

Projects at Oracle



Hardware and Software, Engineered to Work Together.

Projects at Oracle

Inside Oracle: the Company Revolutionizing IT

Advancing Your Career at the World's Most Influential
Business Software and Hardware Systems Company

oracle.com/college



At a time of profound change in not only the tech industry but the entire business world, Oracle is committed to providing innovative solutions to meet the new wave of challenges brought about as our global economy moves faster, gets more social and mobile, requires more visibility, reaches more people, and moves in real time all the time.

Welcome to Projects at Oracle, the most current, comprehensive book of ongoing development projects at Oracle. This book is published exclusively for you, the Oracle candidate, and written by Oracle product developers and management across the company. Prospective Oracle employees, including top graduates worldwide, turn to this book as their primary source of knowledge about Oracle's development organization.

See Larry Lynn's letter, continued on next page

Projects at Oracle

Larry Lynn's letter, continued from page 1

You will notice many teams responsible for developing and enhancing Oracle's wide spectrum of global products and services. We introduce our development projects to show you how Oracle can solve just about any business need you can imagine. We believe that no matter what your interests are, you will find challenging opportunities to develop your exciting career here at Oracle.

And speaking of exciting, Oracle's among the world leaders in tackling some of the most demanding and far-reaching tech challenges of today: Big Data, cloud computing, engineered systems, social computing, mobile, security, analytics, next-generation databases, end-to-end virtualization, and much more. Because one thing that's remained constant at Oracle for the past 35 years is that our business is information—how to manage it, use it, share it, and protect it. We are proud to celebrate these years of innovation—helping businesses and governments make the most of their information. Oracle provides the world's most complete, open, and integrated business software and hardware solutions to run any business.

Globally, hundreds of thousands of organizations in just about every industry imaginable use Oracle. Whether through the Cloud or on-site, business users develop, deploy, run, and manage the applications and systems they need to succeed using Oracle's integrated offerings. Oracle engineers use the latest, most exciting technologies to develop and enhance products. We support social networking sites, blogs, wikis, podcasts, portal mashups, digital media, and more.

In many ways, Oracle's revolutionizing the tech industry by doing things no other company's done before: devising hardware and software architectures to deliver the extreme performance and power that businesses today desperately need at a lower cost than other tech companies can offer. We don't expect customers to pick and choose dozens of disconnected point solutions and then find ways to make them all work together: we offer end-to-end solutions for cloud computing and customer experience.

We also take responsibility and contribute to our community—we support environmental protection in our solutions and through our extensive global employee volunteer programs.

We invite you to use this book as your career resource. Take time to make the right decision for yourself. We can find ideal work for you at one of our popular development centers, whether at our worldwide headquarters located in Redwood Shores, California or in Colorado, Massachusetts, New Hampshire, New York, Oregon, and other locations.

Do not be surprised to find yourself responsible for essential aspects of new product development and existing product improvement, from concept to implementation. If you would like to meet talented, sharp people like you who contribute to the full potential of our technology and to our bright future, we hope you seriously consider Oracle as your career choice.

We look forward to meeting you,

Larry Lynn
Vice President of College Recruiting

Projects at Oracle

	Page
Inside Oracle: the Company Revolutionizing Information Technology	1
ORACLE PUBLIC CLOUD	5
SYSTEMS HARDWARE & SOFTWARE DEVELOPMENT (Server and Storage Systems)	6
Developers, Performance, and Applications	6
Disk Storage Systems	7
Microelectronics	7
Solaris Operating System	7
SPARC Enterprise Systems	7
SPARC Volume Systems	8
Tape Technologies	8
TECHNOLOGY DEVELOPMENT	8
Database Technologies	8
Advanced Analytics	8
Advanced Queues	9
Automatic Storage Management	9
ASM Cluster File System and Dynamic Volume Manager (NEDC)	9
Berkeley Database and Mobile Server	9
Big Data Technology	10
Cloud Infrastructure Performance and Availability Management	10
Cluster High Availability and Manageability	10
Clusterware and Real Application Clusters	11
Core Database Storage and Cache Engine	11
Data Rescue	11
Data Technology: Data Storage, Space, Transaction Processing	12
Data Warehouse and Language Technology	13
Database Access	13
Database Cloud and High Availability Development	14
Database Development Tools	14
Database High Availability and Recovery	14
Database Resource Manager	15
Database Security	15
Database Server Manageability	15
Database Test and Productivity Tools	15
Database Upgrades and Utilities (NEDC)	16
Enterprise Replication (Oracle GoldenGate and More)	16
Exadata	16
Manageability and Diagnosability Infrastructure	17
Maps and Spatial Location-Based Technologies (NEDC)	17
Multimedia, Medical, and GeoSpatial Imaging (NEDC)	17
Net Services	17
NoSQL Database	18
Online Analytical Processing	18
PL/SQL and Compiler	18
Replay Technologies and Workload Intelligence	19
Semantic Web Database Technologies (NEDC)	19
Server Technologies Performance	19
SHARP	19
Text	19
TimesTen In-Memory Database	20
Virtual Operating System	20
Windows Technology	20
XML Database	21
Fusion Middleware	21
Application Development Tools (Oracle ADF)	21
Application Server: Cloud Foundation and Group	22
Business Analytics	23
Customer Experience and User Engagement	24
Exalogic	25
Fusion Middleware Platform Product Management	25
Integration products (SOA, BPM, OEP, ODI)	25
Java Products Group	27
Security and Identity Management	27
User Productivity Kit	28

