata.

DTHREE ANNOUNCES INTELLIMAXX 5.0

Oracle partner dthree, a provider of customer interaction management solutions, has used Oracle Database and components of Oracle Fusion Middleware to create IntelliMaxx 5.0, an online marketing management platform.

dthree required an infrastructure that could accommodate management and analysis of rapidly growing data sets generated through customer interactions across multiple channels. The company also needed to maintain flexibility and security while taking advantage of rich internet applications and functionality enabled by Web 2.0 technology.

IntelliMaxx provides marketers with context-driven business intelligence and collaboration tools designed to improve marketing campaign effectiveness and business results.

"For most marketers, the complexity of their jobs is accelerating at an unprecedented pace," says Keyvan Cohanim, CEO of dthree. "An increasing volume of data is coming at them from fragmented sources and being presented in multiple formats that often have little or nothing to do with the context in which the marketers will actually use the information. Using Oracle infrastructure software, we developed a platform that manages, analyzes, and consolidates this wide array of data into a format from which marketers can easily take action to improve campaign performance on the fly."

QUOVA INTEGRATES GEOLOCATION WITH ORACLE IDENTITY MANAGEMENT

Quova, a provider of internet geolocation services and a member of the Oracle PartnerNetwork, has joined the Oracle Extended Identity Management Ecosystem and has integrated its GeoPoint internet geolocation product with Oracle Adaptive Access Manager. The partnership gives the two companies' joint customers a unified access management solution for assessing risk and detecting fraud in online transactions.

Quova's geolocation data assists Oracle Adaptive Access Manager in

identifying suspicious transactions by determining the real-world location of Web site visitors at the country, region, state, or city levels. This information improves fraud detection rates and reduces the number of false positives.

"As a result of Quova's integration with Oracle Adaptive Access Manager, our mutual customers can more easily locate potential cybercriminals and thoroughly address online fraud threats," says Bill Varga, vice president of business development at Quova.

CAPGEMINI AND ORACLE SERVE UP COFE

Capgemini, an Oracle Certified Advantage Partner, is collaborating with Oracle to open a center of excellence called the Capgemini Oracle Fusion Experience (COFE) in Chicago. The new center brings together the industry experience and service-oriented architecture (SOA) delivery capabilities of Capgemini, Oracle, and select hardware and network providers.

Through the COFE lab, companies can access subject matter experts to help with architecture review, solution design, and implementation assistance related to Oracle Fusion Middleware projects. Working onsite or online, these experts can share ideas and action plans related to Oracle Fusion Middleware; showcase real-time SOA proofs-of-concept; access a database of industry knowledge, best practices, success stories, white papers, and other reference materials; and tap into Oracle development teams to clarify product capabilities, future directions, and implementation processes.

"We are excited about bringing the latest technology solutions to help solve our customers' business needs through our COFE lab," says Lynn Anderson, Capgemini North American Oracle service line leader. "Having a collaborative environment where our consultants, clients, and partners can work together to learn and innovate these solutions is key."

In addition, the COFE will offer Oracle training, including a "train the trainer" program, and facilitate cus-

tomers' participation in a joint Oracle-Capgemini community. The goal of the COFE is to help companies understand their options regarding Oracle Fusion Middleware technology and to assist them in optimizing their current and future Oracle investments.

CALIFORNIA SOFTWARE ACQUIRES INTERNATIONAL INNOVATIONS

Oracle partner International Innovations, a technology consulting firm specializing in information management solutions, is now a fully owned subsidiary of California Software, the parent company of Calsoft Enterprise Services. Oracle partner Calsoft is a global systems integrator with more than 1,000 employees and 15 offices.

International Innovations delivers business intelligence, analytics, business rules management, and enterprise search capabilities to help organizations manage and use information to deliver business insights and knowledge. The company specializes in consolidating information from structured and unstructured datasources such as PDFs and Microsoft Word and PowerPoint documents.

Calsoft will maintain International Innovations' dedicated offshore development center for Oracle Business Intelligence Suite Enterprise Edition. The merged companies will focus on fixed-bid business intelligence projects around the globe. ■

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InMage Systems
www.inmage.net

Tech Mahindra
www.techmahindra.com

Teradata
www.teradata.com

dthree
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Quova
www.quova.com

Capgemini
www.capgemini.com

Calsoft and International Innovations
www.calsoftes.com

Playing to Win

Oracle grant helps Junior Achievement expand business simulation to global classrooms.

Used in the same sentence, the words *teenager* and *video game* might conjure images of a snack-littered basement, lit only by a tumultuous swirl of images flickering on the TV screen. But Junior Achievement (JA Worldwide)—the world's largest organization dedicated to educating students about workforce readiness, entrepreneurship, and financial literacy through experiential, hands-on programs—hopes to get more than sleepless nights and sore thumbs out of high school gamers.

The organization created JA Titan, a clever simulation of a modern manufacturing business, as a powerful tool for preparing high school students for the complexities of the business world. Launched in 2000, the game transforms JA's existing economics curriculum into a fun and engaging online game. Currently, JA Titan reaches approximately 40,000 students in 1,500 classrooms around the United States. Based on the success of JA Titan in U.S. classrooms, Oracle has awarded JA a US\$1 million Oracle Commitment Grant to expand the program around the world.

JA Titan players take on the role of CEOs who compete against computer or human opponents to get the best bottom-line results from their virtual businesses. Using a dashboard interface similar to those commonly found in real-world enterprises, players review data about the business, manage budgets and production, and even solicit advice from a group of business managers. By allocating funds to different parts of the business, players gain advantages over their opponents—invest heavily in R&D and they'll get a leg up on product features, but under-

spend on marketing and they'll have a warehouse full of forgotten widgets.

The game is in line with an emerging trend of using video games as educational tools, in both the classroom and the workplace. And teachers say student response has been great. "The JA Titan program has been one of the



Students from Herbert Hoover High School in San Diego, California, compete in Junior Achievement's Titan of Industry Challenge—a local and national competition that uses JA Titan as a platform for testing students' business knowledge.

most engaging tools I have ever used in my eight years of teaching," says Ryan Hollingshead, a social studies teacher at Castle View High School in Denver, Colorado. "The [process] for students to plan, make decisions, and interpret data is incredibly easy and forces students to really consider what it takes to run a business."

With Oracle's support, JA Titan will be able to reach thousands of additional students around the world. Oracle's grant will help fund JA's global rollout of JA Titan, translating the game into 10 new languages and launching it in 10 new countries. The goal is to bring JA Titan to an additional 100,000 students around the world.

Sean C. Rush, president and chief

executive officer of JA Worldwide, notes that this global rollout benefits new populations of students as well as existing users in the U.S. "American high school students will be able to work with, learn from, and interact with their peers from Europe, Asia, and Latin America," he says. "JA Titan shows students what it's like to be 'CEO for a day,' helps bring the global economy to life for young people in an exciting and powerful way, and gives students a taste of success in a corporate environment."

While hundreds of Oracle employees volunteer every year in K-12 classrooms around the world to teach the JA curriculum, the company's investment in JA Titan marks an important new approach to preparing students for the workforce. Clare Dolan, vice president of Oracle's Corporate Citizenship programs, believes that the game's mixture of broad business principles and

playful competition makes JA Titan a powerful addition to the JA curriculum. "Twenty-first-century workers must know how different lines of business contribute to the success of a company," says Dolan. "JA has a proven track record for preparing students to meet this challenge, and JA Titan is another example. Oracle is happy to support JA Titan's global expansion." ■

Aaron Lazenby is a director with Oracle Publishing.

webLOCATOR

Oracle Corporate Citizenship
oracle.com/corporate/community

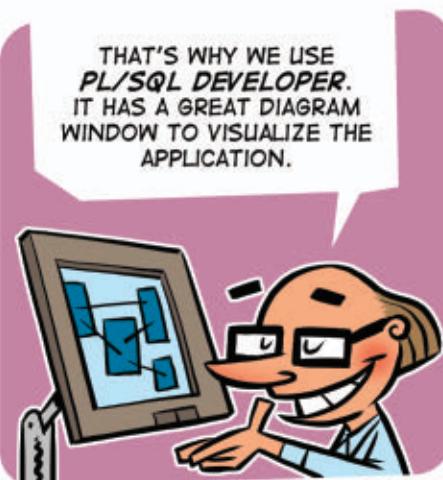
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www.ja.org

The adventures of Harry & Garry

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Mobile Matters

Oracle powers crime-fighting devices and better cell phone coverage.

Armed with Information

Law enforcement personnel have a new tool in their crime-fighting repertoires: mobile devices that deliver critical—and even lifesaving—information during the course of a citation, chase, arrest, or investigation.

Using handheld devices, smart phones, or mobile PCs equipped with the Mobile Unit Field Reporting System (MUFRS) from Mobile BIS, law enforcement officers can significantly increase the efficiency of everything from issuing traffic citations to tracking and arresting criminal suspects. During the course of a routine traffic stop or in-depth field investigation, MUFRS delivers historical information in real time about a person, vehicle, location, warrant, and more. It supports multimedia data such as photos, video, and even voice recordings, to aid officers in making a positive identification.

MUFRS uses Oracle Database Lite Mobile Server to synchronize data bidirectionally between Oracle Database Lite Client on the mobile device and an Oracle Database 10g server running a centralized records management application. Officers in the field can use their mobile devices even in areas with no wireless connectivity. When they return to an area with coverage, wireless data communication is re-established between the device and the centralized repository. When arrests or citations are made, the information is transmitted to the central server and records management system, where it is tracked and integrated into the local court and police jurisdiction's application software. Meanwhile, the citation or charge is automatically printed at the scene on a wireless Bluetooth printer.

Armed with information, law enforcement officers are not only gaining efficiencies in their day-to-day duties but also helping to make their communities safer.



Breaking Cell Phone Barriers

Today's cellular phones let you do a lot more than just make phone calls. Third-generation (3G) cellular technology delivers wireless data services to mobile phones at broadband speeds and allows subscribers to quickly browse Web pages, stream music, watch on-demand video, download and play 3-D games, videoconference, and more. That's all great—until you lose your cellular signal inside your house.

More than one-third of all mobile voice and data traffic originates in the home. However, it's particularly hard for 3G signals to penetrate buildings, due to how walls absorb most of the radio frequency energy.

Enter femtocells, such as those made by ip.access. The company's Oyster 3G is a low-power femtocell base station for homes that provides high-speed end-to-end voice and data access inside buildings where the thickness of walls makes obtaining a 3G signal difficult. Oyster 3G creates a cell inside the home by tapping into the subscriber's broadband service. When a subscriber is at home, the Oyster 3G femtocell automatically takes over the session from the macro network outdoors and routes it through the subscriber's broadband connection to provide better reception and faster data speeds.

The Oyster 3G system embeds Oracle Berkeley DB as a self-maintaining database engine with automatic failure recovery and replication to guarantee 99.999 percent carrier-grade availability. Oracle Berkeley DB delivers high performance, scalability, and availability in a small-footprint, zero-administration package, ideal for Oyster 3G's technical requirements.

As 3G adoption picks up, look for femtocell use to do the same. Industry analysts predict that there will be more than 150 million femtocell users by 2012.

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www.mobilebis.com

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Standards Bearers

Three entrepreneurial peers tout the wonders of Web services.

Tim Tow

How did you get started in IT? I was a CPA who decided that if I could automate the work of 10 accountants, they had to pay me for the work of at least 2 accountants. I was right—and programming is a lot more fun than accounting anyway!

How do you use the internet today?

I try to answer a few questions a day on Oracle Technology Network or the other Essbase boards, and we use Webcast technology daily for sales and support functions, along with instant-message technology to communicate with our customers.

If you were going to the International Space Station for six months and could only take one Oracle reference book, what would it be? I would take the *Essbase Database Administrator's Guide*, affectionately known as the "DBAG." It's the bible for Essbase administrators. I'd also take *Look Smarter Than You Are with Hyperion Essbase* by fellow Oracle ACE Edward Roske, because it's informative and entertaining.



peerSPECS

Company: Applied OLAP, a firm focused on maximizing its clients' investment in Oracle's Hyperion Essbase

Job title/description: Founder and president, focusing on Applied OLAP's Dodeca product and leading the company's development team

Location: Huntsville, Alabama

Length of time using Oracle products: More than 20 years

Oracle ACE

otn.oracle.com/community/oracle_ace

courses for the Hyperion and Demantra product lines. We've seen great demand from our prospects and partners for such courses, due to the fact that companies see tremendous value in these product lines and want to gain competitive advantage by adopting these solutions into their application stack.

peerSPECS

Company: Applation LLC, a provider of business intelligence solutions

Job title/description: President, leading the Applation team in the development of on-demand software solutions

Location: Phoenix, Arizona

Length of time using Oracle products: 14 years

Oracle ACE

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Mike van Alst

What important lessons did you learn early in your career? Back in 1984, I was working for a large bank in the Netherlands. One day, my manager proudly announced that my department would be automated—immediately. The whole floor was converted, terminals had been put in place, and so on. The effect was that 60 percent of the department went home sick. It showed me that there are better ways to automate, so I enrolled in a programming course and joined the IT workforce.

What advice do you have about Web and application development?

Companies switching to Web or application development are often overwhelmed by the massive amount of new skills and knowledge they need. The smart thing to do is to find a good partner company that can speed up the learning process. Just being able to circumvent the pitfalls and learn from experienced personnel helps a lot.

What's your favorite tool or technique on the job?

Web services and BPEL. The industry's past attempts at a more dynamic setup of applications—from structured programming and the use of copybooks and external calls to component-based development, CORBA, and object orientation—had the same goal: functionality. It never came fully to fruition, but ever since the introduction of Web services and BPEL standards, we're finally able to bring more value to the business. ■



Ameed Taylor

What technology has most changed your life? Service-oriented architecture [SOA]. With SOA and Web services, companies have been able to break free of silos and interoperate in ways that were impossible or prohibitively expensive 5 to 10 years ago.

Which new features of Oracle applications are you finding

most valuable? I'm focusing extensive effort on the Hyperion performance management solutions and Oracle Business Intelligence applications, because those products offer the performance and scalability that our clients have requested.

What would you like to see Oracle do more of? Create more online



peerSPECS

Company: IT-eye, a firm specializing in SOA and business intelligence

Job title/description: Principal consultant, defining strategy and serving as a sounding board for all IT-eye architects

Location: Nieuwegein, the Netherlands

Length of time using Oracle products: More than 20 years

Oracle ACE

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A man in a red and blue leotard is performing a high jump over a horizontal bar. He is in mid-air, having just cleared the bar. The background is a digital grid with floating numbers (0.0003, 0.0004, 0.0005, 0.0006, 0.0007, 0.0008, 0.0009) and a large, bold letter 'A'.

MEASURE. A

SCOTT DAWSON

BY DAVID BAUM

ANALYZE. PERFORM.

ORACLE TURNS INFORMATION INTO INTELLIGENCE AND INTELLIGENCE INTO ENTERPRISE PERFORMANCE.

Getting timely, easy-to-access business information that helps organizations make critical decisions—and map strategies—can be a stretch. Oracle's business intelligence (BI) and enterprise performance management (EPM) products and technologies, however, support organizations by making information available across the enterprise and by helping them plan and achieve their performance goals.

John Kopcke, Oracle's senior vice president of business intelligence and performance management, says Oracle's idea of "pervasive BI" has been moti-

vated by a few fundamental principles. "Information must be relevant to all users," he says. "It must be delivered in time to affect business results. It must be accessible through a broad range of mediums such as dashboards, alerts, and reports. And it must be integrated seamlessly into business processes and workflows."

These concepts are quickly becoming reality at Cox Enterprises, one of the nation's leading media companies, where more than 100 BI experts throughout the organization are developing self-service reporting environments for tens of thousands of users. To reduce IT costs, Cox is encouraging its BI team to standardize on a handful of robust tools such as Oracle Business Intelligence Suite Enterprise Edition and Oracle's Hyperion Essbase – System 9.

Spencer Taft, business intelligence group manager for Cox Enterprises, describes a successful BI venture in the HR department, where managers frequently request reports and analytics from Oracle's PeopleSoft applications and related systems.

"ERP [enterprise resource planning] systems were not designed for analytics and flexibility. As a result, IT involvement is usually required to create new reports and queries, which means that our PeopleSoft development and support teams are taken off other initiatives to field these requests," he says. "In many cases, large data volumes were ported into Microsoft Excel for 'spreadsheet gymnastics.' Now there's a faster, better, and more cost-effective solution for a lot of people."

IMPROVING FLEXIBILITY, REDUCING COMPLEXITY

To improve flexibility and minimize these maverick "spreadmarts," Cox decided to use Hyperion Web Analysis (now part of Oracle Business Intelligence Suite Enterprise Edition) in conjunction with Hyperion Essbase and a data warehouse that compiles data from PeopleSoft and related systems. Now Cox Enterprises has one central reliable source for populating numerous dashboards and queries, enabling the BI team to reduce the number of data feeds to production source



"[Using Oracle's Hyperion,] HR personnel that used to spend two to three weeks producing EEOC reports can create these same reports in 10 to 20 minutes."

—Spencer Taft,

Business Intelligence Group Manager, Cox Enterprises

users from having to know SQL to generate complex reports, reversing the typical 80/20 rule about BI. Now, our users are spending more time consuming useful information and less time trying to prepare it."

So far, the BI team has rolled out the BI solution to 150 users in HR, finance, and payroll—often reducing the time needed to create and run new reports from many days to less than one hour.

"HR personnel that used to spend two to three weeks producing EEOC [Equal Employment Opportunity Commission] reports can create these same reports in 10 to 20 minutes," Taft says. "Going forward, information like this and more will be even more accessible by dashboard and portal-like frameworks."

In a different area, the Cox Enterprises BI team created a BI application called Orion that analyzes bookings data from 80 radio stations in 17 markets. In addition to providing a central repository for this data, the application enables executives to monitor and forecast performance of individual markets using near-real-time dashboards.

Previously this information was entered and consolidated manually on a weekly basis. To automate this important

systems for customers.

Cox also uses automation to reconcile data among the PeopleSoft applications, the data warehouse, and several Hyperion Essbase cubes on a daily basis, which enables people to create meaningful reports from high-quality data. An important component in the Oracle BI foundation, Hyperion Essbase is an online analytical processing (OLAP) server with an advanced calculation engine. For Cox, it provides an environment for rapidly developing custom analytic and enterprise performance management applications.

"Nontechnical users can generate queries without having to rely on the development team," says Taft. "Business users can create regular or ad hoc reports just by dragging data elements from the fact and dimension tables in our published data model. This frees these

revenue management process, Cox designed a corporate data mart of key dimensions and facts and then loaded the information into Hyperion Essbase cubes. The team used Hyperion Essbase to deliver results to executives via PDF files; they can also view interactive reports to compare prior year actuals, budget, and most-recent bookings.

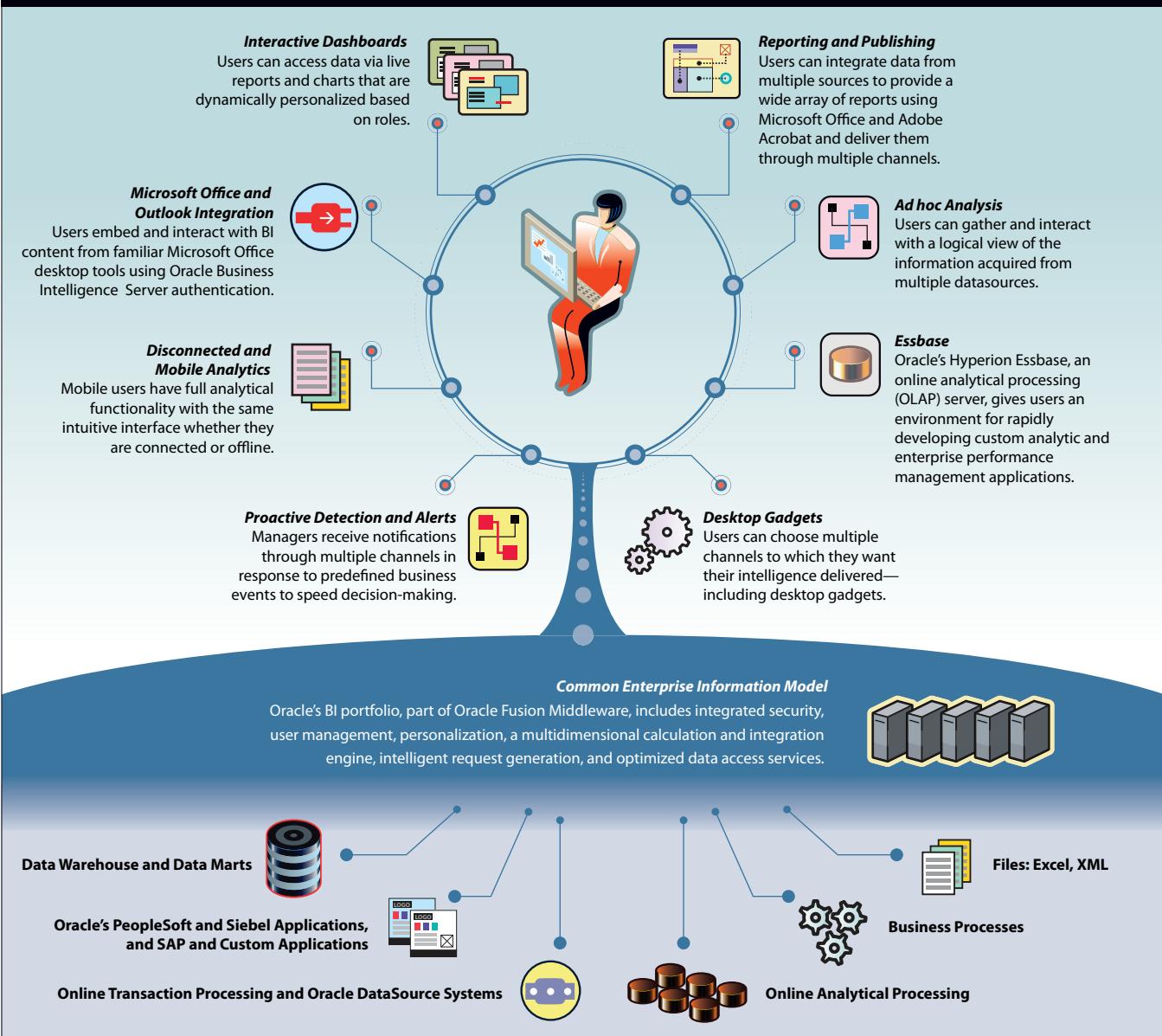
"It used to take a controller in each of the 17 markets about an hour per week to run reports and manually enter data into the data collection system," Taft says. "After that, corporate

employees spent about five hours per week consolidating the data for corporate reporting." The new system automates the entire process and securely delivers the reports via PDFs in Microsoft Outlook. Taft projects the savings at US\$200,000 per year, because executives use the information to spot areas that need attention and opportunities for profitability in Cox Radio operating markets.