Projects at Oracle

Projects at Oracle

Continued

Projects at Oracle

	Page
TECHNOLOGY DEVELOPMENT	28
Systems and Applications Management	28
Application Management	29
Cloud Computing and Virtualization	29
Enterprise Configuration Management	29
Enterprise-Ready Infrastructure	29
Knowledge Management	29
Middleware and Application Performance Management	29
Software Provisioning and Installation Technologies	30
Ops Center	30
Performance	30
Quality Assurance	30
Testing as a Service	30
Services	30
Demonstration Solution Services	30
Product Development Information Technologies	31
Server Globalization Technology	31
Server Technologies Curriculum Development	31
Server Technologies Information Development	32
BUSINESS APPLICATIONS DEVELOPMENT	32
Applications Portfolio Development	32
Cloud Services (Talent Cloud)	32
Customer Experience (CX)	32
Commerce	32
CRM	33
Knowledge Management	33
E-Business Suite	33
Fusion	34
JD Edwards EnterpriseOne	34
JD Edwards World	34
PeopleSoft	34
Supply Chain Management	34
Support for Oracle Applications Development	35
Oracle Applications Labs	35
INDUSTRY-SPECIFIC SOLUTIONS... AND PRIMAVERA...	35
Communications	35
Health Sciences	35
Primavera Project and Portfolio Management	36
Retail	36
Utilities	36
ORACLE CLOUD SERVICE ENGINEERING US, India, Ireland, Romania	37
ORACLE CHINA (Asia Research and Development Center)	37
ORACLE INDIA	38
ORACLE MEXICO DEVELOPMENT CENTER	38
ORACLE EUROPEAN DEVELOPMENT CENTRE (IRELAND)	39
USER EXPERIENCE	39
ORACLE CORPORATE ARCHITECTURE	39
Axiom Storage	39
Global Information Security	40
Global Product Security	40
Global Trade Compliance	40
Government Security	41
Linux and Virtualization	41
MySQL	41
Oracle Labs	42
Sun RayThin Client Technology	42
ORACLE ON DEMAND	42
CUSTOMER SUPPORT SERVICES	42
ORACLE UNIVERSITY	43

ORACLE PUBLIC CLOUD

Oracle publicly unveiled our groundbreaking Cloud computing strategy during Larry Ellison's Open World 2011 keynote speech. According to analysts, the Oracle Public Cloud (OPC) is a key strategic move. OPC plans to offer a comprehensive set of applications and services for enterprises; these include Software as a Service (SaaS), Platform as a Service (PaaS) and Data as a Service (DaaS) offerings integrated with key Oracle products, such as the Oracle Database, Fusion Middleware, and Fusion Applications. We embrace and integrate social media to take the enterprise class of services to a new era of conducting business and engaging with customers and partners. Our strategic acquisitions in social media bolster our Cloud strategy. The combination of leading Oracle enterprise software, strategic Cloud investments, and a driven strategy from our leadership ensures that OPC will jump out of the gates in the enterprise Cloud computing race.

Projects at Oracle

Our Cloud organization has spent the last year making the current OPC release a reality. We are excited about Oracle's Cloud computing strategy. The Cloud computing space is big and still emerging. As part of the team leading Oracle into the Cloud, we innovate and make significant contributions to strategic Cloud development at Oracle. We design and build new functionality and are involved in cutting-edge initiatives. Our top engineers are involved in front-line Cloud development. The Oracle Public Cloud organization oversees the following areas of development: Cloud Operating System and Infrastructure Services, Cloud Marketplace, Cloud Data Services, and Cloud Enterprise Social Platform and Mobile Services.

Cloud Operating System and Infrastructure Services

We ensure all services and applications on the Cloud are deployed and provisioned onto hardware in a fully automated way. We build the system on top of virtualized Compute, Storage, and Network orchestrating Cloud services and applications. Services describe themselves declaratively in a blueprint, where they specify service dependencies, monitored metrics, resource requirements, and custom attributes. The operating system then orchestrates billing and business and systems provisioning to standup a complete service instance. To build and deploy meaningful applications on the Oracle Cloud platform, users rely on a rich set of foundational services. Applications need the ability to store files or objects, in which they persist configuration, runtime state, or application assets. To interoperate, applications may need to send/receive messages using a queuing or publish/subscribe service and may need to communicate with users through channels such as texting and email. We build services on which applications rely, such as Storage, Messaging, and Notifications.

Our Core Cloud Infrastructure area deals with all aspects of on-boarding tenants, enabling them to purchase any services offered on the Oracle Cloud, automatically deploying and provisioning these services for the tenants' use, and subsequently monitoring and reporting use of these services. Here, we address two critical functions: first, making the process of acquiring, provisioning, and managing the services for the tenant simple and elegant; second, lowering Oracle's administrative cost.

PaaS/Platform Services addresses the needs of developers on the Oracle Cloud by providing a platform for developing and deploying enterprise applications and services that can also be extensions and value added services for our SaaS offerings. The platform services area encompasses a wide variety of services, such as Java Service, Web Developer Service, Database Service, Storage Service, Search Service, Message and Queuing services, and Sync service. Our Application Store is much like Apple's App Store in that developers can post applications and services for OPC tenants to discover and purchase.

Cloud Marketplace

We also build the Oracle Cloud Application Store/Marketplace where any partners and developers can build, certify, and list applications. For example, an Oracle CRM customer needing to integrate a third-party Compensation Management service can do so by buying and using a third-party application from the store. The Oracle Application Store opens up innovation and value creation to larger audiences and expands Oracle Cloud capabilities. Our goal is to create the premiere Cloud computing platform offering the greatest variety of valuable applications solving customers' business problems.

Cloud Data Services

For Data Services, Oracle is acquiring, creating, and managing high-value content and content insights and intelligence for consumption in our SaaS services. We are developing (1) analytics and insight services on Big Data, such as Social Data; (2) a Business Directory Exchange to host company and person contact data from multiple data providers and automatically provision the contacts into SaaS on demand by our tenants; (3) industry and segment-based KPIs that can be computed based on anonymizing and aggregating data from tenants on an opt-in basis and resold to tenants in a pay-to-play model; and (4) a service to enable tenants to obtain information and insights from social media data, such as from Twitter, Facebook, and Google+.

Cloud Enterprise Social Platform, Mobile Services

Oracle is building a social platform for improved company and customer interaction and useful marketing, commerce, and service experiences. Our tools provide the ability to publish, listen, engage, and monitor across social platforms, such as Facebook, Twitter, Youtube, Pinterest, and Google+. With Cloud Mobile Services, we are enabling applications developed on iOS, Android, and Windows8 platform and running on mobile devices to seamlessly interact with all Oracle Cloud services.

SYSTEMS HARDWARE & SOFTWARE DEVELOPMENT

Software. Hardware. Complete. After the acquisition of Sun in 2010, thousands of Oracle developers now work on hardware and new software areas. Oracle invests in innovation by designing hardware and software systems engineered to work together.

Developers, Performance, and Applications

We ensure Oracle's Sun systems are highly optimized and integrated with the entire Oracle software portfolio, including database, middleware, and applications. Our engineers focus on performance and work with Oracle Solaris engineering and other product development groups across Oracle, as well as processor design groups. We regularly publish industry-standard benchmark results, including many world records, on the full range of Oracle Sun systems and across the spectrum of major industry applications. We also work with independent software vendors to bring major industry applications to the Oracle Solaris platform and ensure that they are well-optimized and supported. And, we develop and support the suite of developer tools, including compilers used across Oracle's product lines based on SPARC and x86.

Disk Storage Systems

We develop disk storage systems and software. We write file systems, tiered storage systems, and archive solutions used at organizations as big as the Library of Congress and the United States Army. We are working with Fibre Channel, iSCSI, SAS, and SATA, as well as Infini-Band, to deliver I/O to tape, disk, and flash-based storage devices. We are currently world record holders in transaction-based processing. We develop enterprise storage products driving data architectures for Oracle's customers. Our storage systems support use with any type of application and are also optimized for deployment with Oracle Solaris, Oracle Enterprise Linux, Oracle Virtualization, and the Oracle Database and Applications. Our work on storage is also shared with core development on the Solaris operating system kernel. Our developers work on core I/O infrastructure (kernel engineering and device drivers in areas such as Multipath I/O, SAS, SCSI, Fibre Channel, iSER, SRP, FCoE, and the core kernel device driver APIs); backup and archive; protocols and interoperability (file protocols such as NFS and SMB stacks in the kernel for both server and clients and interoperability with Active Directory, LDAP, Kerberos, and other related areas); clustered filesystems and distributed data; our ZFS Storage 7000 product line; and flash and storage hardware.

Microelectronics

It's not easy to create something the size of your thumbnail with a couple billion transistors and connections so small that thousands of them would fit into a single human hair. We use the best silicon technology to develop microprocessors and ASICs keeping Oracle's Sun systems in the lead on database and other high-performance computing and networking tasks. We have some of the most reliable, scalable, and energy-efficient systems in the industry. These systems are the core building blocks for enterprise, Web, and high-performance computing infrastructures. Integrated circuit design requires the expertise of people in many specialty areas, such as microprocessor architecture, logic design and verification, circuit design and verification, emulation, design for test, and design automation.

Solaris Operating System

The Oracle Solaris Operating System delivers enterprise-grade performance, stability, and security. One OS, supported on more than 1,000 SPARC and x86 platforms, can span the Web tier, the data warehouse, and the most demanding technical compute applications. Solaris is the base for supporting general-purpose computing as well as running an optimized Oracle software stack. Solaris is known for innovations such as the Zones Application Containers, the Crossbow Virtualized Networking stack, the zfs File System, Predictive Self Healing, as well as dtrace. We ensure that the Solaris kernel provides support for the latest hardware innovations, continues to easily scale as the era of multicore processors blossoms, and provides new features. Areas of focus in the kernel include virtual memory, affinity awareness, I/O, scheduling, power management, boot, CMT/NUMA optimizations, libc improvements, and many more. Solaris is one of the most secure operating systems in the world. We are responsible for Solaris cryptography, authentication, network security, roles, auditing, and trusted extensions. We work closely with many partners both across Oracle and within the industry and are pioneers in standard-setting bodies and security-related consortia.

SPARC Enterprise Systems

Our products range from entry-level servers to some of the industry's largest servers with 64 sockets. We help define chip sets that can scale to a very large number of processors. Our engineers deal with challenges around cooling, dense packaging, signal integrity, and power. We optimize our systems and architectures with all other parts of the software stack to

Projects at Oracle

produce an integrated system. We innovate from the silicon up in developing our systems. Our systems are designed for the most challenging mission-critical applications in the world and include a line of servers specifically for telecommunications. We work on definition, architecture, design, engineering, program management, integration, validation, and delivery of systems. We support other Systems hardware organizations in specialties such as PCB design; mechanical, thermal, acoustic, power, and packaging engineering; product documentation; and regulatory testing. Engineers implement and support tools for the system design environment. Our Publications Team drives content design and delivery strategies for customer-facing documentation supporting all SPARC hardware products.