Taft credits a lot of progress in BI to great people and solid executive sponsorship. He is starting to see a day when BI

Oracle Business Intelligence (BI)

Oracle Business Intelligence, part of Oracle Fusion Middleware, is the most comprehensive portfolio of technology and applications for enabling the insight-driven organization.



and analytics become more ingrained into Cox companies and help Cox create competitive advantages. He thinks that true EPM and “information democracy” are becoming more achievable, a potential direction he describes as his “über-vision” for the organization.

BI AT THE TIPPING POINT

This kind of long-range strategic thinking is

increasingly important to many organizations. Even more important is the ability to tie performance and planning with strategy. Hyperion Planning – System 9 is one of the Hyperion performance management applications, a modular suite of integrated applications that link strategy to planning and execution. Oracle’s Kopcke says the suite supports the entire management cycle of EPM, which includes goal-setting, modeling, planning, monitoring, analysis, and reporting.

Oracle EPM software aims to help customers define man-



"We are supplying users with advanced insight so they can make more-informed financial decisions, improve contract and grant tracking, and get a better picture of our workforce assignments and trends," says Michael Barrett, Florida State University's vice president for ERP.

agement processes such as plan-to-perform, record-to-report, and investigate-to-invest. “These are the key management processes that will take organizations to the next level with BI,” Kopcke says.

John Hagerty, vice president and research fellow at AMR Research, thinks that with the rise of EPM and the lure of the operational excellence it promises, BI technology

has reached a tipping point: it has become a strategic asset that most organizations can't live without.

“BI is now part of how decisions get made,” he says. “It's moving from a disjointed combination of tools and technologies to a cohesive environment that helps managers paint a picture of what's going on in the business. Many companies have told us that by 2010, performance management software will be one of the most strategic investments that they can make.”

IMPROVING CAPABILITIES WITH BUSINESS INTELLIGENCE APPLICATIONS

Oracle BI product integrations enhance companies' overall capabilities and allow customers to derive additional value from their existing Oracle Business Intelligence and Oracle Applications investments. Two such integrations are Oracle Business Intelligence Applications and Oracle E-Business Suite Release 12, and enhanced integration between Oracle's Hyperion Essbase and Oracle Business Intelligence Suite Enterprise Edition.

Oracle Business Intelligence Applications deliver intuitive, role-based intelligence for everyone in an organization—from front-line employees to senior management—and enable better decisions, actions, and business processes. Based on best practices, these solutions, such as Oracle Financial Analytics and Oracle Supply Chain Analytics, enable organizations to gain greater insight and value from a range of datasources and applications including Oracle E-Business

Suite, Oracle's PeopleSoft, Oracle's Siebel, and third-party systems such as SAP. Oracle Business Intelligence Applications include pre-built content and adapters for several Oracle E-Business Suite modules, including Oracle Financials, Oracle Human Capital Management, Oracle Order Management and Fulfillment, and Oracle Supply Chain.

Enhanced integration between Hyperion Essbase and Oracle Business Intelligence Suite Enterprise Edition provides customers with a unified, enterprise BI solution that delivers best-in-class query, reporting, analysis, and modeling capabilities. Hyperion Essbase takes advantage of the hot-pluggable and advanced query capabilities of Oracle Business Intelligence Suite Enterprise Edition to access heterogeneous datasources for modeling “what if” business scenarios and forecasts.

In addition, Oracle Business Intelligence Suite Enterprise Edition natively supports

Hyperion Essbase as an optimized datasource. With this integration, Hyperion Essbase customers can leverage the suite's enterprise information model to enable pervasive deployment and delivery of Hyperion Essbase information across the enterprise.

“The enhanced BI support for Oracle E-Business Suite and Hyperion Essbase helps customers reduce integration costs and complexity while enabling greater capabilities by linking the products together,” says Paul Rodwick, vice president of product management, Oracle business intelligence. “Oracle Business Intelligence Suite Enterprise Edition, Oracle Business Intelligence Applications, and Hyperion Essbase all help customers to generate greater value from their existing Oracle and non-Oracle ERP [enterprise resource planning] and CRM [customer relationship management] systems via the hot-pluggable capabilities of Oracle BI software.”

"By reducing the time it takes to produce and distribute reports, we can deliver what users want, when they want it, instead of always falling behind the demand curve."

—Michael Barrett, Vice President for ERP, Florida State University

When properly deployed, Hagerty says, BI provides visibility to business users in places where they couldn't see clearly before. "It helps these users take a step back and develop a knowledgeable perspective on a business function or domain. This is what organizations really value. They want to use BI to acquire real knowledge about the inner workings of their organizations."

BI GOES TO SCHOOL

It's not just commercial ventures that are looking for this type of knowledgeable perspective. Today's colleges and universities must respond to challenging social and economic trends ranging from complex operational issues and competition to declining financial support, escalating costs, and increasing demand for student loans. Challenges such as these have brought the need for responsible decision-making to the forefront of administrators' concerns.

Florida State University, an undergraduate, graduate, and research university with more than 40,000 students, found that it needed to deliver timely, accurate reports that put the right information into the hands of decision-makers. Florida State uses Oracle Business Intelligence Suite Enterprise Edition to leverage data stored in its PeopleSoft Enterprise Financial Management, PeopleSoft Enterprise Human Capital Management, and PeopleSoft Enterprise Grants Management applications, and the university is in the process of extending a self-service reporting and analytic environment to end users within individual departments.

"We chose PeopleSoft Enterprise applications for their robust reporting capabilities as well as their high-quality grants management tools," says Michael Barrett, vice president for ERP at Florida State University. "Now we are supplying users with advanced insight so they can make more-informed financial decisions, improve contract and grant tracking, and get a better picture of our workforce assignments and trends."

Oracle's acquisition of PeopleSoft

formed a good strategic fit for the university. Oracle has integrated Oracle Business Intelligence Suite Enterprise Edition with the PeopleSoft environment by establishing Oracle Fusion Analytics as the middleware layer between the two. Barrett says this simplified the task of developing metadata and transformation logic so they could create reports quickly. His organization also uses Oracle Business Intelligence Publisher for core financial statements and official published documents. This new publishing system has provided extensive capabilities with limited customization, and users are finding it easy and efficient.

Now that the core reports and analytics are in place, the university plans to create dashboards to deliver information to casual users, "essentially putting them on a PeopleSoft portal and providing relevant information within a graph or chart," he says. The overriding goal is to push reporting out to each department by teaching the faculty and staff how to use the data provided by IT. Once the dashboards are implemented and training is completed, the expected user count could reach 6,000.

"By reducing the time it takes to produce and distribute reports, we can deliver what users want, when they want it, instead of always falling behind the demand curve," Barrett says.

SNAPSHOT

Cox Enterprises

www.coxenterprises.com

Location: Atlanta, Georgia

Industry: Media and automotive services

Employees: 80,000

Oracle products: Oracle Database, Oracle's Hyperion Essbase – System 9, Oracle Business Intelligence Suite Enterprise Edition, Oracle E-Business Suite, Oracle's PeopleSoft Enterprise (Human Resources Benefits Self-Service, Payroll for North America Learning Management, Candidate Gateway, Talent Acquisition), Oracle Incentive Compensation, Oracle Financials

Florida State University

www.fsu.edu

Location: Tallahassee, Florida

Industry: Higher education

Employees: 12,000

Oracle products: Oracle Business Intelligence Suite Enterprise Edition, Oracle's PeopleSoft Enterprise Financial Management, PeopleSoft Enterprise Human Capital Management, PeopleSoft Enterprise Grants Management

R.L. Polk & Co.

www.polk.com

Location: Southfield, Michigan

Industry: Professional services

Employees: 1,650

Oracle products: Oracle Database, Oracle Real Application Clusters, Oracle Business Intelligence Suite Enterprise Edition, Oracle Enterprise Manager, Oracle Data Guard, Oracle Automatic Storage Management, Oracle Clusterware, Oracle Identity Management, Oracle Portal, Oracle Discoverer, Oracle WebCenter

BI AND DATA WAREHOUSING

For some companies, the sheer volume of data they gather and store can mean that delivering what users want, when they want it is almost impossible to achieve. If you can't find it, critical data can forever go unexamined.

That's where data warehousing enters the picture.

R.L. Polk & Co. is a market-research company that has provided analytical and statistical data services to the automotive industry since 1922. R.L. Polk collects and compiles data from more than 240 sources, including state agencies, automotive manufacturers, financing companies, and a variety of providers of lifestyle and demographic data. It all adds up to nearly 40 terabytes of Oracle data.

One of R.L. Polk's primary data warehouses maintains data on 500 million

vehicles and 250 million households. A wide variety of the company's customers depend on this information, including automotive and commercial vehicle manufacturers and dealers; automotive aftermarket companies; insurance, finance, and media companies; and advertising and government agencies.

"Many of our databases have billions of rows of data and several terabytes of information, all of which is stored, managed, and analyzed using Oracle software," says Douglas Miller, director of R.L. Polk's database group.

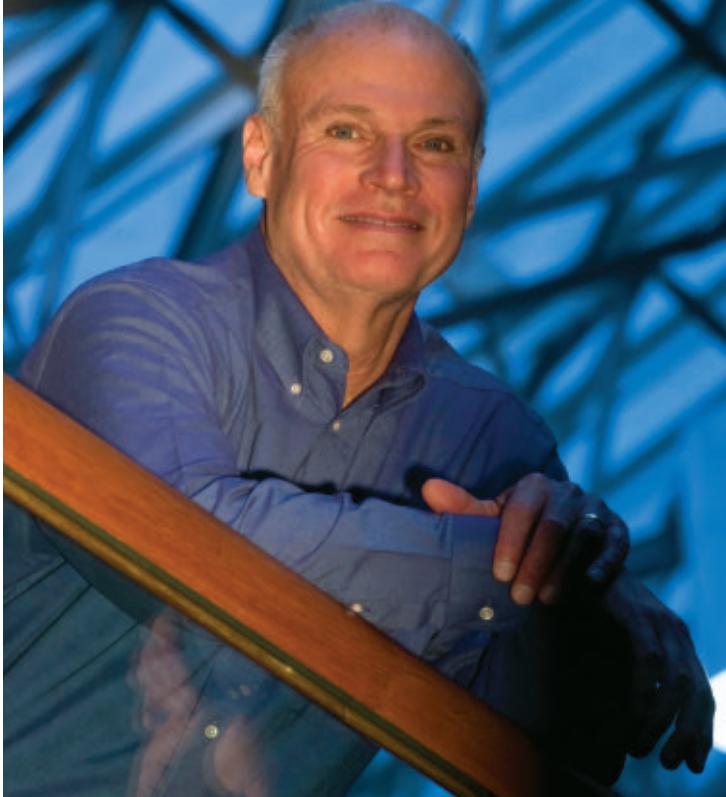
"Oracle has set a direction of innovation with its data warehouse functionality. Each release of the database brings another level of sophistication to our operation. We have been using the technology since Oracle7, and we've never been disappointed."

R.L. Polk has several BI applications to allow its customers to mine automotive data and generate reports. One of the most popular is PolkInsight, a geographic information system that lets customers explore consumer and vehicle data by geography, market segment, and dealership boundaries. Polk built PolkInsight using Oracle Discoverer, and the BI application lets customers build and schedule parameter-driven reports through a self-service reporting environment that supports about 4,000 registered users.

SUPPORTING USERS

Miller likes the BI technology embedded in Oracle Database 10g, such as materialized views and query rewrite. "We've been able to support huge numbers of users in a very efficient way with these technologies," he says.

Each customer segments the automotive market differently, so R.L. Polk has devised virtual private databases that enable them to "view information through the lens of their own set of dimension tables." Previously, Miller and his team built anywhere from 50 to 100 Oracle materialized views to support these private databases and the associated queries. Today, working closely with Oracle, they are using Oracle OLAP—an option to Oracle Database 11g Enterprise Edition—to



"Oracle is becoming the powerhouse in the BI tool space, which helps us stay on an upward path as a BI innovator. At every turn, Oracle delivers something that helps us further our business."

—Douglas Miller, Director, Database Group, R.L. Polk & Co.

from Oracle Business Intelligence Suite Enterprise Edition. "Oracle is becoming the powerhouse in the BI tool space," concludes Miller, "which helps us stay on an upward path as a BI innovator. At every turn and with every release, Oracle delivers something that helps us further our business." ■

David Baum (david@dbaumcomm.com) is a freelance business writer based in Santa Barbara, California.

next STEPS

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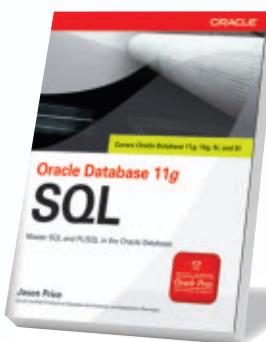
Written by leading Oracle professionals, Oracle Press books offer the most definitive, complete, and up-to-date coverage of Oracle products and technologies available. We've been the premier source for Oracle information for more than a decade, and the tradition continues with the release of Oracle Database 11g.



**Oracle Database 11g
PL/SQL Programming**

Michael McLaughlin

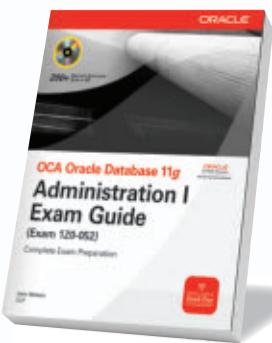
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Jason Price

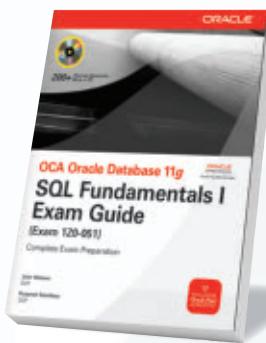
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John Watson

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I-HUA CHEN

LICENSE TO OPERATE

ORACLE SERVES, SUPPORTS, AND VIRTUALIZES THE LINUX ENTERPRISE.

IT administration isn't for the faint of heart. Not only do IT administrators need to scale information systems to meet increasing business demands; they also need to meet service-level agreements that improve performance and availability—while reducing costs. Acquiring operating system, virtualization, database, clustering, middleware, and applications software from different vendors may provide the necessary IT pieces, but integrating these components can become too complex—and too costly—an adventure.

Oracle virtualization, database, clustering,

BY DAVID A. KELLY

middleware, applications, and management tools running on Linux—backed by Oracle's Unbreakable Linux support program—offer a low-cost and powerful solution that is both complete and elegant.

"Oracle's support for Linux is much more than just adding another deployment option to Oracle products," says Al Gillen, research vice president, system software, at IDC. "IDC sees Oracle's approach as moving toward a more closely integrated stack of software that includes not only Linux, but the virtualization layer—Oracle VM—and middleware—Oracle Fusion Middleware—as well as database and application solutions."

HOW TO HANDLE GROWTH

Recreation is not just something that IT professionals wish they had more time for—it's big business. And whether the recreation is powerboats, kite boarding, fishing, skateboarding, gardening, popular science, or just about anything else, Bonnier Corporation relies on Linux to help connect people to their passions.

Bonnier Corp. is the U.S.-based company of the Bonnier Group, an international media company based in Sweden with operations in more than 20 countries. Over the past year, Bonnier Corp. has grown through acquisition from a 350-person company with US\$80 million in annual revenue to a company with more than 1,000 employees and approximately US\$350 million in revenue.

The company publishes more than 40 magazines (including *Field & Stream*, *Islands*, *Parenting*, *Saveur*, and *Skiing*) and related Web sites aimed at helping people connect with the activities they love. However, managing that kind of fast growth and supporting more than 100 Web sites for magazines, events, and marketing is a big IT challenge.

"We've had a very high growth rate. Over the past year, our Web visitors have more than quadrupled," says Scott Baker, database administration manager, Bonnier. To handle that growth, its



Bonnier Corp. benefits from knowing that its Linux servers will work smoothly with its Oracle Database environment. "Oracle has worked to optimize the way the database and operating system work together, so there won't be new problems when we upgrade either one," says Scott Baker, database administration manager (left), pictured with Brian Smith, manager of lab operations.

expanding content, and the need to manage its broad Web presence, Bonnier turned to Oracle and Linux. "Oracle Database, Oracle Enterprise Linux, and Oracle Streams are all backbones of our company that help us connect people to their passions," says Baker.

Baker decided to upgrade the company's Oracle Database to accommodate the bigger, high-traffic Web sites Bonnier needed to host. And he took advantage of Oracle Enterprise Manager Grid Control (Oracle Grid Control) to monitor and administer the database.

"Oracle Grid Control saves us many hours of menial DBA tasks," says Baker. "We've used the database cloning feature within Oracle Grid Control to move databases from one server to another, and the total time that it takes us to clone a database is five minutes." The team uses Oracle Streams for the migration of the Web sites into Bonnier's new data center.

"It's a good solution for us," Baker says. "We can keep the databases replicated and in sync and move all the sites over into the new data center gradually." The data migration was completed on time, and moving the Web sites is about 80 percent completed and has worked without a hitch so far.

SNAPSHOTS

Bonnier Corporation

www.bonniercorp.com

Location: Winter Park, Florida

Employees: More than 1,000

Revenue: US\$350 million

Oracle products and services: Oracle Enterprise Linux, Unbreakable Linux, Oracle Database, Oracle Application Server, Oracle Forms, Oracle Discoverer, Oracle Reports, Oracle Grid Control, Oracle Streams

Beaumont Hospitals

www.beaumonthospitals.com

Location: Royal Oak, Michigan

Employees: 14,950

Revenue: For patient care, approximately US\$1.85 billion (2007)

Oracle products and services: Oracle Enterprise Linux, Unbreakable Linux, Oracle Grid Control, Oracle Database, Oracle Real Application Clusters, Oracle E-Business Suite, Oracle Content Database

COST-EFFECTIVE GROWTH

Bonnier runs 35 Linux servers in a mixed environment to handle the QA and production systems for the development teams. For support, they rely on Oracle's Unbreakable Linux program. "We maintain enterprise-level support on all our production systems in case something happens," says Brian Smith, Bonnier's manager of lab operations. "But we haven't had to call in much for support—we haven't had the need."

"We initially saved thousands by using Oracle Enterprise Linux, but that cost savings just increases over time because of the reduced amount of recurring support."

—**Brian Smith**, Manager of Lab Operations, Bonnier Corp.

With Bonnier's many Web sites for magazines, events, and marketing, having a single source of support was an important consideration for Smith when he was evaluating the move to Oracle Enterprise Linux.

"We migrated from Red Hat Linux because we were going to be running Oracle Database on those servers and wanted to standardize on Oracle Enterprise Linux 5 because it's less expensive and we'd only have to go to one place for support," says Smith.

"We initially saved thousands by using Oracle Enterprise Linux instead of Red Hat, but that cost savings just increases over time because of the reduced amount of recurring support or maintenance that we have to pay," says Smith. "As time goes by, it'll definitely save us more and more money."

Bonnier also benefits from knowing that its Linux servers will work more smoothly with its Oracle Database environment. "Oracle has worked to optimize the way the database

and operating system work together, so there won't be new problems when we upgrade either one," Baker says.

SAVING MONEY, INCREASING AVAILABILITY

Bonnier isn't the only company seeing great benefits from Linux. Take the example of Beaumont Hospitals in Royal Oak, Michigan.

Beaumont migrated from another platform and now has 24 servers that run Oracle Enterprise Linux. "On those servers we have Oracle Identity Manager, Oracle Application Server, Oracle Database, and Oracle Grid Control," said Paul Dillard, Beaumont's manager of database administration.

"The systems that we support on Linux at this time are our contact database, our Web environment—which is an Oracle Real Application Clusters (Oracle RAC) environment—and our identity management environment," he says. Up to 15,000 people can be registered on the identity management system,

VIRTUAL POWER FOR ORACLE ON DEMAND

Virtualization plays a role either directly or indirectly in most deployments going forward," says Al Gillen, research vice president, system software, at IDC. "Most organizations will need to factor virtualization, as a current or future deployment scenario and a consolidation driver, into their deployment plans today."

Oracle VM, a logical complement to the Oracle Unbreakable Linux program, provides a scalable, low-cost server virtualization platform that supports both Oracle and non-Oracle applications. Consisting of open source server software and an integrated Web browser-based management console, Oracle VM provides an easy-to-use graphical interface for creating and managing virtual server pools running on x86- and x86-64-based systems. Users can create and manage virtual machines that exist on the same physical server but behave like independent physical servers. Each virtual machine created with Oracle VM has its own virtual CPUs, network interfaces, storage, and operating system.

Among other benefits, Oracle VM offers well-tested, high-performance server virtualization that can handle mission-critical production environments. With Oracle VM, Oracle provides the combined benefits of server clustering and server virtualization for grid computing and faster

deployment through preconfigured VM templates of Oracle Database and Oracle Enterprise Linux. Oracle VM delivers server consolidation and improves resource use, and it also offers a certified solution that supports Oracle's database, middleware, and applications.

With Oracle VM, organizations can have a complete software stack—from the operating system to the virtualization services to the database to the middleware to the applications themselves—with a single point of enterprise-class support.

For Laurent Sandrolini, vice president of product management, Oracle On Demand, Oracle VM is an important evolution in grid computing. Oracle On Demand has already standardized its services on Linux. Oracle E-Business Suite; Oracle's PeopleSoft, Hyperion, and Siebel applications; and Oracle Retail are all delivered on a Linux-managed grid.

"After Linux, Oracle VM is Oracle On Demand's next transformation. Virtualization is a milestone on our continued journey to give customers a superior ownership experience," says Sandrolini. "Virtualization changes the economics of the software delivery business by optimizing the underlying infrastructure while enhancing the service to customers."

Not only can Oracle VM help organizations reduce their infrastructure requirements, it can

also help the environment. That's an important consideration for Oracle. As part of the EPA Green Power Partnership program, Oracle is already purchasing 25 percent of its on-demand data center power from renewable sources, far more than the 3 percent required.

"The deployment of Oracle VM on our managed grid will contribute up to a 25 percent reduction in server power usage. Oracle On Demand manages the largest Oracle Linux grid. More than 5,000 servers are dedicated to supporting enterprise customers. Yet since our VM initiative started, we've been able to add customers while reducing our overall server footprint," says Sandrolini.

By adding virtualization to its Linux foundation, Oracle On Demand can also enhance key services for customers, such as provisioning, capacity management, change management, and even disaster recovery.

"Virtualization isn't only about consolidating servers," Sandrolini says. "Oracle VM affords faster provisioning of services, a new model to deliver capacity on demand, and an opportunity to innovate within the Information Technology Infrastructure Library, a framework for IT best practices. All in all, Oracle VM is fast becoming a critical aspect of enhancing every area of our on-demand service."



Paul Dillard, manager of database administration at Beaumont Hospitals, says that moving to an Oracle Linux environment has enabled the hospital system to cut IT costs. "We've reduced our costs by 40 percent," he says.

and at any given time about 1,000 are logged on. The identity management environment consists of three servers that replicate to one another to ensure constant availability in the event of a failure. Oracle databases are used as warehouses for the clinical systems.

The switch to Oracle Enterprise Linux has enabled Beaumont to cut costs significantly.

"For half the price of one of our old servers, we were able to get a highly available Oracle Linux environment, including two Oracle RAC nodes," says Dillard. "The cost savings is significant, not just in hardware but in maintenance fees for the hardware environment. By moving to highly available Oracle Enterprise Linux-based servers for our Web environment, we've reduced our costs by 40 percent. The money we've saved by moving to Oracle Enterprise Linux has allowed us to invest in other areas of IT and do things that we may not have been able to do otherwise."

Not only has Beaumont saved money; it has also increased availability and performance.

"Performance with Oracle [Enterprise] Linux has been equal to or better than our previous environment," Dillard says. "In addition, we have virtually no downtime in our highly available Oracle environment. The failover environment we were using had at least 5 to 15 minutes of failover time."

Beaumont also uses Oracle Grid Control to provide out-of-the-box management for its multiserver Linux environment, and having one central place to monitor the network has proven to be very beneficial.

"The money we've saved by moving to Oracle Enterprise Linux has allowed us to invest in other areas of IT."

—Paul Dillard, Manager of Database Administration, Beaumont Hospitals

"Virtually our whole network is monitored by Oracle Grid Control," says Dillard. "We manage the environment using Oracle Grid Control. We can even buy patches using Oracle Grid Control."

SUPPORT FROM TOP TO BOTTOM

For most IT organizations, low cost and the enterprise-class support available with Linux have made it a viable alternative to traditional data center solutions. With new options such as Oracle VM (see sidebar, "Virtual Power for Oracle On Demand"), organizations have even more reasons to consider Linux.

Oracle demonstrates its own confidence in Linux by running everything from internal Oracle systems to its massive Oracle On Demand data center on it.

"We have the virtualization layer, Linux, the database, application servers, applications, and management products that manage top-to-bottom," says Wim Coekaerts, Oracle's vice president of Linux engineering. "We also have a single support number that goes top-to-bottom, so it completes our single contact/single management control solution."

Having that type of assurance and support when deploying business-critical Linux systems is an important factor for forward-looking organizations. That's why Oracle continues to invest in supporting Linux top to bottom.

"We're very serious about Linux," says Coekaerts. "We wouldn't be running the company on it if we weren't." ■

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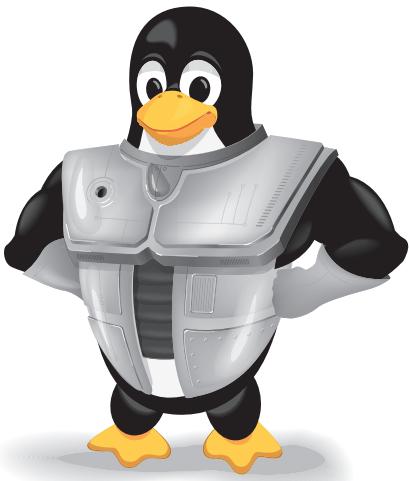
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GROWI

BY MARTA BRIGHT

What does “going green” mean to organizations that must handle more information than ever before? Developing the next generation of clean energy production? Hoisting solar panels onto the roof? Rethinking the design of the data center? Server virtualization?

“Embracing green practices involves a little bit of all these things,” says Nigel Montgomery, research director at AMR Research. Two organizations—one involved in energy research, the other in energy supply—are using Oracle technology in different ways to achieve the same goal: improving the world’s environmental health.

KEEPING A SAFE YET EFFICIENT DISTANCE

Pacific Gas and Electric Company (PG&E) provides power to 15 million people scattered

throughout 70,000 urban and rural square miles of Northern and Central California. Delivering energy around the clock to its customers is a balancing act that has the utility purchasing, generating, distributing, renewing, and reducing the outflow of energy when customer demand peaks and power grids become overtaxed. To do this better, PG&E is spending nearly US\$1 billion in enhanced demand response and energy efficiency programs. The utility hopes that this effort, the largest IT project in the company’s history, will challenge customer thinking and behavior.

One of PG&E’s premier efforts, the SmartMeter program, is a usage-monitoring plan that eventually will reach across the company’s entire service territory and give customers detailed rate and usage information that will help them understand, manage, and reduce their gas and electric consumption. “Over the next five years, we’ll have computer

GOING GREEN

ORGANIZATIONS ARE MANAGING MORE INFORMATION, REDUCING FUEL CONSUMPTION, AND DEVELOPING CLEAN ENERGY WITH ORACLE TECHNOLOGY.

"Much of what we've accomplished we attribute to Oracle RAC. Instead of scaling up a massive mainframe, we've distributed across smaller, more energy-efficient systems."

—Eugene Park, Senior Director of Application Services, PG&E

modules on literally every meter," says Eugene Park, PG&E's senior director of application services. "This will alter a once-a-month customer relationship to a once-an-hour—potentially once-every-15-minute—relationship."

The benefit is instant information that's gathered, analyzed, and then sent back to customers (possibly by e-mail or cell phone alerts) as a reminder to, for instance, run their washing machines and vacuum cleaners after 7 p.m. when demand and prices are lower. "SmartMeter technology helps us show customers exactly when and how they can save money and energy by backing off usage during peak hours," says Park.

As PG&E expands the SmartMeter program, the utility will also be phasing out onsite meter readers, which means fewer carbon-producing company vehicles out on the roads. "In addition to regular readings, if customers want to stop or start service, SmartMeter technology will enable us to operate remotely instead of having somebody drive out there

to reconnect service," says Park.

The SmartMeter program started gaining traction in 2005 when PG&E wanted to enhance its customer care and billing system, which produces 350,000 bills and processes US\$60 million in payments each day. "We needed a substantial upgrade," says PG&E IT Director Alain Erdozaincy. At the time, the utility was using an IBM DB2 database operating on a mainframe, which PG&E needed to leave behind.

"We knew we needed to support the data growth created by the SmartMeter program, so we worked with Oracle on creating a scalable clustered configuration," says Erdozaincy. PG&E now depends on the Oracle technology stack—including Oracle Database, Oracle Real Application Clusters (Oracle RAC), and Oracle Grid Control—to run its data center.

With Oracle RAC, the utility can use smaller, more-efficient servers that offer excellent performance and scalability while handling 720 times the amount of data, according to Park.

"We needed to support the data growth created by the SmartMeter program, so we worked with Oracle on creating a scalable clustered configuration," says PG&E IT Director Alain Erdozaincy (left). "Over the next five years, we'll have computer modules on literally every meter," says Eugene Park, senior director of application services.

PHIL SALTONSTAL



ORACLE PRODUCTS: GREENING THE TECHNOLOGY STACK

Oracle technologies can help organizations reduce the need for new hardware, even when data volumes are growing exponentially. These two technologies also help organizations cut their energy consumption.

Oracle Advanced Compression

The new advanced compression option in Oracle Database 11g enables organizations to compress all types of structured and unstructured data, including documents, images, and multimedia stored inside their databases. By using Oracle Advanced Compression, organi-

zations can reduce storage requirements for large database tables by a factor of two to four, thus reducing both storage costs and energy consumption. Oracle Advanced Compression can be used with any type of Oracle Database application; it doesn't require any application changes; and it enables queries, reports, and backups to run faster.

Oracle VM

Oracle VM server virtualization software enables you to run hardware at a higher capacity by allowing multiple logical servers to operate on

a single machine, thus reducing the amount of hardware needed, the cost to maintain the hardware, and the energy to run the hardware. Oracle VM offers scalable, low-cost server virtualization that is three times more efficient than existing server virtualization products, and it supports both Oracle and non-Oracle applications. Entire virtualization environments—including the Linux operating system, Oracle Database, Oracle Fusion Middleware, and Oracle Applications—are certified with Oracle VM. (For more on Oracle VM, see "License to Operate" on page 32.)

"Much of what we've accomplished we attribute specifically to Oracle RAC. Instead of scaling up a massive mainframe, we've distributed across smaller, more energy-efficient systems," he says.

That approach makes sense to AMR Research's Montgomery. "If you're using processing time, you're using energy," he says. "Energy costs money, so if you can increase efficiencies and reduce processing time, the savings can be put to better use—focusing on other IT- or non-IT-related activities such as improving energy consumption in other parts of the business."

PG&E also offers a variety of programs that will reward corporate customers for adopting server virtualization/consolidation along with other improvements such as enhanced airflow control systems and more-efficient data storage.

STILL WATERS, DEEP ENERGY

Generating power from nuclear fusion could become one way to dramatically reduce the carbon footprint. "Thermonuclear fusion is the gold standard of clean-energy-related technologies," says Edward Moses, principal associate director, National Ignition Facility & Photon Science (NIF) at the Lawrence Livermore National Laboratory. "People might not be completely knowledgeable about how fusion works at this time, but it may be the solution to the growing clean-energy production challenges that we are all deeply concerned about," he says.

Scientists and engineers at NIF are using extremely powerful lasers to produce controlled thermonuclear

fusion. By squeezing isotopes of hydrogen atoms to intensely high pressures and temperatures similar to those that exist at the center of the sun, they hope to create more energy than what was put into the system. The laser system—which at full capacity will fire 192 beams—uses up to 60 instruments such as cameras and oscilloscopes to measure the results of running an experiment. (This work was performed under the auspices of the Lawrence Livermore National Security, LLC [LLNS], under Contract No. DE-AC52-07NA27344.)

"Even with all of this interplay of instrumentation, an experiment is over in less than a millionth of a second; in fact, most of the data is taken in a few billionths of a second. What we're left with are almost unimaginable amounts of data that have to land in our Oracle Database and be analyzed within 30 minutes," says Tim Frazier, NIF applications director, who is responsible for managing scientific data.

To manage its business as well as its science, NIF runs Oracle Database 11g with Oracle RAC, Oracle Application Server, and the Oracle content management framework. "We use Oracle in all areas of the business, from construction planning and budgeting down to the database-driven laser control system," says Frazier.

With just a 30-minute window of time in which to capture and store massive amounts of image-based data, the performance of Oracle Database 11g—and its Oracle SecureFiles feature—is critical. "If we don't have a high-performance method for saving images into the database, the instruments may time out, and we'll lose data," Frazier explains. "When we're in full operation, we'll generate hundreds of terabytes each year, which means that the compression feature of [Oracle] SecureFiles

SNAPSHOTS

Pacific Gas and Electric

www.pge.com

Location: San Francisco, California

Industry: Utility

Employees: 20,000

Oracle products: Oracle Utilities Customer Care and Billing, Oracle Database 11g, Oracle Real Application Clusters, Oracle Automatic Storage Management, Oracle Grid Control, Oracle RMAN, Oracle Data Guard

National Ignition Facility & Photon Science

lasers.llnl.gov

Location: Livermore, California

Industry: Research and development

Employees: 800

Oracle products: Oracle Database 11g (with Oracle SecureFiles), Oracle Real Application Clusters, Oracle Advanced Compression, Oracle Automatic Storage Management, Oracle Grid Control, Oracle RMAN, Oracle Data Guard, Oracle Management Pack for Identity Management



"Companies like Oracle are key to succeeding in what many consider humankind's grand challenge mission of clean and plentiful energy," says Edward Moses (right), principal associate director, National Ignition Facility & Photon Science (NIF) at the Lawrence Livermore National Laboratory. Tim Frazier (left), applications director, adds, "We use Oracle in all areas of the business, from construction planning and budgeting down to the database-driven laser control system."

will also play a critical role in helping us economically manage all of the associated storage."

As for year-over-year data growth, according to Frazier, the intention is to keep all experimental data and the results of analysis available for instant retrieval throughout the lifetime of the facility, which is approximately 30 years. "Add to that all of the metadata that accompanies our experimental data, and in just a three- or four-year time frame, we could easily reach the multipetabyte level," he says.

The analytic phase of fusion experiments is driven by a series of Oracle BPEL workflows that perform tasks such as shot scheduling, supervising and coordinating the schedule and flow of shot data analysis, maintaining the requisite models for analytical functions, and providing data services for the modules. Oracle BPEL Process Analytics provides a user interface that allows scientists and engineers monitor the analysis process and address anomalies if and when they arise.

"Through the miracle of Einstein's $E = mc^2$, the excess energy produced, which has no carbon waste byproducts associated with it, can be used to generate consumable power," says NIF's Moses. NIF will be the first facility in the world that will have the laser capacity necessary to do this work, although the overall objective of NIF, as a research facility, isn't to generate power. "We want to help engineers and scientists

understand how to generate power with fusion energy," Moses says.

The potential benefits are limitless. "Through NIF we can potentially bring about a supply of clean energy that, if tapped, could be used for humanity's benefit far into the future. That's a very exciting possibility," says Moses. "Companies like Oracle are key to succeeding in what many consider humankind's grand challenge mission of clean and plentiful energy." ■

Marta Bright is a senior editor with Oracle Publishing.

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oracle.com/database/advanced-compression.html

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Oracle Real Application Clusters

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More Support for the Kernel

Oracle developers continue their contributions to the Linux kernel.

The kernel is an integral part of Linux that manages system resources and provides services and APIs on top of hardware for all tools and applications to use. Building on a decade-long commitment to Linux, an experienced engineering team at Oracle continues to develop key Linux kernel technology for the open source community.

"Mainline kernel features adhere to a design and implementation process in which code is reviewed and improved by a significant community of engineers before going to [kernel maintainers] Andrew Morton or Linus Torvalds," says Chris Mason, software development director at Oracle, who leads a team of Linux kernel developers. "Major features commonly take months or years for acceptance, depending on the technology and how significant a change they represent."

Mason's team is working on a variety of important new kernel development projects, including Btrfs, T10 Data Integrity Field (DIF), and Internet Protocol version 6 (IPv6) support for Linux NFS.

BUILDING A BTRFS

Linux is hindered by file systems that haven't kept pace with modern, higher-capacity storage in terms of scalability and efficiency, lacking not just the capability to address higher-capacity storage but also the ability to manage the storage, keep track of it all, and gain the best-possible performance from it. And most importantly, says Mason, Linux needs a file system that can deal with inevitable faults and errors.

"It's fairly easy to create a 16- or 32-terabyte file system, but when there are errors in the underlying storage, you have to do a very long-running

and expensive file system check, resulting in quite a bit of downtime, all of which becomes dramatically worse, the larger the storage," says Mason. "And as storage capacity continues to grow exponentially, it's clear that Linux needs a file system built with the future in mind." This is where Btrfs (pronounced *butter-FS*) comes in.

"One of the key features in Btrfs is the ability to detect any errors in the file system before it uses the data; if the disk returns a bad block or incorrect data, the file system should be able to detect that and do something about it preemptively," says Mason. "Btrfs accomplishes this by adding check-summing to all of the data and metadata in the file system and maintains multiple copies of crucial file system structures."

Other features of Btrfs include efficient writable snapshots, an online file system check that detects and deals with errors online, and storage management capable of controlling numerous disks in the system with intelligent mirroring and striping.

FIELDING DATA INTEGRITY

Oracle is also contributing to the Linux platform in the area of enterprise-class data integrity. It is working on an interface to expose the T10 DIF standard to the Linux kernel and end-user applications. DIF technology in the Linux kernel will enable applications and kernel subsystems to take advantage of crucial data integrity features such as standardized protection metadata, for reduced system downtime and cost savings for end users.

"Data corruption is commonly due not only to bit rot on physical disks but also to transmission errors or bugs in the I/O path between the application and the drive. The DIF project aims

to prevent corrupted data buffers from being written to disk in the first place," says Mason.

Two common corruption scenarios are bad buffer writes, where the write ends up in the right place on the disk but the data written is not what the application sent, and misdirected writes, where the write buffer contains good data but that data ends up being written to the wrong location on disk.

"The DIF is an addition to the SCSI specification that standardizes the contents of the protection metadata and enables extra information to be sent and received from the host controller as well as verified along the chain of devices," says Mason.

In cooperation with Emulex and other key storage industry partners, Oracle has developed an infrastructure that takes the DIF specification a step further, enabling the protection metadata to be exposed to the operating system as well as the application. The Linux DIF project enables applications or kernel subsystems to attach checksums to I/O operations, enabling devices that support DIF to verify the integrity before passing them further down the stack and physically committing them to disk.

STEPPING UP NFS TO IPV6

Oracle Linux kernel engineers are also focused on a third area: enabling the Linux Network File System (NFS) to run natively on IPv6 networks. IPv6 is a network layer for packet-switched networks including the internet; IPv6 compatibility is a key requirement for software purchased by the U.S. federal government after 2008.

Currently, 32-bit IPv4 addresses allow as many as 4 billion unique host addresses, which—despite network

address translation (NAT) routers—aren't enough to support the rapidly expanding population of networked computers. IPv6 provides 128-bit addresses, creating an astronomically sized address space, enabling every computer to have its own globally unique internet address and connect directly without NAT.

Under IPv4, routers have to read most or all of a header before making a routing decision, but with IPv6, headers have a new layout that makes packet routing much more efficient, resulting in better scalability for handling more traffic. Additional IPv6 features include support for mobility, such as automatic globally unique addresses for every device you own; IP security, a suite of protocols for securing IP via authentication and/or encryption; and integrated quality-of-service support that allows resource reservation control and prioritization for different applications, users, and data flows.

"NFS is a very large code base

encompassing several different subsystems in the Linux kernel, so IPv6 enabling all of those things is a fairly large project and it's very difficult to get all of those improvements in and maintain compliance with all the related standards," says Mason. "NFS is supported by many different operating systems and storage devices, making standards compliance and interoperability testing a crucial part of any improvements. We just have to go component by component through the stack, IPv6-enabling things as we go."

The NFS-for-IPv6 project is in the final stages, and NFS support for IPv6 is expected to be in the Linux 2.6.27 mainline kernel.

KERNEL RESULTS

What is the bottom line of Oracle's contributions to the Linux kernel? "Oracle's significant Linux kernel development work with file systems, data integrity, and other contributions will prove beneficial to all Linux users."

says Jim Zemlin, executive director, Linux Foundation. ■

Rich Schwerin (rich.schwerin@oracle.com) is the Linux, virtualization, and open source senior product marketing manager with Oracle technology marketing.

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Btrfs

oss.oracle.com/projects/btrfs/

T10 Data Integrity Field

oss.oracle.com/projects/data-integrity

IPv6 support for Linux NFS

oss.oracle.com/~cel/LSF-08-NFS-IPv6.pdf

linux-nfs.org

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A Home for Your Chrome

Easily enforce consistent look and feel with page templates.

When creating a professional-looking presentation, you define a consistent layout and style for all your slides by editing the “master slide.” You can concentrate on the content and easily change the look later. Using an analogous new feature in the upcoming Oracle JDeveloper/Oracle Application Development Framework (Oracle ADF) 11g release, you design a “master page” to enforce a consistent layout and style for all the pages in your Web application. In this column, we define a page template including common UI elements—or “chrome,” as Web designers call it—and then create a JavaServer Faces (JSF) page based on this template. After testing the template-based page, we’ll change the template and see it reflected in the page automatically.

To continue, download the starter workspace at otn.oracle.com/oramag/oracle/08-jul/o48frame.zip and ensure that you’re using the Oracle JDeveloper 11.1.1.0 Technology Preview 4 release, available as a free download on the Oracle Technology Network at otn.oracle.com/products/jdev/11. Start by extracting the contents of the o48frame.zip file and opening the FrameworksJulAug2008.jws workspace in Oracle JDeveloper. Note that the Model project in the workspace defines a Dept entity object, a DeptView view object, and an HRModule application module. Also, adjust the properties of the **scott** connection in the Application Resources zone of the Application Navigator until you can successfully test a connection to a SCOTT schema. If you need to create the tables, use the provided CreateDeptEmpTables.sql.

CREATING THE PAGE TEMPLATE

The page template will include UI components to achieve the base layout

and will include one or more pluggable content zones at appropriate places. These content zones are represented by JSF facets, which we’ll define here. When we create a page based on the template, we will use the visual editor to populate the appropriate template facets with page-specific content.