SPARC Volume Systems

We bring to market Oracle's Sun SPARC Enterprise servers and blades based on chip multithreading (CMT) technology. Hardware integrated with software provides virtual-machine capabilities through Oracle Solaris containers and Oracle Virtualization Manager for SPARC. We work on definition, architecture, design, engineering, program management, integration, validation, and delivery of systems. We provide support to other organizations in specialties such as PCB design; mechanical, thermal, acoustic, power, and packaging engineering; product documentation; and regulatory testing. Engineers implement and support tools for system design. Our Publications Team drives content design and delivery strategies for customers' product documentation supporting SPARC hardware products.

Tape Technologies

We develop tape enterprise data storage products covering complete archive and backup solutions for data protection and long-term digital preservation. We specialize in library robotics and advanced tape technologies and use skills in robotics, mechanical design, servo implementation, magnetics, recording theory, ASIC design, firmware development, and test and reliability engineering.

ORACLE TECHNOLOGY DEVELOPMENT DATABASE TECHNOLOGIES

The vast majority of the Internet's most popular sites and of Fortune 500 companies use Oracle. Oracle provides the #1 database, #1 data warehouse, #1 database on Linux, and #1 embedded database. With unparalleled performance, scalability, availability, and security, Oracle servers allow Internet and grid applications to be designed for all kinds of systems, including mobile computers, enterprise servers, and Cloud infrastructures. The Oracle Database runs on a choice of clustered or single servers running Windows, Linux, and UNIX. It is designed with 100 percent support for Internet standards such as Java, XML, LDAP, SSL, and SOAP and is continually enhanced to exploit other advances such as flash and Cloud technologies. It is the first database designed to run on a grid infrastructure, allowing effective pooling of a large numbers of servers and storage for all enterprise computing needs. Our engineers use the newest, most exciting, and most profitable technologies to deliver the highest performance, reliability, and security for thousands of popular applications. We work on the most exciting Internet and grid technologies in the industry.

Advanced Analytics Technologies

We provide advanced analytical capabilities: data mining embedded in the database for predictive analytics and tight integration with open-source R for advanced statistical analysis. We build software solutions for data scientists and analysts, so we are experts in

statistics, machine learning, and operations research. The data mining component supports the entire workflow for data mining: a power user interface for creating analytical workflows; highly scalable, sophisticated data-mining algorithms operating directly in the database; and support for data preparation, data-mining model management, and efficient model creating and scoring. The Oracle R component integrates the open-source R statistical language into the database so that R programs can be executed against very large data sets stored in the database; we tackle challenges of scalability and integration to unlock the powerful expressive capabilities of R on the processing capabilities of the Oracle database. We are in Burlington, MA, and Redwood Shores, CA.

Advanced Queues, Automatic Storage Management

Oracle Advanced Queues (AQ) is the first database integrated messaging system providing a rich suite of features. We focus on new applications, new hardware architectures like multi-core and flash, and extreme performance and scalability. Oracle Automatic Storage Management (ASM) serves as a storage foundation for the Oracle enterprise software stack. We build tools to solve customer storage problems. Algorithms patented by the ASM Development Team provide balanced I/O even in dynamic storage configurations. ASM provides versatile protection against and efficient recovery from storage hardware failures.

ASM Cluster File System, Dynamic Volume Manager

New England Development Center

We design and develop Oracle's Cloud File System: The Automatic Storage Management Cluster File system (ACFS) and Automatic Dynamic Volume Management (ADVM) technologies for Linux, UNIX, and Windows platforms. Oracle ACFS is a scalable, single node and clusterwide file system and storage management technology that uses Oracle ASM functionality and supports customer general-purpose application files as well as all Oracle Database file types for single node, cluster, and Cloud configurations. Development projects focus on new features, scaling, high-performance, and file-system-based solutions for Oracle's customer applications.

Berkeley Database and Mobile Server

The Berkeley Database Team is responsible for the Oracle Berkeley DB product line and the Oracle Mobile Server. The Oracle Berkeley DB product line is a family of fast, efficient small-footprint open source storage engines designed to run within an application's process space and provide all standard transactional data services. Our team maintains, enhances, and extends these products, which are among the most widely used open source products in the world. We provide technology and support to application developers; implement in C, C++, or Java; and use our experience with database management and operating or storage systems internals. The source code for all Berkeley DB products can be downloaded from otn.oracle.com. The Oracle Berkeley DB product line includes three products: (1) The Berkeley Database, which is written in C and supports C++, Java, and many scripting language APIs, provides all standard transactional data services for applications. (2) Berkeley DB XML is layered on top of the Berkeley Database product and provides native XML transactional data services via XPath and XQuery interfaces. (3) Berkeley DB Java Edition is a 100 percent Java storage engine providing all standard transactional storage services.

Oracle Mobile Server provides critical infrastructure to enable enterprises to extend the reach of data and applications to mobile and embedded devices. It works with Android, BlackBerry, Windows Mobile, and other handsets. We provide a complete solution for

Projects at Oracle

capturing incremental changes and synchronizing data between a local client database (either Berkeley DB or SQLite) and the Oracle Server Database. While coding, we use knowledge and skills in C/C++, embedded device development, SQL, Java, and Web technologies, and encryption, compression, and database technologies. Writing highly optimized, low-memory footprint, object-oriented client software, and multithreaded, scalable, and reliable server code are our top objectives.