In the Application Navigator, right-click the **ViewController** project and choose **New**. When the New Gallery dialog box appears, select the **JSF** category under the **Web Tier** node in the tree at the left; then in the **Items** list at the right, select **JSF Page Template**, and click **OK**. When the Create JSF Page Template dialog box appears, change the default value of **Page Template Name** to **MainTemplate**. Note that the **File Name** field updates automatically to assign a corresponding name to the JSXP file that will represent the template. Also note the **Create Associated ADFm Page Definition** check box. When designing your own templates, you should check this box if you plan to include data-bound content, such as user profile information you have queried from a UserProfileInfo view object, in the page template. However, for our simple example, you can leave this unchecked.

Now let’s define two facets, one for the main content area of the page and another for a button bar of “actions.” First, we’ll simply define the facet names. (In the next step—when designing the layout of the page template—we’ll add placeholders that represent these facets in the precise location on the page where we want their content to appear.) To define a facet, click the **Facet Definitions** tab in the Create JSF Page Template dialog box and then click **Add** to create a new facet. An empty row appears in the table, with a default

facet name of **facet1**. Edit the name to be **MainContentArea**, and provide a description for the region, such as **The main area for content**. Click **Add** again to define a second facet, name it **ActionButtonBar**, and enter **Buttons to perform actions go here** as the description. Finally, click **OK** to define the new page template. After a moment, the **MainTemplate.jspx** page will open in the visual editor.

DESIGNING THE PAGE TEMPLATE

We’ll start by adding the standard layout elements that we want to appear on every page of our application. Before starting, ensure that the **Component Palette** and the **Property Inspector** are visible. If the contents of either or both are hidden, select the appropriate option(s) in the **View** menu to show them. Ensure also that the list at the top of the **Component Palette** displays the **ADF Faces** category of components. If the contents of the **Layout** section of the **Component Palette** are hidden, drag the section heading up to reveal the layout components.

From **Component Palette -> ADF Faces -> Layout**, drag a **Panel Stretch Layout** component and drop it into the middle of the empty page. In the **Property Inspector**, select the **Style** page, click the **Background** tab, and select **Aqua** from the **Color** list. Move your cursor over the different areas in the **Panel Stretch Layout** component labeled **start**, **end**, **top**, **bottom**, and **center**, and note how this component divides the space on the page into zones, known as facets. Next, from **Component Palette -> ADF Faces -> Layout**, drag a **Spacer** component and drop it into the **start** facet. Drag and drop another **Spacer** component into the **end** facet, and then drag and drop

one more **Spacer** component into the **bottom** facet. These will cause a border to appear around the left, right, and bottom edges of the page.

Next, from **Component Palette** -> **ADF Faces** -> **Layout**, drop a **Panel Group Layout** component into the **top** facet to contain a text component for the application name and the button bar and drop another **Panel Stretch Layout** component into the **center** facet to contain the main content area. In the **Common** page of the **Property Inspector**, set the **StartWidth**, **TopHeight**, **EndWidth**, and **BottomHeight** of this inner **Panel Stretch Layout** component to 0 (zero), and in the **Style** page, click the **Background** tab and select **White** from the **Color** list. From the **Common Components** section of the **Component Palette**, drag an **OutputText** component and drop it inside the **Panel Group Layout** component in the upper left corner of the **top** facet. (You can drop it either onto the visual editor or onto that component in the Structure Window.) On the **Common** page of the **Property Inspector**, enter **My Application** in the **Value** field, and on the **Style** page's **Text** tab, select **large** from the **Size** menu. Drag and drop another **Spacer** component (**Component Palette** -> **ADF Faces** -> **Layout**) after this **OutputText** component, and then drag and drop another **Panel Group Layout** component after that to contain the action buttons.

Finally, we'll add in the references to the two placeholder facets we defined when we created the template. In the **Common Components** section of the **Component Palette**, drag a **Facet Ref** component and drop it into the center of the page. When the Insert Facet Ref dialog box appears, choose the **MainContentArea** facet from the **Facet Name** list and click **OK**. Repeat the process to drag and drop a second **Facet Ref** component inside the **Panel Group Layout** component you dropped to the right of the **My Application OutputText** component. Note how the user-defined facets in the template appear as named boxes with a dotted line around them.

As we'll see shortly, when you build a page based on a template, these will be the only areas where custom content can be created. When the Insert Facet Ref dialog box appears, choose the **ActionButtonBar** facet from the **Facet Name** list and click **OK**. We're done with the page template, so save all your work.

USING THE PAGE TEMPLATE

Next, we'll create a JSF page that's based on our new page template. Right-click the **ViewController** project and choose **New**. Select the **JSF** category, the **JSF Page** item in that category, and then click **OK**. Enter **Departments.jspx** as the **JSF page File Name**, and from the **Use Page Template** list, choose **MainTemplate** to use the page template we created above. Then click **OK** to create the page.

In the visual editor, note that the layout inherited from the page template appears but looks disabled to remind you that it cannot be changed. In a page based on a template, you can add content only to the outlined facets, such as **MainContentArea** and **ActionButtonBar** in our example. Expand the **Data Controls** zone of the Application Navigator, and expand the **HRModuleDataControl** node. Drag the **Departments** data collection, and drop it into the **MainContentArea** facet. When the **Create** menu appears, select **Forms** -> **ADF Read-only Form**. When the **Edit Form Fields** dialog box appears, click **OK** to accept the defaults. Next, expand the **Departments** data collection in the **Data Controls** zone of the Application Navigator and expand the **Operations** folder it contains. Drag the **Next** operation, and drop it into the **ActionButtonBar** facet. When the **Create** menu appears, select **ADF Button**. Now drag the **Previous** operation (from **Data Controls** -> **Departments** -> **Operations**), and drop it as a second **ADF Button** to the left of the **Next** button you just created.

Test your creation by right-clicking the **Departments.jspx** page in the Application Navigator and choosing **Run**. When the page appears in your default browser, you'll see the inherited page template "chrome" and the page-specific

content merged together. Click the action buttons to verify that they work.

CHANGING THE TEMPLATE

Let's say your UI design staff comes back months after the application is already in production and demands that the standard template border be changed from aqua to lime to keep up with the times. With a page template in place, making such visual changes after the fact is easy. To see it in action, open **MainTemplate.jspx** in the visual editor, and in the Structure Window, select the topmost **panelStretchLayout** that is the first child element under the **pageTemplateDef** element. Select the **Style** page in the **Property Inspector**, select the **Background** tab, and select **Lime** from the **Color** list. Save the template, and then rerun the **Departments.jspx** page to see the effect of your change.

We've explored only a very simple example here, but hopefully you can appreciate how powerful this highly requested feature will be in your future Oracle ADF development efforts. ■

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On Exceptions and Rules

Best practices for where, when, and how to handle exceptions

I recently learned that if an exception is raised in the declaration section of my block, that block's exception section cannot handle the exception. That doesn't seem right. Why does PL/SQL work this way, and what does it mean for my coding practices?

If an exception is raised in the declaration section of your block, that exception will propagate out of the block *unhandled*.

PL/SQL behaves like this (or, to be more accurate, the Oracle PL/SQL development team decided to implement exception handling like this) because until local variables and constants are fully elaborated, you don't have a viable subprogram with which to work. Suppose the declaration-raised exception were handled inside that subprogram. To what could you refer inside the exception handler? You couldn't be sure that any of your local variables were initialized.

The key question is: How does this behavior affect the way we should write our code? Before answering this question, let's explore when we are likely to encounter this issue.

Exceptions in the declaration section occur when you try to initialize a variable declared in that section in a way that raises an exception. The most common exception raised surely must be ORA-06502 or VALUE_ERROR, which occurs (to name just two scenarios) when you try to assign a string value that is too large for the variable and when you try to assign a non-numeric value to a number. For example

```
DECLARE
  l_name VARCHAR2(5) := 'STEVEN';
  l_age NUMBER := '49 Years Old';
BEGIN
```

This same rule for exceptions applies to initializing variables declared in a package (outside of any subprogram).

codeLISTING 1: Package assigning a too-large value to a package-level string

```
PACKAGE valerr
IS
  FUNCTION little_name RETURN VARCHAR2;
END valerr;

PACKAGE BODY valerr
IS
  g_name  VARCHAR2 (1) := 'Liu';

  FUNCTION little_name RETURN VARCHAR2
  IS
    BEGIN
      RETURN g_name;
    END little_name;
  BEGIN
    DBMS_OUTPUT.put_line ('Before I show you the name... ');
  EXCEPTION
    WHEN OTHERS
    THEN
      DBMS_OUTPUT.put_line ( 'Trapped the error: ' || DBMS_UTILITY.format_error_stack ());
      RAISE;
  END valerr;
```

If an exception occurs when you try to initialize a package-level variable, that exception will propagate unhandled out of the package, even if the initialization section contains an exception section. In such a situation, the PL/SQL runtime engine still registers the package as initialized and allows you to continue to reference subprograms and variables in the package.

To understand this, consider this sequence of steps and PL/SQL statements:

1. I've compiled a package, valerr, that assigns a too-large value to a package-level string. The package body includes a WHEN OTHERS exception section (see Listing 1).
2. Now I try to run the valerr.little_name function; the exception goes unhandled:

```
SQL> BEGIN
  2   DBMS_OUTPUT.put_line
('Name: ' || valerr.little_name);
  3 END;
  4 /
```

```
BEGIN
*
ERROR at line 1:
ORA-06502: PL/SQL: numeric or value
error: character string buffer too small
ORA-06512: at "HR.VALERR", line 3
ORA-06512: at line 2
```

That's precisely what one would expect. 3. But now I try to call this function a second time—and no exception is raised:

```
SQL> BEGIN
  2   DBMS_OUTPUT.put_line
('Name: ' || Valerr.little_name);
  3 END;
  4 /
```

Name:
PL/SQL procedure successfully completed.

The package has been marked as initialized, and the PL/SQL runtime engine doesn't try to initialize it again, so any code in the package's initializa-

tion section never executes. Yet you can still run all the programs in the package, which can lead to a lot of confusion—and an impression that this error cannot be reproduced.

If you ever encounter this scenario, simply reconnect to your schema. You will then be able to reproduce the error, because Oracle Database will now need to attempt to initialize the package for the new session.

Note also that Oracle considers this behavior a bug (number 5658561). If you are concerned about this behavior and need Oracle to change it, I suggest that you log on to OracleMetaLink and add to this bug your own explanation of how the current behavior harms your applications.

Should this fact about exception handling change how you write your code? I think so. You might sometimes want an exception in the declaration section to propagate unhandled, although probably in most cases, you would rather trap the exception within that block and log the error information.

Doing this is simple: Just don't assign default values to variables in the declaration section. Instead, create a local initialization procedure and assign all default values in that procedure. Then call the initialization procedure in the first line in the executable section of the program, so any exception raised can be trapped in that program. For example, instead of writing a procedure like this:

```
PROCEDURE process_data
IS
  l_name  VARCHAR2 (10) := 'Steven Feuerstein';
BEGIN
  DBMS_OUTPUT.put_line (l_name);
EXCEPTION
  WHEN OTHERS
  THEN
    DBMS_OUTPUT.put_line
      ( 'Trapped the error: '
      || DBMS_UTILITY.format_
      error_stack ());
  RAISE;
END process_data;
```

Do this instead:

codeLISTING 2: Initialization section calling the initialize procedure

```
1 PACKAGE BODY valerr
2 IS
3   g_name VARCHAR2 (1);
4
5   FUNCTION little_name
6     RETURN VARCHAR2
7   IS
8   BEGIN
9     RETURN g_name;
10  END little_name;
11
12  PROCEDURE initialize
13  IS
14  BEGIN
15    g_name := 'Lu';
16  END initialize;
17 BEGIN
18  initialize;
19 EXCEPTION
20  WHEN OTHERS
21  THEN
22    DBMS_OUTPUT.put_line ( 'Trapped the error: ' || DBMS_UTILITY.format_error_stack ());
23  RAISE;
24 END valerr;
```

codeLISTING 3: Variables assigned literal values

```
PROCEDURE process_data
IS
  l_name      VARCHAR2 (100) := 'Steven Feuerstein';
  l_books_sold  PLS_INTEGER;

  PROCEDURE initialize
  IS
  BEGIN
    l_books_sold := book_counter.in_circulation ('Oracle PL/SQL Programming');
  END initialize;
BEGIN
  initialize;
  DBMS_OUTPUT.put_line (
    l_name
    ||
    ' sold '
    ||
    l_books_sold
    ||
    ' books:');
EXCEPTION
  WHEN OTHERS
  THEN
    q$error_manager.raise_unanticipated;
    RAISE;
END process_data;
```

```
PROCEDURE process_data
IS
  l_name  VARCHAR2 (10);
  PROCEDURE initialize
  IS
  BEGIN
    l_name := 'Steven Feuerstein';
  END initialize;
BEGIN
  initialize;
  DBMS_OUTPUT.put_line (l_name);
EXCEPTION
```

```
WHEN OTHERS
THEN
  DBMS_OUTPUT.put_line
    ( 'Trapped the error: '
    || DBMS_UTILITY.format_
    error_stack ())
  );
RAISE;
END process_data;
```

Now when I run the revised process_data procedure, the error is trapped and handled before it is reraised:

```

SQL> BEGIN
 2   process_data;
 3 END;
 4 /

```

Trapped the error: ORA-06502:
PL/SQL: numeric or value error:
character string buffer too small
BEGIN
*
ERROR at line 1:
ORA-06502: PL/SQL: numeric or value
error: character string buffer too small
ORA-06512: at "HR.PROCESS_DATA",
line 19
ORA-06512: at line 2

The same would be true for a package. In the revised valerr procedure in Listing 2, the initialization section simply calls the initialize procedure.

Now that I've given you my advice (move assignments of default values to a separate initialization subprogram), I must admit that I have two concerns about it. First, you can't follow this advice for constants. The default value must be assigned at the time of declaration. Second, in the revised valerr package (in Listing 2), my variable (`g_name`) is declared on line 3 but its value isn't assigned until line 15. In a more typical package, variables will still be declared in the very first lines of the package, but that initialization code will be hundreds, perhaps even thousands, of lines away. Personally, I don't like all that distance.

Assigning my default value on the same line as the declaration of the variable seems easier to understand. All my information is in one place. Do I have to sacrifice this readability for improved error handling? That's a reasonable trade-off, but a compromise could make the most sense here.

Here's what I suggest: If the default value for your variable or constant is a literal, assign the default on the same line with the declaration, but if the default value is the result of an expression, move its assignment down to the initialization procedure.

This approach will improve the readability of your code while minimizing the risk of an unhandled exception. The

codeLISTING 4: PROCESS_DATA revision with block statement

```

PROCEDURE process_data
IS
  l_name VARCHAR2 (100) := 'Steven Feuerstein';
BEGIN
/*
  Immediate use of l_name
*/
  IF l_name IS NOT NULL
  THEN
    ... lots more code here ...
  END IF;

/*
  Lots and lots of code ...
  Then I use a block statement to declare l_books_sold
  right in the area of the program in which it is needed.
*/
<<check_books_sold>>
DECLARE
  l_books_sold    PLS_INTEGER := book_counter.in_circulation ('Oracle PL/SQL Programming');

BEGIN
  IF l_books_sold > 1000
  THEN
    ... lots more code here ...
  END IF;
EXCEPTION
  WHEN VALUE_ERROR
  THEN
    q$error_manager.raise_unanticipated
      ('Problem initializing l_books_sold!');
    RAISE;
END check_books_sold;

... and more code here ...
END process_data;

```

codeLISTING 5: PROCESS_FILE procedure calls UTL_FILE.GET_LINE directly

```

1 PROCEDURE process_file (dir_in IN VARCHAR2, file_in IN VARCHAR2)
2 IS
3   TYPE line_t IS TABLE OF VARCHAR2 (32767)
4     INDEX BY PLS_INTEGER;
5
6   l_file      UTL_FILE.file_type;
7   l_lines     line_t;
8 BEGIN
9   l_file := 
10  UTL_FILE.fopen  (LOCATION          => dir_in
11                  , filename        => file_in
12                  , open_mode       => 'R'
13                  , max_linesize   => 32767
14                  );
15
16  LOOP
17    UTL_FILE.get_line (l_file, l_lines (l_lines.COUNT + 1));
18  END LOOP;
19 EXCEPTION
20  WHEN NO_DATA_FOUND
21  THEN
22    /* Process each line */
23    FOR indx IN 1 .. l_lines.COUNT
24    LOOP
25      do_stuff_with_line (l_lines (indx));
26    END LOOP;
27
28  UTL_FILEfclose (l_file);
29 END process_file;

```

risk should be minimal, because we should be paying enough attention to our code as we write it to recognize that we have just assigned a value that is of the wrong type or the wrong size. Of course, if all the variables are assigned literals, no initialization subprogram will be needed (see Listing 3).

And to trap declaration-based exceptions, you can use block statements. A block statement is a DECLARE-BEGIN-END section that you place inside your exception section. Because this statement can have its own exception section, you can immediately trap the exception and either fix the problem or log and reraise the error.

Block statements enable you to defer declaring variables until they are used in the program. “Just in time” declarations help you avoid a long, single declaration section at the top of large subprograms that contain declarations for each variable used in the subprogram.

Suppose, for example, that in the process_data procedure, I don’t work with the l_books_sold variable until line 245 of that procedure. Rather than declare that variable alongside l_name, which is used immediately in the procedure, I can wait until later in my program and use a block statement. Then I can trap the exception that might have been raised in the declaration section. Listing 4 contains a rewrite of process_data that illustrates the use of a block statement.

One final point: Beginning with Oracle Database 10g Release 1, the PL/SQL compiler can issue warnings about the quality of our code. For example, it will warn us that some of the lines of code in our subprogram will never be run or are “unreachable” (PLW-6002). It would be great if Oracle would add a warning for code like this:

```
DECLARE
  l_name VARCHAR2(5) := 'STEVEN';
  l_age NUMBER := '49 Years Old';
BEGIN
```

so that I don’t have to wait till I run my program to discover my problem. If you agree, I urge you to visit www.ILovePLSQLAnd.net and send a note to Bryn Llewellyn, Oracle’s PL/SQL product manager, expressing your interest in this enhancement.

codeLISTING 6: PROCESS_FILE procedure revision calls a local module

```
1 PROCEDURE process_file (dir_in IN VARCHAR2, file_in IN VARCHAR2)
2 IS
3   TYPE line_t IS TABLE OF VARCHAR2 (32767)
4   INDEX BY PLS_INTEGER;
5
6   l_file      UTL_FILE.file_type;
7   l_lines     line_t;
8   l_eof       BOOLEAN          := FALSE;
9
10  PROCEDURE get_next_line (line_out OUT VARCHAR2, eof_out OUT BOOLEAN)
11  IS
12  BEGIN
13    UTL_FILE.get_line (l_file, line_out);
14    eof_out := FALSE;
15  EXCEPTION
16    WHEN NO_DATA_FOUND
17    THEN
18      line_out := NULL;
19      eof_out := TRUE;
20  END get_next_line;
21 BEGIN
22   l_file := UTL_FILE.open (LOCATION      => dir_in,
23                           , filename      => file_in,
24                           , open_mode     => 'R',
25                           , max_linesize  => 32767
26                           );
27
28  WHILE (NOT l_eof)
29  LOOP
30    get_next_line (l_lines (l_lines.COUNT + 1), l_eof);
31    EXIT WHEN l_eof;
32  END LOOP;
33
34  /* Process each line */
35  FOR indx IN 1 .. l_lines.COUNT
36  LOOP
37    do_stuff_with_line (l_lines (indx));
38  END LOOP;
39
40  UTL_FILE.fclose (l_file);
41 END process_file;
```

.ILovePLSQLAnd.net and send a note to Bryn Llewellyn, Oracle’s PL/SQL product manager, expressing your interest in this enhancement.

APPLICATION SOURCE CODE INSIDE AN EXCEPTION HANDLER

I was taught that it is a bad practice to put application source code inside an exception handler. We should be able to remove all our exception sections, and—assuming no errors—our code should work the same. But I’ve run into lots of situations where I execute a SELECT INTO (an implicit one-row query), expecting it to return no rows (in other words, that’s the correct result). However, Oracle Database raises a NO_DATA_FOUND exception, and I then have to write application logic down in the exception section. Should I never use an implicit SELECT INTO statement in my code?

You are precisely right: it is considered a bad practice to place anything but exception management code in an exception handler. If you put application code inside a WHEN clause, other developers must know to look in this section for application logic. Because that is not the norm, this logic is often overlooked.

So let’s agree: place application code inside a WHEN clause only when it’s necessary to handle the error (usually, this involves logging and reraising the exception). As you so rightly point out, this raises a conundrum when you write a SELECT INTO statement in your executable section. Does that mean that you should never write SELECT INTOs in your programs? Let’s explore this issue.

The implicit SELECT INTO will raise NO_DATA_FOUND if no rows are

found and TOO_MANY_ROWS if more than one row is found. These two exceptions need different handling. Llewellyn suggests that we group all exceptions into three categories: *deliberate*, *unfortunate*, and *unexpected*.

In *deliberate* exceptions, the code deliberately raises an exception as part of its normal behavior. UTL_FILE.GET_LINE, which raises NO_DATA_FOUND when you read past the end of file, is a perfect example of a program that raises a deliberate exception.

Unfortunate exceptions are those where an exception has been raised that may not constitute an error in your application logic. It might, for example, simply be a different data condition. NO_DATA_FOUND, raised by a SELECT INTO, is an *unfortunate* exception.

A “hard error” that was raised, that you did not expect, and that may indicate a serious problem in your application is an *unexpected* error. TOO_MANY_ROWS is a classic unexpected error; it indicates that you have duplicate values for a primary key or unique index.

Before you start building your next application, decide on a strategy for handling exceptions of these three types. Then, when you run into a particular exception, figure out which category it falls into and take the appropriate action. Here are the guidelines I follow for these three exception types:

Deliberate. Redesign your program so that you can avoid placing application logic in the exception section. For example, in one way to apply this rule to UTL_FILE.GET_LINE, the process_file procedure in Listing 5 reads the contents of a file and then processes each line it read. Check out the loop in lines 16 through 18: it looks like an infinite loop (it contains no EXIT statement), but, in fact, it will stop when UTL_FILE raises NO_DATA_FOUND.

So my exception section traps that error and then processes each line. Unfortunately, that line processing code is in the exception section. What's a programmer to do?