Big Data Technology

The Big Data Team is extending Oracle's database offerings with an exciting new generation of solutions, using Hadoop and NoSQL technologies to tackle new challenges in data management and data analysis. Oracle Big Data products include (1) Oracle Big Data Appliance, a high-performance hardware/software platform optimized for high Hadoop (using Cloudera's Distribution of Apache Hadoop) and Oracle NoSQL Database and (2) Oracle Big Data Connectors, a suite of software focused on integrating Hadoop with the Oracle Database and other Oracle products. Big Data Connectors allow big data that has been acquired and processed on Apache Hadoop to be loaded into or accessed from Oracle Database with extreme performance so users can analyze all data together.

Engineers on our team become experts in the Hadoop ecosystem, Oracle Database, and Oracle NoSQL Database. Keeping abreast of the Apache open-source offerings and other industry trends, we are building exciting new products as Oracle's customers extend their current database architectures to embrace Big Data.

Cloud Infrastructure Performance and Availability Management

As Cloud computing begins to pervade the enterprise, its infrastructure, based upon established grid technologies, needs to provide stable performance and availability to meet service-level agreements. This requires the collection, correlation, and analysis of accurate metrics and the application of workload and network models to ensure the optimum allocation and protection of virtual and physical resources in real time. We design and develop technologies that deliver this solution, including such products and features as quality of service management, cluster health monitors, and prediction-based active failure prevention. We work in demand and performance modeling, autonomic and elastic computing, and prediction-based learning algorithms to develop complete Oracle technology stack solutions for release in Oracle Database, Oracle Fusion Middleware, and Oracle Enterprise Manager products.

Cluster High Availability and Manageability

We are responsible for research, design, and development of high-availability, manageability, and diagnosability infrastructures and tools that help the cluster database server, RAC, and other Oracle products become easy to deploy, verify, diagnose, and manage on clusters. We work on distributed services, hierarchical clusters, cluster repository, cluster high availability, storage and network discovery, cluster verification, grid plug-n-play, clusterwide deployment, configuration, database server and cluster management, database administration, workload management, and monitoring and tuning of the Oracle clusterware and RAC, supporting a single-system image. We work with other Oracle divisions and many clustering groups and industry standards bodies.

Clusterware and Real Application Clusters

The Clusterware and Real Application Clusters (RAC) group is responsible for R&D of the clustering infrastructure and RAC Database, both key components of Oracle's private database Cloud architecture, on Linux, Solaris, Windows, and other Unix platforms. Private database Cloud enables customers to consolidate servers, storage, and database workloads onto a shared hardware and software infrastructure, providing on-demand access to database services in an elastically scalable manner. Oracle Clusterware allows clustering of independent servers so that they cooperate as a single system. Oracle Clusterware and Oracle Automatic Storage Management together provide Oracle's private Cloud infrastructure software (Oracle Grid Infrastructure), supporting Oracle RAC, Oracle Cloud File Systems, and other software. Oracle RAC is a cluster database with a shared cache architecture. Oracle RAC technology enables Oracle Database to achieve its highest levels of availability and scalability for all business applications. Most of our customers' largest mission-critical OLTP systems and data warehouses run on Oracle RAC today. We build security infrastructure to provide finer grain access control and provide encryption for data stored on secondary storage devices and automated key management for Oracle Cloud File Systems. We research and develop access control models to solve real-world problems such as internal threats and sensitive-data protection. We work on clustered filesystems, algorithms, and secure operating systems. This involves both user-level as well as kernel-level development work on a wide range of platforms, including Linux, Unix, and Windows.

Core Database Storage and Cache Engine

We develop the scalable, distributed, fault-tolerant database storage and cache engine that spans disk, flash, and RAM. The goal is to effectively exploit the storage hierarchy to allow low-cost, disk-based systems to perform like in-memory systems. The core engine consists of both a distributed memory cache for running large Oracle database on massively parallel clusters and Smart Flash-based caches that perform database-aware intelligent data caching using flash storage. In addition to having superlative performance, the core engine also supports powerful recovery capabilities such as Flashback that acts as a rewind button for the database, allowing us to rapidly bring the data to a prior point in time. The core storage and cache engine provides the foundation for all storage-related capabilities of the Oracle database. As hardware changes (hundred-core processors, exabyte memory systems, lightning-fast flash storage, and high-speed networking) force fundamental shifts in software architectures, our breakthroughs define next-generation storage and I/O architectures.

Data Rescue

We invent the next wave of disaster recovery and database restoration software to recover data in less time. We repair data before users know it was broken and protect data in all kinds of environments, both real and virtual. Using the latest in storage and database technology to create a secure, error-free operation with the guarantee of recovery in the face of disaster, we enable no data to be lost during minimal system downtime. Concurrency and scalability challenge us. We learn OS internals, database internals, storage, networking, security protocols, and Web services and are responsible for Oracle's existing data-protection products. We are also developing a game-changing, new data-protection system that will take data protection for Oracle databases to new heights of scalability and functionality. Our software is the last line of defense against data loss. We design and write software that will be used by hundreds of thousands of Oracle's customers when all else has failed.

Data Technology

Data Storage, Space Management, Transaction Processing

We design and develop the data storage and processing engine for the Oracle Database and the Sun Oracle Exadata Database Machine with focus on big data management and real-time in-memory analytics. To learn more about our recent innovations like compression and columnar technology, see one of CEO Larry Ellison's recent presentations. Our next-generation technology has been regularly featured as one of the Top 5 features in the database as published by external sources for three recent releases. We work on file systems and clustered-server systems, algorithms, and database technology. We develop new algorithms and then apply them in the world's most successful server product.