Never call UTL_FILE.GET_LINE directly! Listing 6 shows a rewrite of this

codeLISTING 7: ID_FOR_NAME function revision

```

1  FUNCTION id_for_name (
2    department_name_in  IN  departments.department_name%TYPE
3 ,  propagate_if_ndf_in  IN  BOOLEAN := FALSE
4 ,  ndf_value_in       IN  departments.department_id%TYPE := NULL
5 )
6  RETURN departments.department_id%TYPE
7 IS
8   l_return departments.department_id%TYPE;
9 BEGIN
10  SELECT department_id
11    INTO l_return
12    FROM departments
13   WHERE department_name = department_name_in;
14
15  RETURN l_return;
16 EXCEPTION
17  WHEN NO_DATA_FOUND
18  THEN
19    IF propagate_if_ndf_in
20    THEN
21      RAISE;
22    ELSE
23      RETURN ndf_value_in;
24    END IF;
25  WHEN TOO_MANY_ROWS
26  THEN
27    q$error_manager.raise_unanticipated
28      (text_in      => 'Multiple rows found for department name'
29 ,  name1_in    => 'DEPARTMENT_NAME'
30 ,  value1_in   => department_name_in
31 );
32 END id_for_name;

```

codeLISTING 8: Calling revised ID_FOR_NAME function

```

PROCEDURE load_from_staging_table
IS
  c_no_such_dept CONSTANT PLS_INTEGER := -1;
  l_id departments.department_id%TYPE;
BEGIN
  FOR dept_rec IN (SELECT * FROM dept_staging_table)
  LOOP
    BEGIN
      l_id :=
        id_for_name (dept_rec.department_name
                    , raise_if_ndf_in => FALSE
                    , ndf_value_in  => c_no_such_dept
                    );
      IF l_id = c_no_such_dept
      THEN
        submit_update_request (dept_rec);
      ELSE
        submit_add_request (dept_rec);
      END IF;
    END;
  END LOOP;
END load_from_staging_table;

```

procedure that addresses the problem. I create a local module, get_next_line, that calls UTL_FILE.GET_LINE for me. It traps NO_DATA_FOUND and returns TRUE for the OUT Boolean argument to indicate end-of-file.

I then write a WHILE loop that shows under what circumstances the

loop will terminate. Immediately after the loop, I finish up with the rest of my application logic and close the file.

The code you'll need to write to work around a deliberate exception will, of course, vary for each exception (and the circumstances that raise it).

Unexpected. The guideline for handling

unexpected exceptions is straightforward. In general, you should log the error, along with any application-specific information that will help you understand what caused it. And then you should reraise the error to stop the outer block from continuing to execute.

Avoid hard-coding INSERT statements into your log table, and instead rely on a single, reusable, and generic error management package that will take care of all the administrative details for you.

Unfortunate. Now let's discuss what to do about unfortunate exceptions such as NO_DATA_FOUND. As with the deliberate exception, the general rule is to avoid having to put application logic into the exception section. The way to do that with an unfortunate exception is to make it possible for the programmer to choose whether an exception should be raised.

To demonstrate this approach with NO_DATA_FOUND, suppose that Sam has written a program that returns the ID for a department when provided the department name:

```
FUNCTION id_for_name (
    department_name_in IN departments
        .department_name%TYPE
)
    RETURN departments.department_
id%TYPE
IS
    l_return departments
        .department_id%TYPE;
BEGIN
    SELECT department_id
        INTO l_return
        FROM departments
        WHERE department_name =
            department_name_in;
    RETURN l_return;
END id_for_name;
```

Sandra needs to write a batch process that reads rows from a staging table containing department data. If that department already exists, she must submit a request through Oracle Advanced Queuing to update that department. If the department does not exist, she submits a request to add a new department. She writes her program, taking advantage of Sam's existing code, which

makes them both feel good:

```
PROCEDURE load_from_staging_table
IS
    l_id departments.department_id%TYPE;
BEGIN
    FOR dept_rec IN (SELECT *
        FROM dept_staging_table)
    LOOP
        BEGIN
            l_id := id_for_name
                (dept_rec.department_name);
            submit_update_request (dept_rec);
        EXCEPTION
            WHEN NO_DATA_FOUND
            THEN
                submit_add_request (dept_rec);
        END;
    END LOOP;
END load_from_staging_table;
```

If the department name is not found in the table, the id_for_name function raises NO_DATA_FOUND. So Sandra creates an anonymous block inside the loop, traps the exception, puts the "request to add a new department" logic (submit_add_request) in the exception section, and keeps on going.

However, this is precisely what we want to avoid: application logic in the exception section. Again, what's a programmer to do?

To address this drawback, rewrite the id_for_name function—and, by extension, all single-row queries and lookup functions (see Listing 7). This approach has several key features. First, a new parameter, propagate_if_ndf_in, specifies whether the NO_DATA_FOUND exception (when raised by the SELECT INTO) will be propagated out of the function.

Second, a new parameter, ndf_value_in, provides the value that will be used to indicate that no data was found, if the exception is not propagated. You might be tempted to simply pass back NULL to indicate "no data found," but that value (or, rather, lack of a value) may sometimes be a legitimate column value. So why hard-code it?

Third, if NO_DATA_FOUND is raised, then it is propagated out of the function with a reraise (RAISE; on line 21) only if the user has asked for that

behavior. Otherwise, the function returns the "no data found" indicator value.

Last, if TOO_MANY_ROWS is raised, the error manager utility logs the error, including the department ID that caused the trouble, and propagates the exception out unhandled.

With this new version of the id_for_name function, Sandra can now rewrite her load program (see Listing 8). She has decided to use -1 to indicate that the department was not found. She also "hid" the -1 value behind a constant, so that the code is self-explanatory. All the application logic is located in the executable section, and the code is much more straightforward and easy to understand and maintain.

Don't expect that you can remove all the exception sections in your PL/SQL code and that it will work fine when no exceptions are raised. The existence of deliberate and unfortunate exceptions makes this impractical.

You can, however, hide these types of exceptions from your high-level application code in two ways. You can encapsulate the program that deliberately raises an exception and transform that exception into a flag or another type of data, or you can give the developer the choice of propagating unfortunate exceptions or returning a value indicating that the exception was raised.

Whichever approach you take, the most important thing is to discuss and decide these issues before you start building your next application. ■

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Cache Payback

Put performance in your pocket with the client result cache.

Oracle Data Provider for .NET (ODP.NET) enables you to take advantage of features exposed by the underlying Oracle Call Interface. One such feature new in Oracle Database 11g Release 1 and Oracle Database 11g Release 1 Client is the client result cache.

The client result cache is a portion of memory that is automatically allocated (on the client) to cache query results. Caching query results on the client makes it possible to avoid round-trips to the server to execute, query, and fetch data. This, in turn, leads to better performance and decreased resource consumption on the network and the server.

Note that separate processes do not share a client result cache—there is one cache per client process. However, within a single client process, sessions with the same user settings can share the same client result cache.

This column shows you how to use the client result cache to increase returns on your query performance in ODP.NET 11g client applications.

A CONSISTENT PICTURE

The client result cache is automatically kept consistent with the database. When a change occurs in the database that affects or invalidates the results in the client result cache, the Oracle Call Interface client receives a notification of the change.

Entries in the cache are managed by a least recently used (LRU) algorithm, and they do not expire. This means that entries in the cache can be removed when space is needed to hold new entries, but in the absence of such space pressure, entries can remain in the cache for as long as the cache exists.

The characteristics and behavior of

the client result cache are controlled by three server-side parameters:

CLIENT_RESULT_CACHE_SIZE. Specifies (in bytes) the maximum size of the client result cache. The default value is 0 (zero), and the parameter must be set to a value greater than 32K to enable the client result cache.

CLIENT_RESULT_CACHE_LAG. Specifies (in milliseconds) the maximum amount of time the client result cache can lag behind potential server-side changes that would affect the result set. The default lag value is 3,000 milliseconds (3 seconds).

RESULT_CACHE_MODE. Specifies whether result set caching happens automatically or on demand. The default value of this parameter is MANUAL, indicating that caching occurs when requested by the client.

Note that each of these parameters is static, so after making changes to their values, you must restart the database instance. I recommend reviewing the *Oracle Call Interface Programmer's Guide, 11g Release 1 (11.1)* documentation for additional details on the above parameters, cache monitoring statistics, and supported query types.

CLIENT CONTRIBUTIONS

One of the big benefits of the client result cache is that it requires no changes to your .NET application code. To use the client result cache, however, you need to make sure that two conditions are satisfied on the client.

First, statement caching must be enabled in the client application. Fortunately, this is the default mode with ODP.NET 11g, so it is likely that you will not need to take any action to enable statement caching. If you have disabled statement caching, you can enable it either in the registry or

via the database connection string in your code. See the *Oracle Data Provider for .NET Developer's Guide* for further details on statement caching.

Next, if the RESULT_CACHE_MODE server parameter is set to its default value of MANUAL, you must add a hint to your SQL statement. A hint "directs" Oracle Database to perform an operation in a specific manner. The client result cache hint is named result_cache, and it would follow the SELECT keyword in a SQL statement:

```
select /*+ result_cache */ column1,
column2, ...
```

The online version of this column, at otn.oracle.com/oramag/oracle/08-jul/o48odpnet.html, describes how to set up and run this column's sample code, which repeatedly executes a simple SELECT statement with and without the client result cache and measures the statement execution times. ■

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Compress to Impress

Use Oracle Advanced Compression to conserve resources and improve performance.

John the DBA at Acme Bank is looking at charts and spreadsheets from the company's capacity planning group. Amid all the fancy-looking graphics and numbers, the message is clear—the bank's database size is going to grow incredibly in the near future. There are many reasons—the natural growth of the business, moving existing applications from desktop systems to the enterprise domain, the constant development of new applications, legal requirements to retain data longer, and so on. The data volume is going to grow exponentially, and the processing capacity (CPU, network, and I/O bandwidth) will also grow, but not at the same pace. This poses major challenges for database operations:

1. *Storage costs skyrocket.* To contain the costs, management has suggested using cheaper (and slower) disks, which will negatively affect performance.
2. More data also means *more backup space is required.* To contain these costs, one option is to reduce the number of backups to disk, which is not ideal, because it will increase the restore time.
3. More backed-up data means *the backup window will be much larger,* affecting—and likely conflicting with—other backups.
4. The increase in data volume also means *an increase in I/O* through components such as host bus adapter (HBA) cards and network-attached storage (NAS) heads, negatively affecting performance.
5. More data in the database means that a larger system global area (SGA) is needed, and *a larger SGA means more*

memory. If more memory is not available, a smaller proportion of the data will be cached, reducing performance.

To address these challenges, the

current data volume more efficiently on disk, all the other issues would disappear. The question is how to reduce the space consumption without deleting data.

Oracle Advanced Compression, a new option in Oracle Database 11g Enterprise Edition, is the answer to Acme's data growth problem.

Compression is not new in Oracle Database. Oracle8i Database introduced compression in indexes, by eliminating duplicates from index leaves. Oracle9i Database Release 2 added a new table compression feature that eliminated the storage of repeated values in tables. It supported bulk load operations, and it was very powerful in data warehouse environments. The Oracle Advanced Compression option in Oracle Database 11g Enterprise Edition has richer and far more-

powerful features, however, suitable even for transaction-intensive online transaction processing (OLTP) databases.

COMPRESSION STEPS AND DISK SPACE

The steps to enable compression are very simple. To demonstrate, John creates two tables for account holder information—one compressed (ACCOUNTS_COMP) and one “regular” (ACCOUNTS_REG). John creates the ACCOUNTS_COMP compressed table by using the script shown in Listing 1. Note the “compress for all operations” line in the listing, which creates the table as compressed for all data manipulation language (DML) operations—therefore enabling compression for OLTP tables. (The other compression option is “compress for direct_load operations,” which enables compression only for direct path loads,



DBAs at Acme have proposed the usual solutions: adding disk space, memory, network capacity, and I/O bandwidth. But, with the financial belt-tightening, these solutions are not going to get approved by management. Jill, the DBA manager, hopes John can find an alternative solution to sustain the current level of performance, if not improve it, while using the same amount of disk space, memory, and I/O—or even less.

SOLUTION: COMPRESSION

Even though the problems are many, the root cause can be summed up easily: exponential growth in data volumes. More data requires more disk space, which, in turn, means higher costs for database and backup storage and more I/O. If there were a way to store the

such as `INSERT /*+ APPEND */` or `SQL*Loader` with the direct path option.)

John creates the `ACCOUNTS_REG` table by using the script in Listing 1, except that he changes the table name to `ACCOUNTS_REG` and omits the “compress for all operations” clause. Then he uses the `ins_acc.sql` script, available with the online version of this article, at otn.oracle.com/oramag/oracle/08-jul/048advcomp.html, to simulate an ACME application and insert records into both tables. After the inserts, John checks the number of blocks on each table:

```
select segment_name, blocks
from user_segments
where segment_name like 'ACCOUNTS_%';
```

SEGMENT_NAME	BLOCKS
ACCOUNTS_COMP	4096
ACCOUNTS_REG	11264

The space savings in the `ACCOUNTS_COMP` table are clear. Both tables have the same number of identical records, but the `ACCOUNTS_COMP` compressed table has only 4,096 blocks, a space savings of about 64 percent compared to the 11,264 blocks in the `ACCOUNTS_REG` table. Of course, notes John, the space savings will vary, depending on the nature of the data.

John also tests whether the compression ratio is the same for later manipulations of the table. He runs the `ins_acc.sql` script once again on both the tables and rechecks the number of blocks:

```
select segment_name, blocks
from user_segments
where segment_name like 'ACCOUNTS_%';
```

SEGMENT_NAME	BLOCKS
ACCOUNTS_COMP	8192
ACCOUNTS_REG	22528

The compression ratio is still around 64 percent ($1 - (8192/22528)$).

I/O AND MEMORY

To demonstrate other savings from Oracle Advanced Compression, John

codeLISTING 1: Creating the ACCOUNTS table

```
create table accounts_comp (
    acc_no          number           not null,
    first_name      varchar2(30)     not null,
    last_name       varchar2(30)     not null,
    acc_type        varchar2(15),
    acc_open_dt     date,
    acc_mgr_id     number,
    city            varchar2(30),
    street_name     varchar2(30)
)
compress for all operations
/
```

codeLISTING 2: Test query

```
set serveroutput on size unlimited
alter system flush buffer_cache
/
col value noprint new_value start_cpu
select value
from v$sesstat s, v$statname n
where sid = (select sid from v$mystat where rownum < 2)
and s.statistic# = n.statistic#
and n.name in ('CPU used by this session')
/
col value noprint new_value start_reads
select value
from v$sesstat s, v$statname n
where sid = (select sid from v$mystat where rownum < 2)
and s.statistic# = n.statistic#
and n.name in ('session logical reads')
/
set autot on explain stat
set timing on
select acc_mgr_id, acc_type,
       avg((sysdate-acc_open_dt))
from accounts_reg
group by acc_mgr_id, acc_type
order by acc_mgr_id, acc_type
/
set autot off
select value - &start_cpu cpu_consumed
from v$sesstat s, v$statname n
where sid = (select sid from v$mystat where rownum < 2)
and s.statistic# = n.statistic#
and n.name in ('CPU used by this session')
/
select value - &start_reads logical_reads
from v$sesstat s, v$statname n
where sid = (select sid from v$mystat where rownum < 2)
and s.statistic# = n.statistic#
and n.name in ('session logical reads')
/
```

creates a test query against the example tables; he also collects the statistics and the optimizer plan, by issuing the `SET AUTOT` command, and notes the execution time. Before he runs each test query, he flushes the buffer pool so that the table will be read from the database rather than from the SGA.

First he issues the test query against the regular table, as shown in Listing 2; Listing 3 shows the output. Then he issues the test query in Listing 2 against

the compressed table, by replacing `ACCOUNT_REG` with `ACCOUNT_COMP` in the `FROM` clause; Listing 4 shows that output.

The execution time was 5.33 seconds for the regular table but 4.24 seconds for the compressed table—a 20 percent improvement in execution time. The number of logical reads done explains the improvement: 11,212 in the regular table, as opposed to 4,122 for the compressed table. This resulted in some

codeLISTING 3: Statistics for regular table

```
...
Elapsed: 00:00:05.33
...
| Id | Operation          | Name           | Rows  | Bytes | Cost (%CPU) | Time      |
| 0 | SELECT STATEMENT   |                | 15    | 285   | 3095 (3)   | 00:00:38 |
| 1 | SORT GROUP BY     |                | 15    | 285   | 3095 (3)   | 00:00:38 |
| 2 | TABLE ACCESS FULL | ACCOUNTS_REG | 1000K | 18M   | 3035 (1)   | 00:00:37 |

Statistics
...
11121 consistent gets
11118 physical reads
...
CPU_CONSUMED
354
LOGICAL_READS
11212
```

codeLISTING 4: Statistics for compressed table

```
...
Elapsed: 00:00:04.24
...
| Id | Operation          | Name           | Rows  | Bytes | Cost (%CPU) | Time      |
| 0 | SELECT STATEMENT   |                | 15    | 285   | 1170 (7)   | 00:00:15 |
| 1 | SORT GROUP BY     |                | 15    | 285   | 1170 (7)   | 00:00:15 |
| 2 | TABLE ACCESS FULL | ACCOUNTS_COMP | 1000K | 18M   | 1109 (2)   | 00:00:14 |

Statistics
...
4031 consistent gets
4025 physical reads
...
CPU_CONSUMED
304
LOGICAL_READS
4122
```

savings in CPU_CONSUMED (354 for the regular table, to 304 for the compressed table), and although this CPU savings is not substantial (in fact, the documentation states that in some cases, the CPU consumption might be higher), John observes that the savings in I/O are large enough to create a drop in the response time. This performance gain will be more pronounced in large, full-table

scans, typically found in Acme's reporting and batch-oriented applications.

Because each block in the compressed table now packs more rows, a smaller SGA can handle the same amount of data. Conversely, the existing memory will accommodate more blocks, reducing the probability that a trip to the disk will be necessary, which further improves I/O and subsequently

enables better response time.

John looks at his tests and concludes that space savings are not the only advantage of compression. It also improves memory and I/O efficiencies, resulting in better query performance in many cases. For table scans, there can also be some CPU savings from reduced I/O.

TYPES OF COMPRESSION

Oracle Advanced Compression offers more than one type of compression, which is important, because Acme needs to use compression for different types of data processing, data formats, and system usage. John looks at the different types of compression available and how they might address Acme's different needs.

OLTP table compression. With OLTP table compression, the compression occurs at the block level. Data is not compressed as it is inserted; rather, an internal algorithm is used to decide when a block has enough uncompressed data and is ready for compression. When a block is ready, the compression algorithm takes a value from a record and creates a reference to that value in a "symbol table" toward the header of the block. Then the algorithm tries to find an identical value in that block, and for each one it finds, it replaces that value with the symbol from the symbol table. This way the data inside the block is compressed anywhere it occurs—not just in specific columns or rows. Each block is independently compressed with its own symbol table, so the compression is usually faster than it is for non-Oracle algorithms, which normally use a global symbol table. This independent compression at the block level is adaptive to new or modified data—blocks can be compressed and recompressed to update the symbol tables as necessary. A global symbol table, however, is much more difficult to update without locking, meaning that those algorithms are not adaptive to changes in the data, which can reduce compression ratios over time.

Oracle Advanced Compression does not occur the moment data is inserted or changed. Rather, data comes in as is (uncompressed) and when a specific internally defined threshold is reached,

the compression algorithm kicks in for all data in the block, in batch mode. So all transactions on a block do not experience the CPU overhead of compression—only the transaction that triggers compression experiences a compression-related wait, which is minimal. This batch algorithm keeps the CPU overhead for DML operations very low, thereby making Oracle Advanced Compression suitable for OLTP systems.

Compression of unstructured data. Acme also stores a lot of nonstructured data, such as XML documents, signatures (as GIF files), and statements (as PDF documents). Due to several regulations governing the bank—Sarbanes-Oxley, the Gramm-Leach-Bliley Act, and so on, Acme must preserve this unstructured data in the database, which takes sizable chunks of storage.

Oracle Advanced Compression is not only for relational data. In Oracle Database 11g, other datatypes can also be compressed, sometimes with slight syntax variants. For instance, Oracle SecureFiles (the next-generation large objects [LOBs] introduced in Oracle Database 11g) has two ways to reduce storage: compression and deduplication. (For more information on Oracle SecureFiles compression, John bookmarks the “SecureFiles: The New LOBs” article on Oracle Technology Network [OTN]: otn.oracle.com/pub/articles/oracle-database-11g-top-features/11g-securefiles.html.) He creates an Oracle SecureFiles test example in which the CONTRACTS_SEC table is altered to include a compressed LOB column—ORIG_FILE:

```
alter table contracts_sec modify lob
(orig_file) (compress high)
```

And if Oracle SecureFiles data repeats in the ORIG_FILE column of the CONTRACTS_SEC table, deduplication will remove the duplicates and store only the pointers to them, eliminating duplicate storage. Thus, if four copies of the same document are stored in the ORIG_FILE column, the file will be stored only once after deduplication, providing a 75 percent reduction in space used.

John confirms the syntax to enable deduplication in the ORIG_FILE column:

```
alter table contracts_sec modify lob
(orig_file) (deduplicate)
```

Backup compression. An Oracle Database instance can be backed up in two ways: by using Oracle Data Pump—the logical backup—and Oracle Recovery Manager (Oracle RMAN)—the physical backup. Oracle Advanced Compression comes in handy in both cases. In Oracle RMAN, a new compression algorithm—ZLIB—compresses the data more efficiently (as shown in the “RMAN” article on OTN: otn.oracle.com/pub/articles/oracle-database-11g-top-features/11g-rman.html). In Oracle Data Pump, the dump file can be compressed.