Data Storage Team

We design storage and access structures for the entire database, from bitmap indexes to columnar storage. From the constantly changing landscape of processor and storage technology to new application requirements (such as XML, media streaming, indexing), we provide technology leadership for the Oracle Database Server. We are building the world's fastest and most feature-rich filesystem and indexing technology. Recent efforts have been in areas related to compression, deduplication, encryption, sliding inserts for efficient XML storage, snapshots, filesystem caching and performance, and scalability in clustered server environments. The storage layer for the Oracle database is responsible for the storage and retrieval of all data stored in Oracle (relational, XML, OLAP warehouses, files). We organize data inside disk blocks, creating and managing efficient structures from which those blocks are accessed (such as a B-tree, bitmap index, LOB, cluster) and methods for accessing data from these transactional data structures. Our group has very hard, intractable problems to solve in distributed systems. We are also working on providing an intelligent storage subsystem so that the database can push predicate evaluation, projection, and aggregation to the storage layer, effectively pushing the logic to the data as opposed to pulling massive amounts of data to the CPU. Additionally, there are new row-major and column-major storage schemes that we need to design to cater to business intelligence for processing petabytes of information.

Space Management Team

People want to store everything on disks—books, pictures, health records, music, videos, everything. Disks are getting bigger. Disks are getting cheaper. But disks are not getting much faster or easier to manage. At the core of Oracle's business is our ability to store data and do it in a high-performance, scalable, reliable, and manageable way. Now consider that we need to do this just as well for an exabyte of data. Disk space management is a fundamental component of the RDBMS that provides an abstraction to the database storage subsystem. Disk space requirements for the database are primarily of two kinds—temporary scratch space required to store intermediate results generated in the database and persistent storage used to store user data. From managing the temporary space for sorting a terabyte data to finding the best slot in the petabyte volume disk for storing the next piece of employee payroll information, intelligent disk space management is one of the foundations for high-performance OLTP and data warehouse systems. Disk space management needs vary with different kinds of data stored in the database. Storing a streaming video has different requirements than storing the product item names. Developing an efficient storage management component that works for all data types and also scales for several hundred thousand concurrent users is one of the toughest challenges we face. We develop next-generation data management technologies at Oracle.

Transaction Processing Team

We develop the engine for the database and midtier transaction processing. We work on transaction locking, multiversion concurrency control, parallel and distributed coordination protocols, cache fusion protocols for clusters, self-learning undo management, and transaction recovery. We build next-generation technologies such as columnar store, transactional storage Web service, continuous query notification, flashback technologies, active database history, heterogeneous standby, and cluster transaction fusion. Ongoing and future projects are in the areas of continuous query notifications, clusterwide distributed transactions (transaction fusion), historical data store, flashback transaction, autocorrecting undo management, and application integration. We do systems-related work including areas of operating systems, databases, parallel and distributed systems, and midtier infrastructure. We also work on the database server kernel and design and develop cool algorithms.

Data Warehouse and Language Technology

We devise and implement technologies in data warehousing and business analytics so customers create, manage, and perform complex business analysis using very large databases. We build and enhance the SQL engine in the Oracle Database, including the algorithms used to implement fundamental database operations such as joins, sorts and aggregations. We also develop sophisticated SQL extensions; our engineers have developed many database concepts like window functions, partition outer join, and pattern recognition that have become part of the ANSI SQL standard. We provide capabilities for scaling to massive data sets: parallel execution (allowing SQL operations to scale across NUMA/SMP and clustered shared-nothing architectures) and database partitioning. We are responsible for the SQL Query Optimizer—a core component of the database for data warehouse applications and all types of SQL applications. We build other algorithmically complex components like Materialized Views, Access Advisors, and Database Designers—tackling difficult problems to help customers improve their SQL applications. We regularly publish papers in database conferences like VLDB and SIGMOD. Our group has been awarded well over 150 patents and has helped make Oracle the leader in data warehousing industry benchmarks like TPC-H. We are investing in emerging technologies for massive scalability, in-memory execution, advanced query optimization, and new processing models like columnar and vector processing.

Database Access

We provide functionally comprehensive, reliable, high-performance, secure, and highly available access to the Oracle Database from various client drivers, including proprietary, standards-based, and open-source drivers. We work on the high-level drivers, the Oracle Call Interface (OCI) layer, the Oracle wire protocol (TTC), and highly scalable server-side protocol handlers that together connect an application written in any language securely to the Oracle Database Server to provide full-featured access to the Oracle Database. To name a few, the consumers of the Database Access components include the JDBC, ODP.Net, PHP OCI8 extension, ruby-oci8, Perl DBD::oracle and Python cx_oracle, various Oracle tools such as SQL*Plus, Real Application Testing (RAT), SQL*Loader, Data-pump, and numerous applications both inside and outside of Oracle such as Peoplesoft, Hyperion, Siebel, and SAP. The Oracle Database itself is a consumer of our components for talking to other Oracle Databases for Distributed SQL, Standby Database, and Replicated Database scenarios. We work on a variety of challenging database problems. The work we do has resulted in a large number of patents awarded to members of the team. The close interaction of the database access layer with other components enables us to also gain significant exposure to the internal workings of other database kernel components.

Projects at Oracle

Our products include the Oracle Call Interface (OCI), Oracle C++ Call Interface (OCCI), C/C++/Java/Cobol Precompilers, Open Database Connectivity (ODBC), Oracle driver for the statistical language R, and SQL*Plus. We also contribute to some of the open source drivers for Oracle Database.