John tests the syntax to create a compressed dump file from the ACCOUNTS_REG table, using the compression=all clause:

```
expdp <User>/<Pass> directory=<DirName>
tables=accounts_reg dumpfile=reg.dmp
compression=all
```

This creates a 41MB compressed dump file named reg.dmp. John runs the same expdp command without the compression clause, which produces a 90MB file. So, Oracle Advanced Compression compressed the dump file by more than 50 percent, quite a savings on any scale. When John imports the compressed dump file back into the table, the Oracle Data Pump import reads the compressed file and decompresses it inline, during the import.

The online version of this article includes additional content on how Oracle Advanced Compression works with Oracle Data Guard in Oracle Database 11g to compress the redo stream for gap resolution between primary and standby servers and achieve effective network compression.

SUMMING IT UP

A reduction in the space used in the database directly translates to reduced space requirements for backups, so Acme does not need to buy additional

backup disks. Because fewer blocks are being backed up, the backup finishes faster and the backup window allocated now will also be sufficient for the future.

Acme also has a staging database as a copy of the production database. The storage requirements for the staging database as well as other database copies such as QA and development drop too. In short, with Oracle Advanced Compression, there is no need for any additional hardware—disks, I/O capacity, memory, tape, or network bandwidth—when Acme’s database grows. John gathers the metrics collected and heads for Jill’s office to give her the good news.

CONCLUSION

The last few years have seen enhancements that were mere imaginings earlier, such as 16-core CPUs and 720GB hard drives. The trend is clearly “up”; we will see more processing power and higher disk capacity in the future, but one thing that hasn’t changed much—and isn’t likely to change—is disk throughput.

This article showed how a forward-thinking John started looking at how to address exponential data growth and ended up addressing both that growth and the limitations of disk throughput by using Oracle Advanced Compression. He has effectively stored more data in less space, accomplishing more data transfer with the same throughput. Not only does it save Acme storage space, but it increases performance as well. ■

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Managing History

Oracle Total Recall enables users to find, track, and use past and present information.

What did you know, and when? U.S. government regulations such as the Sarbanes-Oxley Act and the Health Insurance Portability and Accountability Act (HIPAA) or international agreements such as Basel II increasingly drive the need to track changes to data over long periods of time. All business and service organizations are increasingly held accountable for maintaining a secure history of data on which key decisions—sometimes life-or-death decisions—are based. Oracle Total Recall, an option to Oracle Database 11g Enterprise Edition, makes creating and maintaining a historical record of change over time as simple as flipping on the light switch when you enter a room.

THE NEED FOR RELIABLE DATA

Imagine for a moment that you're the medical director for an ambulance service. Part of your job is to review and sign off on drug test results for new hires. The drug test results for a new paramedic come back, and everything looks good. You clear him to work.

On his first day on the job, he runs the ambulance through a red light at 90 miles per hour and collides with two other vehicles. The heart attack patient in the ambulance now has several broken bones as a consequence. The other two drivers are hurt. The new paramedic is tested at the hospital for drugs, and the results are positive.

A variety of legal action—including lawsuits—is coming.

You check the initial drug test results of your new hire again. This time they are positive for several common street drugs. You know that the results for these tests were negative when you cleared the paramedic, but the current results

investigation shows that the drug lab had reported incorrect results and later corrected those results in one of its regular electronic feeds rather than notifying you by phone and registered letter, as your service contract with the lab requires.



don't—and can't—show what you saw when you cleared the paramedic to work.

You review your malpractice coverage and start updating your résumé.

THE NEED FOR HISTORY

Let's rewrite the information technology ending of this story: After the accident, you check the initial drug test results of your new hire. They are positive for several common street drugs. You appear to have cleared a drug user to drive the ambulance, but you remember that all of the tests were negative when you cleared this paramedic to work. What went wrong?

You click the **Audit Changes** button on the bottom of your screen. You see a history indicating that the drug test results were changed after you made your report on the new hire. Further

ORACLE TOTAL RECALL: TOTALLY EASY

These fictional events are dramatic, but they illustrate the importance of having a reliable history of change to critical data. Of course, you could develop and implement a homegrown solution for maintaining historical records, but you could instead use Oracle Total Recall and focus on the business problem, not the technical implementation.

Using Oracle Total Recall, you can create a reliable history of change in a

few easy steps:

1. Identify related tables to track.
2. Identify and size tablespaces to hold historical data.
3. Create an archive with a defined retention policy.
4. Enable change history tracking for the tables.

Listing 1 shows the beginning of the code that will create and populate a historical record for a simplified medical test schema. To create and populate this schema, run the `med_test_schema.sql` script from the sample code for this article at otn.oracle.com/oramag/oracle/08/jul/o48totalrecall.zip.

Your next step in implementing Oracle Total Recall is to create a *flashback data archive*—a logical storage container for historical data that you can spread over one or more tablespaces.

Connect to your instance as a user holding the FLASHBACK ARCHIVE ADMINISTER privilege (the SYSTEM user holds that privilege by default). Next, issue the following command:

```
CREATE FLASHBACK ARCHIVE medical_tests
TABLESPACE med_archive_1 QUOTA 3M
RETENTION 11 MONTH;
```

When you first create a flashback data archive, specify a retention time. You can specify only one tablespace in the CREATE command, but you can issue subsequent ALTER commands to spread an archive across as many tablespaces as you need. (Use only tablespaces configured for automatic segment-space management). The same retention time applies across all tablespaces in an archive. For example, to spread your archive over a second tablespace, issue the following ALTER command:

```
ALTER FLASHBACK ARCHIVE medical_tests
ADD TABLESPACE med_archive_2
QUOTA 3M;
```

You now have a flashback data archive named MEDICAL_TESTS. The archive will use up to 3MB from each of the two designated tablespaces (MED_ARCHIVE_1 and MED_ARCHIVE_2). Based on the value you provided for the RETENTION parameter, the archive will automatically purge historical data as it ages beyond 11 months.

Best practice is to create a separate flashback data archive for each application module you archive. Don't combine unrelated tables from, say, Payroll and Accounts Payable into one archive, just because their retention times happen to be the same today. Requirements might diverge in the future.

A last bit of housekeeping: grant your schema owner (MED_TEST) access to the archive:

```
GRANT FLASHBACK ARCHIVE
ON medical_tests
TO MED_TEST;
```

User MED_TEST now has permission to write historical data into the

codeLISTING 1: Creating a simplified test result schema

```
CONNECT / AS SYSDBA

CREATE TABLESPACE med_archive_1
DATAFILE '/u01/app/oracle/oradata/orcl/med_archive_1_1.dbf'
SIZE 4M SEGMENT SPACE MANAGEMENT AUTO;

CREATE TABLESPACE med_archive_2
DATAFILE '/u01/app/oracle/oradata/orcl/med_archive_2_1.dbf'
SIZE 4M SEGMENT SPACE MANAGEMENT AUTO;

CREATE USER med_test IDENTIFIED BY secret
DEFAULT TABLESPACE users
QUOTA UNLIMITED ON users
QUOTA UNLIMITED ON med_archive_1
QUOTA UNLIMITED ON med_archive_2;

GRANT CONNECT, RESOURCE TO med_test;

CONNECT med_test/secret

CREATE TABLE test_name (
test_code VARCHAR2(4),
test_name VARCHAR2(30),
CONSTRAINT test_name_pk
PRIMARY KEY (test_code)
);

CREATE TABLE test_result (
patient_id NUMBER,
test_time TIMESTAMP,
test_code VARCHAR2(4),
test_result VARCHAR2(10),
CONSTRAINT test_result_pk
PRIMARY KEY (patient_id, test_time, test_code),
CONSTRAINT test_code_fk
FOREIGN KEY (test_code)
REFERENCES test_name
);
```

MEDICAL_TESTS flashback data archive.

TRACKING CHANGES

Now that you have a container to hold the historical information, your next step is to begin recording changes to the data in the tables of interest. You can archive changes to one table or to a related group of tables—one simple command per table is all you need. For example, connect as the schema owner and issue these commands to begin tracking changes to data in the TEST_NAME and TEST_RESULT tables:

```
ALTER TABLE test_name
FLASHBACK ARCHIVE medical_tests;

ALTER TABLE test_result
FLASHBACK ARCHIVE medical_tests;
```

From this point forward, all changes

to rows in the two tables in the MED_TEST schema are tracked. That historical record of change over time is maintained in the MEDICAL_TESTS flashback data archive, which is spread across the MED_ARCHIVE_1 and MED_ARCHIVE_2 tablespaces.

If you're following along with this article's example, you can make the same changes that I make by executing the SQL statements in Listing 2. Note, however, that the specific dates and times in the record of changes you see in this article won't match what you create and see on your own system. Additionally, because the queries I execute in subsequent listings are date- and time-specific, they will not work as written on your system.

Oracle Database maintains the history in a constant, read-only state. Users, including the schema owner and the

codeLISTING 2: Changing the test results after the fact

```
UPDATE test_result
  SET test_result = 'Positive'
 WHERE patient_id = 101 AND test_code = 'coca'
   AND test_time = TIMESTAMP '2008-02-01 13:17:00';

UPDATE test_result
  SET test_result = 'Positive'
 WHERE patient_id = 101 AND test_code = 'ampa'
   AND test_time = TIMESTAMP '2008-02-01 13:17:00';

UPDATE test_result
  SET test_result = 'Positive'
 WHERE patient_id = 101 AND test_code = 'phen'
   AND test_time = TIMESTAMP '2008-02-01 13:17:00';
```

codeLISTING 3: Querying for the results for a given time

```
SELECT patient_id, test_time, test_name, test_result
  FROM (
    SELECT patient_id, test_time, test_name, test_result,
           MAX(test_time) OVER
             (PARTITION BY patient_id) test_max_time
      FROM test_result tr INNER JOIN test_name tn
        ON tr.test_code = tn.test_code
     WHERE test_time <= TIMESTAMP '2008-02-03 08:00:00'
  )
 WHERE patient_id = 101
   AND test_time = test_max_time;
```

PATIENT_ID	TEST_TIME	TEST_NAME	TEST_RESULT
101	01-FEB-08 01.17.00.000000 PM	Cocaine	Positive
101	01-FEB-08 01.17.00.000000 PM	Marijuana	Negative
101	01-FEB-08 01.17.00.000000 PM	Ampphetamines	Positive
101	01-FEB-08 01.17.00.000000 PM	Phencyclidine	Positive

database administrator, can query the history but cannot alter it. In addition, Oracle Database prevents any modifications to the tables that would invalidate the history. For example, you cannot drop a column. However, you can add columns as needed.

POINT-IN-TIME QUERIES

The schema in Listing 1 highlights an interesting issue with time-based data. A physician might ask, *What are the patient's test results on or before February 3, 2008?*

A similar, but not identical, question is *What are the patient's test results that I could have seen as of February 3, 2008?*

The difference between the two questions is subtle but critical. Question 1 requests an answer about past information, based on the best information *currently available*. Question 2 requests an answer based on information that was available *at some point in the past*. The

difference between questions 1 and 2 is the difference between "what was" and "what was known" as of a given date.

Listing 3 shows one solution to the first question. The WHERE clause within the subquery ensures that only results from before the beginning of the February 3 workday are considered. The WHERE clause in the outer query ensures that only the most recent of those results is reported. Several of the reported results are positive.

Listing 4 adds AS OF clauses to the query from Listing 3 to answer the second question. Those clauses direct the query to reach into the flashback data archive and give the result that the physician would have received at 8:00 a.m. on the day in question (February 3), when all results are negative. Question 2 is exactly the sort of question Oracle Total Recall was designed to answer. Oracle Total Recall is all about being able to prove what data you had

and when you had it.

When you go back in time with a flashback query, be certain that the time stamp or system change number (SCN) you specify is valid for the table and the archive in question. You'll receive an error message if you attempt to reach farther back into the past than can be resolved by either the archive or the current undo tablespace. You cannot query AS OF about a point in time before archiving was enabled on the table you are querying.

UNDER THE HOOD

Oracle Total Recall implements data collection and storage efficiently. A new flashback data archiver process mines undo data that the instance is already generating. There's no extra overhead affecting transactions against tables being archived. If you have the CPU capacity to run the archiver process and the input/output capacity to write the archival data to disk, your transaction throughput should be unaffected by flashback data archiving.

The archiver process collects the data, compresses it, deduplicates it, writes it into the flashback data archives, and exposes it in a standard SQL table. That table is protected from tampering—only the archiver process can write to it.

Query the USER_FLASHBACK_ARCHIVE_TABLES view to find the underlying tables used to store archival data. For example, here's how to find the archive table in which TEST_RESULT archive data is stored:

```
SELECT archive_table_name
  FROM user_flashback_archive_tables
 WHERE table_name = 'TEST_RESULT';
```

ARCHIVE_TABLE_NAME

SYS_FBA_HIST_71101

You can create indexes on the table to improve the performance of frequently executed queries against archival data. For example, if you frequently query the historical record by patient and test time, you can create an index on the archive table such as this:

codeLISTING 4: Querying for the results *as of* a given time

```

SELECT patient_id, test_time, test_name, test_result
FROM (
  SELECT patient_id, test_time, test_name, test_result,
         MAX(test_time) OVER
          (PARTITION BY patient_id) test_max_time
    FROM
      test_result AS OF TIMESTAMP (TIMESTAMP '2008-02-03 08:00:00') tr
     INNER JOIN
      test_name AS OF TIMESTAMP (TIMESTAMP '2008-02-03 08:00:00') tn
        ON tr.test_code = tn.test_code
   WHERE test_time <= TIMESTAMP '2008-02-03 08:00:00'
)
 WHERE patient_id = 101
   AND test_time = test_max_time;

```

PATIENT_ID	TEST_TIME	TEST_NAME	TEST_RESULT
101	01-FEB-08 01.17.00.000000 PM	Cocaine	Negative
101	01-FEB-08 01.17.00.000000 PM	Amphetamines	Negative
101	01-FEB-08 01.17.00.000000 PM	Phencyclidine	Negative
101	01-FEB-08 01.17.00.000000 PM	Marijuana	Negative

codeLISTING 5: Querying the underlying archive table

```

SELECT test_code, test_result, operation,
       SCN_TO_TIMESTAMP(endscn) end_timestamp
  FROM SYS_FBA_HIST_71101
 WHERE patient_id = 101
   AND test_time = TIMESTAMP '2008-02-01 13:17:00';

```

TEST_CODE	TEST_RESULT	OPERATION	END_TIMESTAMP
coca	Negative		05-FEB-08 01.55.32.000000000 AM
ampa	Negative		05-FEB-08 01.55.32.000000000 AM
phen	Negative		05-FEB-08 01.55.32.000000000 AM

```

CREATE INDEX patient_and_time
ON med_test.sys_fba_hist_71101
(patient_id, test_time);

```

You can also query the underlying archive table directly. Listing 5 queries the archive table associated with the TEST_RESULT table. The archive table records SCNs, not time stamps, so the query in Listing 5 puts the SCN_TO_TIMESTAMP function to good use by converting ENDSCN to an ending time stamp. The results show that three records for the specified PATIENT_ID and TEST_TIME showed negative results through 1:55:32 a.m. on February 5. Someone then changed those three records, causing their original values to be written into the archive. (The operation values are all null, because the original records were already present when the flashback data archive was created). Comparing the

three archived records with their current counterparts in the TEST_RESULT table enables you to see what changes were made that morning.

A cautionary note: As a best practice, you're generally better off issuing flashback version queries rather than querying archive tables directly. However, those tables are there, and they are accessible, should you need them.

ADVANTAGES OF ORACLE TOTAL RECALL

Oracle Total Recall yields many benefits over traditional application- and trigger-based archival methods. First, archival data is tamper-proof. No database users, not even privileged users, can change the historical record. This level of security is increasingly demanded by government regulation.

No programming effort is required. There are no archive tables to design, no

code to write, and no triggers to debug. The result has far less risk that anyone will inadvertently damage the archive.

Performance impact is minimal. There is no direct impact on transaction throughput, because the processes involved in archiving run asynchronously.

Oracle Total Recall is implemented natively in Oracle Database and is application-transparent. You can implement it underneath a running application without making changes to existing code.

Oracle Total Recall lends itself to many applications. It's worth considering anytime you need to access past data, either routinely or spontaneously. Oracle Total Recall can be used to collect historical data for routine data mining and business intelligence applications. It can be used as an extended form of Oracle Flashback for data entry error correction. Another creative use is as an archival solution in which older data is routinely deleted from operational tables, with that data still being accessible from a flashback data archive.

The bottom line: Oracle Total Recall provides a single, secure approach to creating a historical record of important business data that can be applied across many applications and toward many goals. It's history at the flip of a switch. ■

Jonathan Gennick (www.gennick.com) is an experienced Oracle professional and a member of the Oak Table Network. He wrote the best-selling SQL Pocket Guide and the Oracle SQL*Plus Pocket Reference, both from O'Reilly Media.

next STEPS

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otn.oracle.com/obe/11g/r1_db/security/flada.htm

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Managing File Versions

Edit files and use version control in Oracle SQL Developer 1.5.

Oracle SQL Developer 1.5 expands its file-based support by introducing tight integration with the CVS and Subversion version control systems. In addition to letting you browse and edit files in the file system, this Oracle SQL Developer release enables you to import files into your source control system, check them out, modify them, and commit the changed files back into the source control system.

This column does not provide details about setting up source control systems, nor does it cover concepts and operations of these systems; rather, it discusses the use of these systems within Oracle SQL Developer and focuses on using Subversion.

To follow this column's examples, you need Oracle SQL Developer 1.5 and access to the HR sample schema in an Oracle Database instance. Start Oracle SQL Developer 1.5, create a new connection to the HR schema, and name it **HR_ORCL**. (For detailed information on creating a connection, see "Creating a Database Connection" in "nextSTEPS" and "Making Database Connections" [otn.oracle.com/otnmag/oracle/08-may/o38sql.html], in the May/June 2008 issue of *Oracle Magazine*, which provides details on the different connection alternatives available in Oracle SQL Developer.)

BROWSING FILES

You interact with your file and source control systems through the new **File Navigator** in Oracle SQL Developer. This tab is available on startup; if it is not visible, select **View -> Files** from the main menu. Using the **File Navigator**, you can navigate to files and open them; files with the SQL extension open in the **SQL Worksheet**,

codeLISTING 1: Initial code for tuning.sql

```
select * from employees e, departments d, job_history j
where e.department_id = d.department_id and e.hire_date = j.start_date;
```

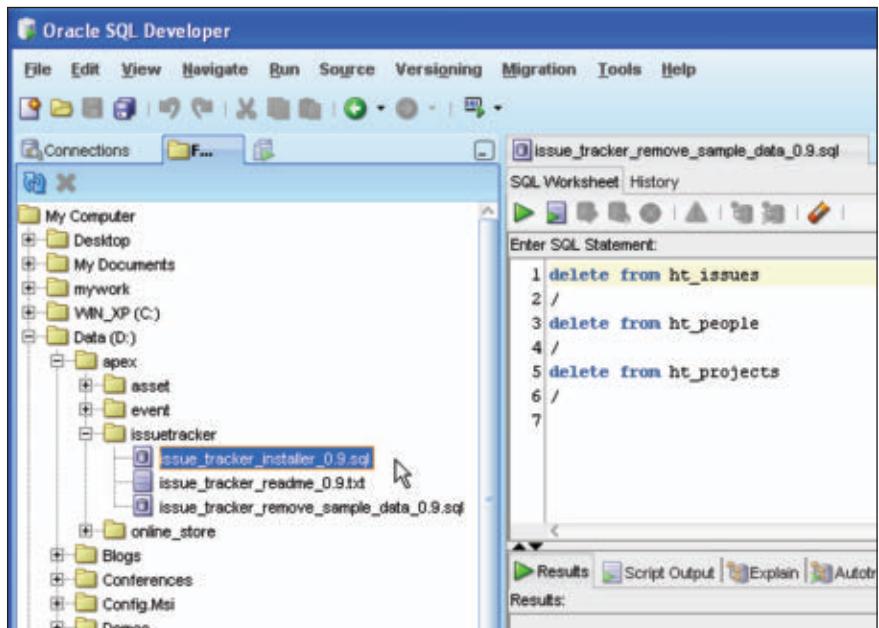


Figure 1: The File Navigator in Oracle SQL Developer

ready to be edited and run as shown in Figure 1.

You can run these SQL files by using F5 (Run Script) and F9 (Run Statement); the latter runs only the currently selected statement (not the full script). With each of these commands, you'll be prompted for the user connection.

If you associate the PKS, PKB, PLS, or PKH file extensions with Oracle SQL Developer, these files will open in an editor that provides compile and compile for debug operations. This means that you can edit and update these files as you would in the **SQL Worksheet** and when you click **Compile** (or **Compile for Debug**), these files compile against the selected schema in the database.

EDITING FILES IN ORACLE DEVELOPER

One advantage of editing files in Oracle SQL Developer is that you have ready access to database connections to verify and test your code. Another advantage is that you have specialized editing tools on hand to assist in the process.

Create a new file in Oracle SQL Developer:

1. Click the **File Navigator** tab. If it is not visible, select **View -> Files** from the main menu.
2. Right-click the **My Computer** folder, and select **New**.
3. In the New Gallery dialog box, select **Database Tier** and **SQL File** and then click **OK**.
4. Enter **tuning.sql** for **File Name**, click **Browse** to provide a suitable location for the file, and click **OK**. (For this

example, I use D:\version\files.) A new empty file is created, and it opens in the **SQL Worksheet**.

5. Enter the code in Listing 1 into the **SQL Worksheet**. When you enter the code, note that reserved words are displayed in bold and in a different color.

6. On the right-hand side of the **SQL Worksheet** is a **Snippets** tab. Move your cursor over the tab to reveal the full Snippets window.

7. With the Snippets window open, select **Optimizer Hints** from the list and drag **LEADING (table-name, ...)**—as shown in Figure 2—onto the **SQL Worksheet**, drop it just after **select**, and change the hint text to

```
/*+ LEADING(e j) */
```

Note that the tuning.sql text in the tab title is in italics, indicating that code has changed and has not yet been saved.

8. Click the **Save** icon. The tuning.sql text in the tab title changes to nonitalic (roman) text, and the file is saved.

In addition to editing individual files in Oracle SQL Developer, you can also use the new code templates feature to better manage frequently used code in multiple files.