Database Cloud and High-Availability Development

We develop high-availability technologies for single and replicated databases. Within a single database, we are responsible for the core recovery engine that ensures your data persists through failures. This recovery engine is also a key component of Active Data Guard, our replication technology for high availability. Active Data Guard is used by customers with thousands of databases, petabytes of storage, and dozens of data centers distributed worldwide. Active Data Guard is tightly integrated with the database engine for ultimate performance. And we are constantly innovating to ensure that Active Data Guard continues to offer superior fault detection, fault prevention, and automatic repair. The problems we attack involve performance, concurrency, and absolute correctness even in the face of failure.

We are also designing and building a groundbreaking database Cloud architecture that will make a globally distributed set of replicated databases appear to database clients as a highly available and scalable virtual database. This new architecture will optimize the performance of applications through intelligent use of globally distributed resources. It will also automate and centralize the configuration, maintenance, and monitoring of a database Cloud.

Database Development Tools

We provide the tools that enable developers to productively create database-centric applications. Our popular products are the on ramp to Oracle Database, helping developers to easily make use of powerful Oracle Database features. Oracle Application Express is the technology that powers the Oracle Store (shop.oracle.com). Sign up for a free account at apex.oracle.com. Oracle SQL Developer is our tool for IDE for database development, and it is used for a wide variety of purposes, including writing, testing, and debugging SQL and PL/SQL. Oracle SQL Developer also contains tools for migrating third-party databases to Oracle, unit testing PL/SQL code, and copying and comparing databases. With Oracle SQL Developer Data Modeler, users can visually create a logical and physical database design and then implement it by generating the commands needed to create a physical database. The Application Express Listener enables the database to be accessible from mobile devices by providing RESTful access to the Oracle Database. Our developers work across the US, Ireland, India, UK, and Australia. We use C, Java, JavaScript, CSS, HTML, XML, SQL, PL/SQL, and SVG.

Database High Availability and Recovery

We are responsible for developing core technologies that underlie Oracle's high-availability solutions such as clusters and standby databases. Our goal is to either prevent failures or ensure that we can recover from all causes of failure—be they system failures, data failures, human error, or disasters. Some projects that we work on include self-healing systems, subsecond recovery of a database after a system crash, flashback technologies that can rapidly repair a damaged database, and parallel recovery. Our code has to be reliable; lifeline software is code that must work even when the system is failing. The software must also perform well during recovery situations and impose minimal overhead during normal operation. For example, our designs must scale on multiprocessors containing hundreds of CPUs as well as clusters of many computers. And, our software must be easy to use.

Database Resource Manager

The Database Resource Manager provides DBAs with the ability to manage how multiple workloads use server and storage resources (database CPUs) by specifying workload priorities, resource allocations, and utilization limits. Resource Manager schedules database processes, much like an operating system scheduler. It also manages use of the disks for Oracle Exadata storage through a sophisticated I/O scheduler. For future releases, we need to control resources such as memory, internal caches, I/O for non-Exadata storage, parallel statements, and more. We therefore devise sophisticated, innovative algorithms portable across different operating systems and different server and storage platforms. We work intimately with today's server and storage technologies, operating systems internals, and OS workload managers. Implementations should have minimal overhead and include optimizations for specialized environments like clustered databases, virtual machines, and NUMA systems. We develop on both Oracle Database and Oracle Exadata. We make Resource Manager a go-to product for all QoS and resource management needs. Developers also benchmark workload scenarios, publish best practice papers for customer use, and interact with hardware and software vendors to address platform or vendor-specific challenges and roadmaps. We analyze and problem solve using operating system and storage system fundamentals, performance evaluation and tuning skills, and C or C++.

Database Security

Not only do hackers attack databases that contain data about business assets, customers, and citizens, but sometimes even privileged insiders siphon off the databases for their own personal gain. Building detective and preventive database security technology is challenging, especially when one considers the existing installed base of applications and business processes. We have been the first ones to innovate in areas of authorization, auditing, and encryption in databases. We build transparent data encryption, redaction, masking, virtual private database, and real-time audit warehouse. We also control the privileged insiders. We work in database firewalls, network monitoring, intrusion detection, key management, secure configuration, and many security protocols such as Kerberos and SSL. We integrate with applications, application servers, identity management, and operating systems to create a secure end-to-end platform. We are passionate about building innovative security solutions that scale, perform, and, most importantly, stay far ahead of hackers and malicious insiders.

Database Server Manageability

We develop a self-tuning, self-diagnosing database, designing technologies in the database kernel so that the database can manage itself out of the box. We have developed technologies in Oracle Database to automatically speed up execution time of a SQL and to self-diagnose performance bottlenecks in slow-running systems (even high-powered clustered database environments). We cover cross-tier performance diagnostics, automated self-tuning for emergency situations, and building data interfaces for innovative UIs to empower DBAs to navigate performance data captured in the database.

Database Test and Productivity Tools

We predict customer expectations, simulate real-life problems, and test and ensure that customers get the highest-quality database servers and clients. We work on upcoming releases of Oracle, enveloping technologies including RDBMS, security, XML, RAC, data access, data warehousing, Cloud computing, Exadata, Big Data Appliance, replication, Oracle GoldenGate, gateways, advanced queuing, messaging, multimedia, data storage, backup, recovery, high availability, Net Services, JDBC, UCP, OCI, COM+, and .Net. We also focus on design

and development of various productivity tools, such as measuring database server code coverage or identifying memory leaks and security holes. We work closely with development and product management teams. We learn new technologies while reviewing functional and design specifications, validating new Oracle database features by developing applications that simulate expected usage scenarios, and developing tools as needed. We also ensure high quality in existing database features.