To create a template,

1. Select **Tools -> Preferences**, and in the Preferences dialog box select **Database -> SQL Editor Code Templates**.

2. Click **Add Template**.

3. Enter **ord** for **ID**, enter **order by e.last_name** for **Template**, click **OK** to complete the code template, and close the Preferences dialog box.

This example is trivial, but it is designed to give you an idea of how you can add code templates of your own and use them. The best code templates to add are large chunks of frequently used code, such as user-defined exception handlers.

Return to your tuning.sql code in the **SQL Worksheet**, place the cursor just before the final semicolon, type **ord**, and then type the key combination **Ctrl-Shift-T** to replace the **ord** with the full piece of code.

Finally, format your code:

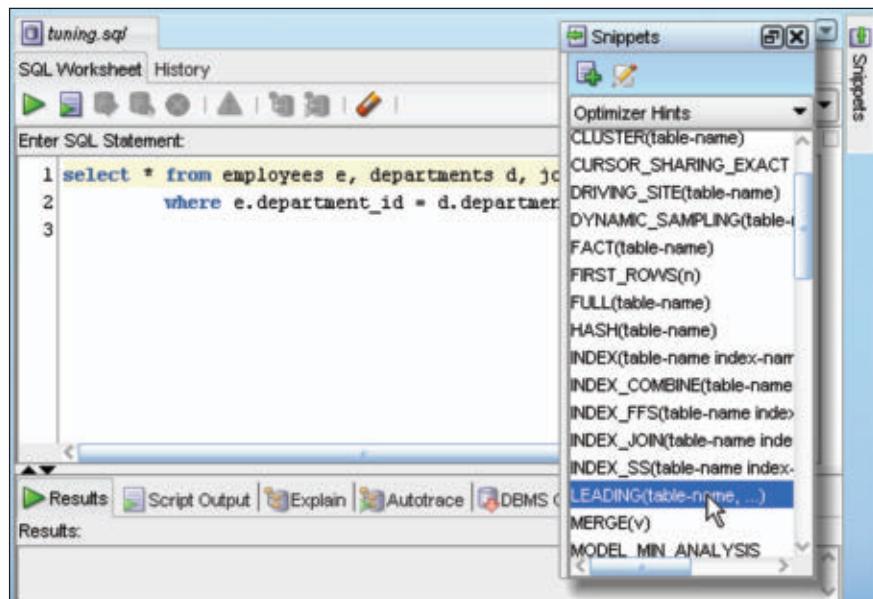


Figure 2: Inserting snippets

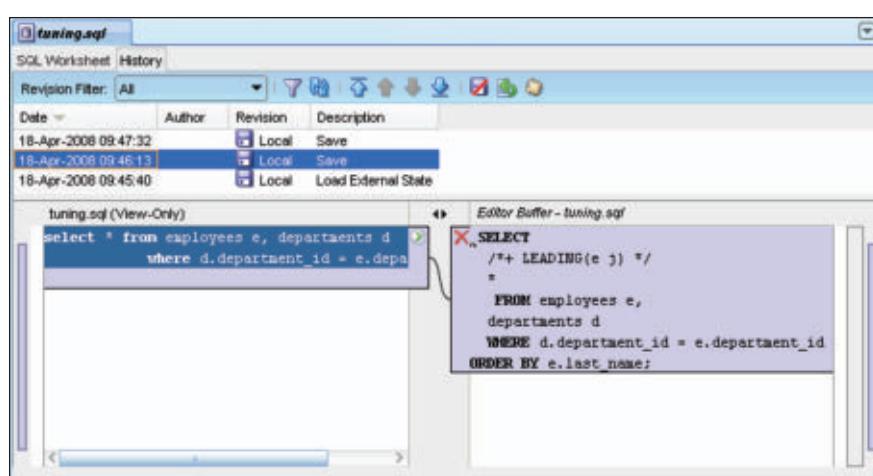


Figure 3: Reviewing the history of a file

1. Return to the Preferences dialog box (select **Tools -> Preferences**), and select **Database -> SQL Formatter**.
2. Expand the **SQL Formatter** node, and select **Line Breaks**.
3. Select **1** from the **Number of Commas per line** list, and check the **Before Comma** check box.
4. Select **Other** (under the **SQL Formatter** node), and select **Keywords Uppercase** from the **Case** list. Click **OK**.

5. Back in the **SQL Worksheet**, right-click the code and select **Format**.
6. Click the **Save** icon, and close the file (select **File -> Close** or click the X in the **tuning.sql** tab).

Click the **File Navigator** tab, and

select **View -> Refresh** (or click the **Refresh** button) to refresh the folders and files listed. Navigate to the folder where you saved the tuning.sql file, and open it. Note that there are two tabs for this file: **SQL Worksheet** and **History**. If you saved the file at various points during this exercise, you'll see the different iterations displayed in the **History** tab, as shown in Figure 3.

Now, associate the tuning.sql file with the HR schema. Click the **SQL Worksheet** tab, expand the list on the right-hand side of the **SQL Worksheet**, and select your HR_ORCL connection. After you select a connection, the **Commit**, **Rollback**, **Execute Explain Plan**, and **Autotrace** icons become

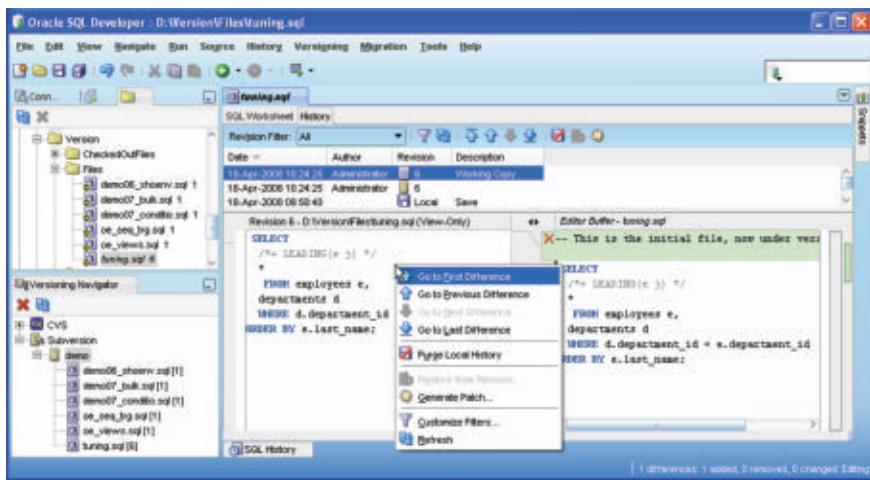


Figure 4: Versioned files in Subversion

available, and you can run the file against the HR schema.

SETTING UP FOR VERSION CONTROL

This section assumes that you have access to Subversion or have a Subversion repository. If you do not have a repository set up, begin by creating a new Subversion repository:

- From the main menu, select **Versioning -> Subversion -> Create Repository**.
- Enter a **Repository Path**, such as C:\Documents and Settings\<user>\demo, and a **Connection Name**, such as demo, and click **OK**.
- Whether you have just created a repository or are using your own, you need to create a connection to it. From the main menu, select **View -> Versioning Navigator**. If you have just created a repository, expand the **Subversion** node in the **Versioning Navigator** to reveal your connection. If not, right-click **Subversion** and select **New Repository Connection**.
- Populate the dialog box with your connection details using this repository example: for **Repository URL**, enter file:///c:/Documents and Settings/<user>/demo, and for **Connection Name**, enter demo. (In this example, there is no **User Name** or **Password**, but if you are using an external repository, you need to populate these fields too.)
- Click **Test Connection**, and when a successful connection result appears in

the **Status** box, click **OK**.

If you are connecting to an existing repository, expand the **Subversion** node and browse the objects in your repository. If you have just created your repository, populate it by importing files:

- In the **File Navigator**, navigate to a folder you want to bring under version control; for this example, select the D:\version\files folder.
- From the main menu, select **Versioning -> Subversion -> Import Files**.
- Using the wizard, select the **Repository Connection** you created. Click **Next** to navigate to the Source panel.
- Click **Browse** to navigate to D:\version\files. Click **Next** to go to the Filters panel, and click **Next** again to go to the Options panel.
- Ensure that **Perform Checkout** is selected. Click **Next**, review the summary, and click **Finish**.
- In the **Versioning Navigator**, select the **Demo** connection and click the **Refresh** icon.

You can now see the files in your Subversion repository. These are read-only files and display the current state of your files.

Click the **File Navigator** tab, click the **Refresh** button, and review the contents of the D:\version\files folder. These files are now marked as versioned, and the version number is displayed. You can open, edit, and save (commit to check in) these files. You

can select any versioned file and select **Versioning -> Subversion** to review the versioning options available.

Now open the tuning.sql file you worked on earlier. Make a few changes or add a comment, and select the **History** tab to review the differences between the original file and any changes you have made. Right-click the file in the **History** tab, and review the versioning options available to you (as shown in Figure 4). Save the file and the changes. Note the new overlay icon on the file in the **File Navigator**. Right-click the filename, and select **Commit** to check the file in.

CONCLUSION

Much more than just a database browser, Oracle SQL Developer offers utilities for day-to-day database tasks such as creating and altering database objects and an environment for running scripts and doing ad hoc reports.

Oracle SQL Developer 1.5 takes these activities to a new level, by introducing version control. Tightly integrated with CVS and Subversion, it enables you to navigate through and edit versioned files from within Oracle SQL Developer. The new versioning support provides merge and compare facilities, and you can import and check out files from within the tool. ■

Sue Harper is an Oracle senior principal product manager based in London. Her technical blog, sueharper.blogspot.com, explores Oracle SQL Developer features.

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Using Database Advisors

Get advice on key management challenges and improve performance in Oracle Database 11g.

Advisors are powerful tools that provide specific advice on how to address key database management challenges, covering a wide range of areas, including space, performance, and undo management. Advisors are built around two infrastructure components:

Automatic workload repository (AWR). This repository provides services for collecting, maintaining, and utilizing statistics for problem detection and self-tuning purposes. The statistical information is stored in the AWR in the form of snapshots.

Automatic database diagnostic monitor (ADDM). This monitor performs analysis, detects bottlenecks, and recommends solutions. Recommendations can include the type of advisor that needs to be used to resolve the problem.

This column focuses on some of the database advisors that are invoked by ADDM to help you improve database performance. It presents sample questions of the type you may encounter when taking the Oracle Database 11g Administration Workshop I exam, which enables you to earn the Oracle Certified Associate level of certification.

SQL TUNING ADVISOR

The *SQL tuning advisor* analyzes problems with individual SQL statements, such as a poorly performing optimizer plan or the mistaken use of certain SQL structures, and makes recommendations for improving their performance. You can run the SQL tuning advisor against resource-intensive SQL statements, a set of SQL statements over a period of time, or from a SQL workload. Typically, you run this advisor in response to an ADDM performance finding that recommends its use.

Oracle Database 11g introduces the automatic SQL tuning advisor, which

can be configured to automatically run during system maintenance windows as a maintenance task. During each automatic run, the advisor selects high-load SQL queries in the system and generates recommendations on how to tune them. **John starts to create a new table based on data in the customer table. The following criteria must be applied on the data:**

- **All columns of the customer table must be available in the new table.**
- **The new table must have data for only those customers whose average order is US\$1 million or more per quarter, who have not made payments for the last two orders, and whose payment period has exceeded the credit period.**

John notices that the table-creation process is taking very long to complete. The DBA has enabled the automatic SQL tuning advisor with automatic implementation, but when he runs the SQL tuning advisor, he notes that this SQL statement was poorly formed and not automatically tuned.

Why did the server not automatically tune this statement?

- A. The automatic SQL tuning advisor ignores CREATE TABLE AS SELECT statements.
- B. The automatic SQL tuning advisor ignores CREATE TABLE statements.
- C. The automatic SQL tuning advisor tunes only SQL queries.
- D. The automatic SQL tuning advisor does not tune DML statements.

The correct answer is A. Even though the automatic SQL tuning advisor is enabled, it does not resolve every SQL performance issue. It does not automatically resolve issues with the following types of SQL statements: CREATE TABLE AS SELECT and INSERT SELECT, ad hoc or rarely repeated SQL, parallel queries, and recursive SQL.

You have received complaints about the degradation of SQL query performance and have

identified the most-resource-intensive SQL queries. What is your next step to get recommendations about restructuring the SQL statements to improve query performance?

- A. Run the segment advisor
- B. Run the SQL tuning advisor on the most-resource-intensive SQL statements
- C. Run the AWR report
- D. Run ADDM on the most-resource-intensive SQL statements

The correct answer is B. After you have identified the SQL statements that are the most resource intensive, you use the SQL tuning advisor to get recommendations on how to tune them. Answer A is incorrect because the segment advisor reports on the growth trend of segments and provides recommendations on whether a segment needs to be shrunk. Answer C is incorrect because AWR is a repository that stores performance-related information in the form of snapshots. Answer D is incorrect because ADDM uses these statistics to perform analysis and detect bottlenecks and then recommends solutions.

SQL ACCESS ADVISOR

The *SQL access advisor* provides recommendations for improving the performance of a workload. In addition to analyzing indexes and materialized views as in Oracle Database 10g, the SQL access advisor in Oracle Database 11g analyzes tables and queries and provides recommendations on optimizing storage structures.

The SQL access advisor tunes a schema to a particular workload. Typically, when you use the SQL access advisor for performance tuning, you perform the following steps: create a task, define the workload, generate recommendations, and implement recommendations.

You can use the SQL access advisor to receive recommendations on which of the following:

- A. Schema modifications
- B. Tuning resource-intensive SQL statements
- C. Improving the execution plan of SQL statements
- D. SQL workload

The correct answers are A and D. The SQL access advisor analyzes an entire workload and recommends changes to indexes, materialized views, and tables to improve performance. Answers B and C are incorrect because the SQL tuning advisor makes recommendations on tuning resource-intensive SQL statements and improving the execution plan of SQL statements.

MEMORY ADVISOR

The *memory advisor* is a collection of several advisory functions that help determine the best settings for the total memory used by the database instance. They provide graphical analyses of total memory target settings (as shown in Figure 1), SGA and PGA target settings, or SGA component size settings. You use these analyses to tune database performance and for what-if planning. Several memory advisors are available for memory tuning (note that the availability of these advisors depends on whether the automatic memory management [AMM] and the automatic shared memory management [ASMM] features are enabled or disabled): The *SGA advisor* provides information about percentage improvement in DB (database) time for various sizes of SGA, the *shared pool advisor* provides information about the estimated parse time in the shared pool for different pool sizes, the *buffer cache advisor* provides information about physical reads and time for the cache size, and the *PGA advisor* provides information about cache hit percentage against PGA target memory size. **You have enabled AMM and ASMM features in your database, and you use Oracle Enterprise Manager to manage your database. Which memory advisors—memory size advisor, shared pool advisor, buffer cache advisor, or Java pool advisor—will you be able to use?**

- A. Only memory size advisor
- B. Only shared pool advisor
- C. All four of the memory advisors

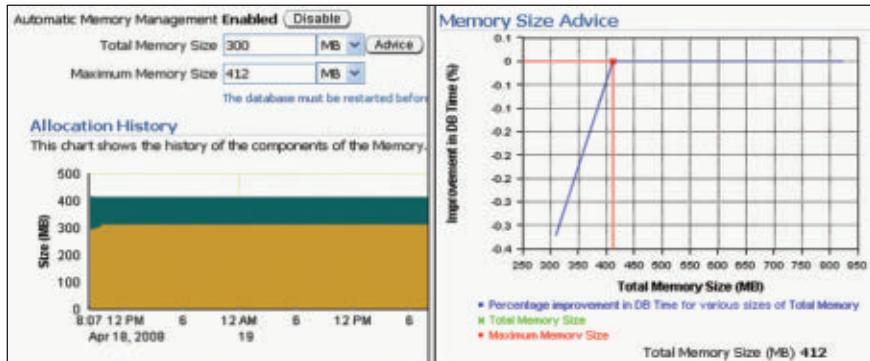


Figure 1: Total memory target settings

- D. Shared pool advisor, buffer cache advisor, and Java pool advisor

The correct answer is A. When AMM and ASMM are enabled, the system adapts to workload changes by automatically sizing SGA and PGA components. Because you will not receive advice on these individual components of SGA, the corresponding advisors will be disabled.

UNDO ADVISOR

The *undo advisor* helps you determine the size of the undo tablespace. You can compute the minimum size of the undo tablespace, based on either the statistics gathered over a designated time period or an undo retention period. Using the runtime statistics collected in the AWR, you can use the undo advisor to extrapolate how future requirements might affect the size of the undo tablespace. You then use the Undo Management page in Oracle Enterprise Manager to make the changes recommended by the undo advisor. **You are a DBA of an online transaction processing (OLTP) system that supports thousands of users and millions of transactions every day. As part of the periodic tuning activity, you plan to use the undo advisor to ensure that the size of the undo tablespace meets the requirements of the longest-running transaction of the instance. What information will the advisor use to determine the size of the undo tablespace?**

- A. The analysis time period
- B. The undo retention period
- C. The undo generation rate
- D. The number of undo tablespaces in the database

The correct answers are A, B, and C. The undo advisor uses the analysis time period, the undo retention period, and

the rate of undo generation to recommend the minimum size of the undo tablespace that can meet the requirements of the longest-running transaction. Answer D is incorrect because only one undo tablespace is active at any particular time, so it does not matter how many undo tablespaces a database has.

CONCLUSION

This column has focused on some advisors that help you manage and tune your database:

- **SQL tuning advisor** provides recommendations on actions such as rewriting the statement, changing the instance configuration, and adding indexes.
- **SQL access advisor** takes a SQL workload as an input and recommends which indexes, materialized views, and logs to create, drop, or retain for faster performance.
- **Memory advisor** provides graphical analyses of total memory target settings, SGA and PGA target settings, or SGA component size settings.
- **Undo advisor** determines the undo tablespace size that is required to support a given retention period. ■

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On Redefinition, Nature, and Triggers

Our technologist redefines tables, compares keys, and warns about DDL in triggers.

I have a table that contains millions of records, and I need to update it regularly. I want to perform an UPDATE and a COMMIT for every, say, 10,000 records. I don't want to do this in one step, because I may end up with rollback segment issues. Any suggestions?

Well, this is much more complex than it looks. Suppose you do break this large transaction up into many small ones, and halfway through, something, such as an ORA-01555 (snapshot too old) error caused by your committing frequently or a system failure, goes wrong. So now your batch update is partway done—it is “somewhere in the middle”—and needs to be restarted. Unless you wrote lots of code to make it restartable, you might have a huge mess on your hands. How do you pick up where you left off?

For example, the problem with code that looks like this:

```
declare
  cursor c is select * from t;
begin
  open c;
  loop
    fetch c bulk collect
    into l_data limit 500;
    ... some process ...
    forall i in 1 .. l_data.count
      update t set ...
    /* using l_data */
    commit;
    exit when c%notfound;
  end loop;
  close c;
end;
```

is that the odds of an ORA-01555 are very high, because you are reading the table you are modifying and the SELECT * FROM T must be as of the time when the query was started. As

you are modifying this table, the probability of an ORA-01555 goes up—and you are the cause of it. The undo you generate with your UPDATE of table T is likely to be needed by your SELECT on table T; however, when you execute a COMMIT, you enable the database to reuse your generated undo—and if it does (because the undo retention is set too small or because there is insufficient undo space allocated to hold all of the undo you are generating), you will almost certainly get the ORA-01555 error.

Additionally, when you do run into the ORA-01555 error and the code block fails, how do you restart it? You might need either a column in that table that could tell you if it had been bulk-updated already or another tracking table into which you inserted the primary keys of rows already modified, using “SELECT * FROM T WHERE PK NOT IN (select pk from tracking_table)” or a similar approach to do this.

So you are faced with writing lots of code to accomplish this. My preference would be to do one of the following things:

■ **Just update the table in a single statement.** This approach will be by far the most efficient in terms of resource usage. The concern about possible rollback segment issues is very much offset by the fact that you *need* that undo for your query to complete successfully.

■ **Use DBMS_REDEFINITION to process the update.** This will have the possible advantage of being an online operation (with no locking conflicts—which can be good or bad, depending on the circumstances). It will also avoid any row migration that might happen with an UPDATE that makes rows “larger” than they were. It will result in the most-compact data structures afterward

as well. You can even add an ORDER BY to the table redefinition in Oracle Database 10g and above to resequence the rows on disk if that makes sense.

■ **Use CREATE TABLE AS SELECT to select the “updated data” into a new table.** This is similar to the DBMS_REDEFINITION option but is an offline operation (so no modifications can be permitted to the original source table while you are doing this) and is more manual. Whereas the DBMS_REDEFINITION option automates the creation of indexes, grants, and constraints—everything you need to create a copy of an object—the CREATE TABLE AS SELECT method requires you to do all of that manually.

Let's look at using DBMS_REDEFINITION to create an “updated copy” of a table. The goal is to create a new column that is a concatenation of three existing columns, rid the table of the three existing columns, and sequence the rows on disk by another column (to have the existing data sorted by that column on disk). I'll start with a copy of ALL_OBJECTS to test with, as shown in Listing 1.

So I have a table T with a constraint (and possibly more, such as grants, indexes, triggers, and so on). As you can see in Listing 1, the data is stored randomly on disk—it is definitely not sorted by OBJECT_NAME, as the full table scan I started with a SELECT * FROM T shows. I would like to take three columns—TEMPORARY, GENERATED, and SECONDARY—and concatenate them into a new FLAGS column. Further, I would like to “drop” the TEMPORARY, GENERATED, and SECONDARY columns as well as the SUBOBJECT_NAME, DATA_OBJECT_ID, and TIMESTAMP columns from the new table and, last, organize the

existing data by OBJECT_NAME. Note that any newly added data will not be stored in sorted order in the table.

To accomplish that, I'll need an interim table for copying the existing data into:

```
SQL> create table t_interim
```

```
2 (
3   object_id      number,
4   object_type    varchar2(18),
5   owner          varchar2(30),
6   object_name    varchar2(30),
7   created        date,
8   last_ddl_time  date,
9   status         varchar2(7),
10  flags          varchar2(5)
11 )
12 /
Table created.
```

Now I am ready to begin the UPDATE, using the DBMS_REDEFINITION package—available with Oracle9i Database and above—to do an online table redefinition, as shown in Listing 2. (The ability to sort the data during a redefinition was added in Oracle Database 10g Release 1.)

The COL_MAPPING parameter in the START_REDEF_TABLE procedure is what does the UPDATE and DROP column magic. You basically execute a SELECT on the data, using the COL_MAPPING parameter, which can include functions (which you would have used in the SET clause of the UPDATE). The ORDERBY_COLS parameter accomplishes the resequencing of the existing table data on disk. If you enable SQL_TRACE=TRUE when executing the call to START_REDEF_TABLE, you will see an INSERT like this being executed:

```
INSERT
/*+ BYPASS_RECURSIVE_CHECK APPEND */
INTO "OPS$TKYTE"."T_INTERIM"
("OBJECT_ID","OBJECT_TYPE","OWNER",
"OBJECT_NAME", "CREATED",
"LAST_DDL_TIME","STATUS","FLAGS")
SELECT "T"."OBJECT_ID",
"T"."OBJECT_TYPE",
"T"."OWNER","T"."OBJECT_NAME",
"T"."CREATED","T"."LAST_DDL_TIME",
```

codeLISTING 1: Initial table T

```
SQL> create table t
2   as
3   select OWNER, OBJECT_NAME, SUBOBJECT_NAME,
4         OBJECT_ID, DATA_OBJECT_ID, OBJECT_TYPE,
5         CREATED, LAST_DDL_TIME, TIMESTAMP, STATUS,
6         TEMPORARY, GENERATED, SECONDARY
7   from all_objects
8   order by dbms_random.random;
Table created.

SQL> alter table t
2   add constraint t_pk
3   primary key(object_id);
Table altered.

SQL> select object_name
2   from t
3   where rownum <= 5
4   /
OBJECT_NAME
_____
java/rmi/MarshalException
SYS_C008650
ALL_IDENTIFIERS
/5ed18cf1_SimpleAuthPopupBasic
/1cca9769_MonitoredObjectImpl
```

```
"T"."STATUS",
"T"."TEMPORARY"||'/'|
"T"."GENERATED"||'/'|
"T"."SECONDARY"
FROM "OPS$TKYTE"."T" "T"
ORDER BY OBJECT_NAME
```

Note that the TEMPORARY, GENERATED, SECONDARY, SUBOBJECT_NAME, DATA_OBJECT_ID, and TIMESTAMP columns do not get copied to the T_INTERIM table but the TEMPORARY, GENERATED, and SECONDARY columns get concatenated into the new FLAGS column.

Because that INSERT includes APPEND in the hint, you can not only bypass UNDO (which happens by default with APPEND—no undo is generated for the T_INTERIM table during this initial load) but can also, if you choose, bypass REDO generation for this table as well by altering it to be NOLOGGING before performing the START_REDEF_TABLE procedure. (If you bypass REDO generation, make sure to coordinate with the group responsible for backups *before* doing that! They'll need to schedule a backup of the affected data file shortly after this operation to make the new data recoverable).

That START_REDEF_TABLE procedure I just invoked did a couple of things. It copied the data from T to T_INTERIM, copied only the data of interest, sorted the data during the load, and did it all efficiently (bypassing UNDO and optionally REDO). It also set up just enough replication between T and T_INTERIM to enable me to keep them in sync, so that at the end of the redefinition, the two tables are logically equivalent—they have the same number of rows.

Now I need to copy over the dependent “things”—such as indexes, constraints, and grants. I can use the COPY_TABLE_DEPENDENTS API call (a feature of Oracle Database 10g and above) to perform this, or I can copy over the table dependents myself, using DDL (along with any option I'd like: NOLOGGING, PARALLEL, and so on). In this example, I use the COPY_TABLE_DEPENDENTS API call:

```
SQL> variable nerrors number
```

```
SQL> begin
2   dbms_redefinition.copy_
table_dependents
3   ( user, 'T', 'T_INTERIM',
4     copy_indexes => dbms_
```

codeLISTING 2: DBMS_REDEFINITION.START_REDEF_TABLE procedure

```
SQL> declare
 2   l_colmap varchar(512);
 3   begin
 4     l_colmap :=
 5       'object_id,
 6       object_type,
 7       owner,
 8       object_name ,
 9       created,
10       last_ddl_time,
11       status,
12       temporary || "/" ||
13       generated || "/" ||
14       secondary flags ';
15
16   dbms_redefinition.start_redef_table
17   ( uname      => user,
18     orig_table  => 'T',
19     int_table   => 'T_INTERIM',
20     orderby_cols => 'OBJECT_NAME',
21     col_mapping => l_colmap );
22 end;
23 /
PL/SQL procedure successfully completed.
```

```
redefinition.cons_orig_params,
5   num_errors => :nerrors );
6 end;
7 /
PL/SQL procedure successfully completed.
```

```
SQL> print nerrors
```

NERRORS
0

That did it. If you were to query the data dictionary now, you'd see two tables with equivalent constraints, grants, triggers, indexes, and so on. I am ready to finish the redefinition now—it will involve synchronizing the tables and then locking both T and T_INTERIM for a brief moment to swap their object names in the data dictionary so T will become T_INTERIM and T_INTERIM will become T:

```
SQL> begin
 2   dbms_redefinition.finish_
redef_table
 3   ( user, 'T', 'T_INTERIM' );
 4 end;
5 /
PL/SQL procedure successfully completed.
```

```
SQL> select object_name, flags
 2   from t
```

OBJECT_NAME	FLAGS
/1000323d_DelegateInvocationHa	N/N/N
/1000323d_DelegateInvocationHa	N/N/N
/1000e8d1_LinkedHashMapValueIt	N/N/N
/1000e8d1_LinkedHashMapValueIt	N/N/N
/1005bd30_LnkdConstant	N/N/N

As you can see, table T is now the updated table, with the new FLAGS column and with the existing rows in the table sorted on disk by OBJECT_NAME.

As previously mentioned, using CREATE TABLE AS SELECT to select data into a new table could produce a result similar to using DBMS_REDEFINITION, but the process, including the creation of indexes, grants, and constraints, would be more manual. However, in the standard edition of Oracle Database, where online redefinition is not available, using CREATE TABLE AS SELECT might be the most efficient way to accomplish this.

NATURAL OR SURROGATE KEYS

The project I'm currently working on has the database design rule that all tables must have a surrogate key. This is required even if a perfectly good natural key exists.

The primary motivation appears to be to

improve join efficiency by removing the possibility of having to join two tables on more than one column.

Personally I'm not a fan of surrogate keys in general or of this sort of blanket policy in particular. I believe that there is often much to be gained by having the child table inherit the primary key of the parent table as part of the primary key of the child table.

Do you have any comment about natural keys versus surrogate keys in general? Do you favor surrogate keys over natural keys? How tight would performance considerations have to be to justify such a scheme?

Ahh, the age-old debate—one that neither side will ever “win.” Having a rule such as this is the perfect example of why I don't really like the term *best practice*, or ROTs (rules of thumb). One person's best practice is another person's nightmare.

If you have a natural key, by all means, use it. The natural key should be immutable and sensible; they are sometimes rare in real life, but they do exist.

For example, if I had a DOCUMENT table and a DOCUMENT_VERSION table, I would definitely use document_id (which might be a surrogate) as the primary key of one table and the combined document_id,version# as the primary key of the other table (and DOCUMENT_VERSION might have an association with authors, so its primary key is a foreign key elsewhere in the system too).

That is, I would set it up like this:

```
create table document
( document_id number primary key,
-- populated by a sequence perhaps
other_data...
);
```

```
create table document_version
( document_id references document,
  version# number,
  other_data ...
constraint doc_ver_pk primary key
( document_id,version# )
);
```

for the reasons you just listed. One thing to be very sure of, however, is that the primary key is immutable. Never

changing. In this case, the surrogate key in the DOCUMENT table is immutable and the natural key (which happens to include a surrogate key from something else) in the DOCUMENT_VERSION table is as well.

The natural key would have to be present in my table from the get-go, with NOT NULL and UNIQUE constraints on it. The use of a surrogate key here would only add to the work of all INSERT operations—having to now generate a surrogate key as well as uniquely constrain both the surrogate key and the natural key. So, if the natural key is both immutable and reasonable, by all means use it. (In this case, *reasonable* means, for example, that it does not take 17 columns to store the natural key—having 2, 3, 4, or maybe even 5 columns is reasonable.) To read the many and varied discussions of this divisive topic, see asktom.oracle.com/pls/ask/search?p_string=%22natural+key%22.

DDL IN TRIGGERS

Everything I have ever read about triggers explicitly states that DDL, because of an implicit COMMIT, cannot be used within a trigger. I have, though, seen in blogs and other places that people have claimed to have gotten it to work through various hacks, but I have never been successful in doing so. I have two questions relating to this:

1. Why doesn't using pragma autonomous_transaction solve this within a procedure called from a trigger?

2. Do you know of a workaround for executing DDL in a procedure called from a trigger?

Well, to answer No. 1, pragma autonomous_transaction would permit you to do DDL in a trigger, but *thankfully* you never succeeded. Be very thankful of that. In answer to No. 2, in the extremely rare case—extremely rare case—where this is actually desirable and necessary, I suggest using DBMS_JOB to schedule the CREATE statement after your transaction has committed.

First, think for a moment about the ramifications of doing nontransactional work in a trigger. What happens when you need to roll back? Well, of course, the DDL would not roll back—you

would be left “halfway there.” The DDL would have happened, but the transaction that caused the DDL would not have happened (having been rolled back). You would be left with a mess.

Whenever you are tempted to do something nontransactional in a trigger, think 500 times more about it and then always decide against it. It can lead only to really bad things.

If you use DBMS_JOB, it will look something like this:

```
SQL> create table do_ddl
  2  ( job number primary key,
  3    stmt varchar2(4000)
  4  );
Table created.
```

```
SQL> create or replace
  2  procedure do_ddl_safely
  3    ( p_job in number )
  4  is
  5    l_rec do_ddl%rowtype;
  6  begin
  7    select *
  8      into l_rec
  9      from do_ddl
 10     where job = p_job;
 11    execute immediate l_rec.stmt;
 12  end;
 13  /
Procedure created.
```

And then you will use a block of code similar to the following to invoke the DDL procedure shortly after you commit your transaction:

```
SQL> declare
  2    l_job number;
  3  begin
  4    dbms_job.submit
  5    ( l_job,
  6      'do_ddl_safely(JOB);' );
  7    insert into do_ddl
  8    ( job, stmt ) values
  9    ( l_job, '...The statement
   to be executed...' );
 10  end;
 11  /

```

DO_DDL_SAFELEY is a stored procedure you write that does DDL, catching errors if needed, notifying people,

and correctly doing whatever needs to be done. It will execute *shortly* after you commit.

And best of all, if you roll back, the INSERT into the job queue does too. You are protected—the DDL won't happen. Use this approach anytime you are thinking of doing something nontransactional in a trigger.

See this series on a related topic (write consistency), including how triggers might fire more than once for a given statement—yet another reason to avoid nontransactional operations in a trigger:

- tkyte.blogspot.com/2005/08/something-different-part-i-of-iii.html
- tkyte.blogspot.com/2005/08/part-ii-seeing-restart.html
- tkyte.blogspot.com/2005/09/part-iii-why-is-restart-important-to.html ■

Tom Kyte is a database evangelist in Oracle's Server Technology division and has worked for Oracle since 1993. He is the author of Expert Oracle Database Architecture: 9i and 10g Programming Techniques and Solutions (Apress, 2005) and Effective Oracle by Design (Oracle Press, 2003), among others.

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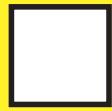
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Thank You for Your Time

A lot has changed during my three years as IOUG president.

This is my last column as president of the Independent Oracle Users Group (IOUG). My three years as president seem like a short time, but many changes have taken place.

To begin, Oracle has acquired more than 40 companies, adding technology, applications, and products to the Oracle brand. As a result, the Oracle community has expanded tremendously, adding all the users of those separate products and technologies to the Oracle family.

Moreover, Oracle has held on to experience and expertise and done a good job integrating technologies and products into the Oracle universe. As a result, users enjoy a wider and deeper range of solutions than ever before.

During this time, Oracle has forged deeper bonds with user groups. Top Oracle executives, including President Charles Phillips and Senior Vice President and Chief Marketing Officer Judy Sim, work with user groups on many levels. It's now common for Oracle executives to speak at user group events, which drives attendance and participation.

The user group scene has changed as well. Many readers are familiar with the International Oracle Users Group Community (IOUC), a federation of Oracle user groups. Recently it has done a tremendous job of working with Oracle to get the features and strategic direction that worldwide users want to see, as well as helping to develop beta programs so users can shape and test products.

Regional groups are also stronger than ever—the IOUG hosts the Web sites of dozens of these regional groups—and Oracle Application Express technology makes that possible. The IOUG also helps regional groups with their programs by coordinating speakers and vendors for local events. The end winners are the members of the user

groups and Oracle's customers.

The COLLABORATE 08 conference was a joint effort by the IOUG, the Oracle Applications Users Group (OAUG), and the Quest International Users Group (Quest). More than 7,500 users and 250 vendors attended this year's conference in Denver. Last year, there were 250 sessions from the IOUG alone; this year, the IOUG had more than 400 sessions. Such growth in this one conference represents the expansion we've seen in user interest and participation just in the last two years.

IOUG membership has grown 25 percent in the last three years, and more users than ever are realizing the benefits. Special interest groups now offer year-round programs. These reflect a new attention to business intelligence, data warehousing, and analytics. The growth in awareness of these areas parallels a fundamental shift in the Oracle marketplace.

I'm not even tempted to claim credit for these wonderful advances in our user group system. We have a strong and dedicated board of directors that keeps us moving forward. Our enthusiastic and hardworking volunteers make it all happen. With a success like COLLABORATE 08, you're looking at the effort of hundreds of volunteers working for the best interests of everyone.

Looking ahead, we have interesting things to anticipate. Oracle's research and development has created an amazing technology in Oracle Fusion Middleware. In the next few years, you can expect releases of applications based on it, and these releases will be easier to integrate with existing Oracle solutions.

I have a bullish view on the economy's impact on Oracle. If companies seek to consolidate to save money, who better to consolidate with than Oracle? If they want to use virtualization to squeeze the

maximum return from their hardware, Oracle VM is the obvious choice. And attendance at COLLABORATE was up significantly this year—a good sign for Oracle users, given that in tough times companies tend to cut back on travel, education, and marketing efforts.

I wish the incoming IOUG president, Ian Abramson, the best of luck. I've known Ian for 14 years. He's a smart and charismatic leader, and the IOUG is in good hands. His special expertise in business intelligence, data warehousing, and analytics will be quite valuable.

I'd like to thank Charles Phillips and Judy Sim for seeing the value of user groups and supporting so many of our activities and events. Thanks to Mary Lou Dopart, Oracle's senior director, user group management, and her team in promoting Oracle and user interests through the IOUC. My thanks to the IOUG board for all that they have done during my three years as president.

Most of all, thanks to the members of the Oracle user community, who are so involved and passionate about Oracle technology. You make it all worthwhile. ■

Ari Kaplan (ari_kaplan@ioug.org) is the outgoing president of the Independent Oracle Users Group (IOUG) and a senior consultant at Datalink. He founded Expand Beyond Corporation, a leader in mobile IT software. He has been involved in Oracle technology since 1992.

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Securing the Supply Chain

The educational supply chain must change.

I recently participated in a U.S. Defense Science Board study (see nextSTEPS) that examined foreign influence over the software supply chain. The study noted that, even as vendors need worldwide access to technological talent that enables them to create commercial software benefiting the U.S. Department of Defense, there is an increased risk that the software supply chain may be compromised by hostile nation-states.

Supply chain security issues are on many people's minds these days. IT operations are effectively regulated more than ever before, via, for example, the Sarbanes-Oxley Act, the Health Insurance Portability and Accountability Act (HIPAA), and various breach disclosure laws such as California SB 1386. IT customers are being pressured to show that they are "more secure" and are, in turn, pressuring their supply chain—software vendors—to prove that the enterprise software they provide is secure. Vendors are being asked everything from "What features and functions do you have to help meet regulatory requirements?" to "How do you embed security within your software development lifecycle?"

In the vendor community, there is a low rumble of discontent about our collective supply chain's current lack of a "secure development lifecycle." I'm not talking about other software suppliers, such as vendors that supply toolkits or components. What I mean by *supply chain* is the universities that supply computer science graduates. There is no secure development lifecycle in the vast majority of universities' degree programs. And that is a problem, perhaps the security problem plaguing the software industry. All the other security remediations in the software supply chain, such as multiple security point solutions, vulnerability analysis services, and patch management,

are largely in response to the fact that most software was neither designed nor built to be secure. Developers don't typically think their code is a target, but it is a target and will only be more of one in the future.

Computer science graduates matriculate from long, labor-intensive degree programs without, in most cases, knowing even the first principles of secure coding and secure engineering practice. They are not stupid, but ignorant: they aren't being taught secure development practice because in many cases, their professors do not know the material or do not know it well enough to teach it.

In the almost 20 years I have spent here, I have seen Oracle evolve from being a strong database company to one of the largest enterprise software companies in the world. We have always been security leaders, and not merely in security features and functions. We lead by broadly training our developers in secure coding practice. We lead by wide deployment of automated vulnerability detection tools (both third-party and homegrown). We've developed security-enforcing interfaces, such as input validation, without expecting every developer (or customer) to be a security expert.

We've recently completed a tutorial on preventing SQL injection (one of the most common application-based attacks), and it is posted externally for anybody to take (see nextSTEPS).

Solving the supply chain security problem is another area in which I want Oracle to lead. We all need universities—our supply chain—to change the way they teach computer science. To that end, Oracle sent a letter to several universities from which we recruit, telling them that we expend significant resources retraining their graduates in secure coding practices.

We described the impact on us and our customers of avoidable, preventable security defects. We stated that in the future, we will give preference in hiring to those universities that emphasize secure coding practices. Our next step was to publish this as an open letter to all universities and to encourage other vendors to do the same: to push their universities to change their curricula so that secure development practice is embedded within the fabric of every class, not just in a single class that students file and forget. The educational supply chain must change.

All customers rely on IT as infrastructure and are being driven by regulation to insist on a secure software supply chain. Producing secure software requires a secure supply chain—university graduates whose degree programs have a secure development lifecycle embedded within every program element. We simply must evolve to defensive mind-sets delivering defensible code, lest none of us survive in a hostile world. ■

Mary Ann Davidson is the chief security officer of Oracle, responsible for secure development practices, security evaluations, and assessments. She represents Oracle on the board of directors of the Information Technology Information Security Analysis Center (IT-ISAC) and the U.S. Defense Science Board and is on the editorial review board of SC Magazine.

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Analyzing Performance

Companies plan ahead with enterprise performance management.

John Hagerty, vice president and research fellow at AMR Research, talked to *Oracle Magazine* about current trends and strategies in business intelligence (BI) and enterprise performance management (EPM).

Oracle Magazine: What is enterprise performance management and how does it relate to BI in general?

Hagerty: Broadly speaking, BI tools provide insight and visibility into what's happening within your business. Enterprise performance management applications put BI tools into a planning context. They help you set goals and measure progress toward those goals, to make sure that you're shooting in the right direction.

A lot of companies use the term *enterprise performance management* to describe a command-and-control philosophy: "What are we going to do and how are we going to get there?" BI is more about sense and respond. You evaluate progress and use information about what's happening in the business to make corrections.

For example, if you're examining sales versus forecasts, that is primarily a BI application. If you're setting goals and strategies for the firm, and devising a concrete plan for how you'll get there, that typically involves EPM.

Oracle Magazine: What types of tools do organizations use to develop their BI and EPM applications?

Hagerty: Business users don't always distinguish which technologies are in play. They simply want information in the context of what they do, whether that means a dashboard, a report, a query, or a predictive analytic component. They don't want complex tools. They just want answers.

Oracle Magazine: Do EPM systems primarily analyze operational data, or do

they access historical information?

Hagerty: Today, EPM applications generally don't look at detailed operational data. Instead they look at summary data and key metrics about how the business is operating, with a focus on financials. But we do see more companies expanding EPM beyond traditional boundaries and constructing targeted operational performance applications to optimize results in specific disciplines within the enterprise, including supply chain, workforce, and customer service.

The more insight a business wants to gather, the more detailed information they go after. They start with summary data and drill down to derive extremely granular information to refine their decision processes.

Oracle Magazine: Are there any BI trends or developments that CIOs in today's forward-thinking companies should be aware of?

Hagerty: As a result of steady consolidation in the BI marketplace, vendors such as Oracle are constructing enterprise platforms that include middleware, applications, and BI performance management capabilities. These platforms are built on a common architecture that can traverse a lot of different business requirements. Ultimately these broad IT architectures help customers reduce total cost of ownership because they are dealing with one platform instead of two or three or four.

Oracle Magazine: Do today's enterprise BI platforms enable any new types of BI capabilities?

Hagerty: In some cases they are enabling more-comprehensive decision-making capabilities. BI has typically had a backward-facing role—tell me where I've been and tally the score—primarily analyzing historical performance. Now we are starting to see pervasive BI appli-

cations that delve deep into the operations of the company. We're especially seeing this phenomenon in manufacturing and retail, where the agility of the supply chain can make or break the performance of the business. In these cases, pervasive BI extends not only deep within the business, but also outside the four walls as these companies pull partners into the BI environment.

Oracle Magazine: What do you see as the future of BI?

Hagerty: The term *BI* is now loosely applied to a lot of different things. Buyers will tell you that BI means query and reporting and analysis. But the technology is spreading its wings, and it is now applied to domains such as access to operational information. Whether you call it pervasive performance management or operational BI, it's basically the same thing. This is the next logical area of investment for a lot of companies, and many of them want to standardize on a common backbone for analytics and reporting. ■

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