Database Upgrades and Utilities

New England Development Center

Nearly every Oracle customer has a need to move huge volumes of data at extreme speeds into, between, or within Oracle databases—and this is the group that makes it happen. We work with technologies such as Hadoop, RAC, and multiple varieties of parallel processing to achieve world-leading performance and help customers meet mission-critical processing demands. A dynamic branch of Oracle Product Development, the New England Development Center is located one hour north of Boston in Nashua, New Hampshire. At this software development center, hundreds of developers work on all facets of many Oracle products using a variety of technologies discussed throughout this book.

Enterprise Replication

We deliver the base platform for our logical replication products, including Oracle GoldenGate, Oracle Data Guard Logical, XStream, LogMiner, Oracle Audit Vault, and Oracle Change Data Capture. As a systems and replication R&D team, we solve problems in systems and invent new enterprisewide solutions using replication technology. Future projects include building a highly scalable, reliable platform for deploying Oracle GoldenGate, secure authentication, encryption, obfuscation, a massive parallel apply infrastructure for any database (for example, Oracle, SQL Server, DB2), zero-downtime application/database upgrades, database consolidations and hardware migrations, and extensible infrastructure for supporting operating system platforms and database vendors. GoldenGate is a key technology for moving and synchronizing information in the Cloud and making the Cloud elastic.

Exadata

With Exadata, we are integrating hardware design and software design to create a new platform for running the Oracle database that provides the world's best performance for both OLTP and data warehousing. We use grid architecture, flash storage, InfiniBand networking, and smart scale-out storage. We want to populate the disk farm or grid with intelligent appliances that are inexpensive, maintain data redundancy for each other dynamically, spread workload amongst each other without the intervention of administrators—even as appliances, or drives within, are added or removed from the grid. It's designed for exabytes. We are making these appliances application-aware, and we are offloading a lot of grunt work from our most important application, the database engine, and giving it to these now-smarter storage appliances to do so much more efficiently with the disk drives plugged into them.

In a hands-on hardware and software environment, we use these technologies: SAS, SATA, SSD, FLASH, SES, SAF-TE, SMART, IPMI, I2C, Java EE, SNMP, RDS, C/C++, IB, UDP, HA, LVM, RAID, 10GE, TOE, RDMA, CHAP, IPsec, OFED, SDP, IPoIB, Linux, Solaris. We work in layers ranging from operating systems up to SQL planning and execution in parallel clustered environments. We experience a wide architectural range. We also use Web technologies for systems management functions.

Manageability & Diagnosability Infrastructure

Our team's goal is to create a self-managing and self-diagnosing database. We develop the infrastructure that supports that goal. For manageability, we have provided features including a repository that automatically collects run-time performance data with minimal impact to the actual performance of the database. Automatic advisers use this repository to provide tuning recommendations to users. We provide a diagnosis engine that provides dynamic, flexible first-failure analysis of software errors. Other Oracle products such as Oracle Fusion Middleware and Fusion Applications also use our infrastructure, making us key to the entire enterprise technology stack. We solve problems in concurrency, multithreading, efficient access to shared resources, portability, and tight integration with the Oracle Virtual OS layer.

Maps and Spatial Location-Based Technologies

New England Development Center

Oracle's database system supports spatial objects as native concepts within a database. Oracle Spatial stores and manages geometries, such as points, lines, and polygons. It indexes geometries with fast R-tree structures. Oracle Spatial supports numerous spatial operators. It supports spatial maps for Java and Ajax-based visualization and embedding of enterprise data within maps. Technologies continue to evolve to include spatial analysis, georaster imaging, 3D data structures (point Clouds, TINs, DTMs), and location-enabling of Oracle's packaged applications and BI offerings. We use C, Java, XML, and SOA Technologies. Oracle Fusion Middleware MapViewer is a Java EE map server that supports advanced interactive and thematic mapping capabilities and Web map services with Java and JavaScript APIs. For maps and spatial development, we work on geospatial data management, location-based technologies, map visualization, and operations on maps.

Multimedia, Medical, and GeoSpatial Imaging

New England Development Center

Oracle Database has native support for image and other multimedia content, including common document image formats, the medical imaging standard DICOM, and geospatial imagery. DICOM, or Digital Imaging and Communications in Medicine, is widely used by clinical and research institutions, along with pharmaceutical companies. For example, customers may need to develop large repositories of DICOM content, from CTs to MRIs, x-rays, ultrasounds, pathology images, and more. Using C, Java, XML, database, and application server technologies, Oracle is developing native database capabilities both to meet the requirements of users of DICOM and to address the needs of geospatial imaging use cases (raster, remote sensing, aerial and satellite imaging) through Oracle Spatial GeoRaster technology. GeoRaster is used with data from any technology that captures or generates raster data and images, such as remote sensing, photogrammetry, and thematic mapping. Visit oracle.com/technology/products/multimedia/index.html and oracle.com/technology/products/spatial/index.html.

Net Services

We provide network programming interfaces (NPIs) used by products throughout Oracle. Some major consumers of these NPIs are data access, distributed databases, heterogeneous services, and RAC users. Every client/server or n-tier interaction in Oracle goes through the network layer. We provide networking expertise to developers and various divisions in Oracle and work with OS/hardware vendors to enhance database connectivity, scalability, and security while achieving high network throughput on a broad variety of platforms and

Projects at Oracle

exploiting new technologies. We constantly evaluate the latest networking and OS technologies, such as InfiniBand and IPv6, and incorporate them into the Oracle network layer. The network stack provided by our group is portable. It transparently integrates a wide variety of clients, servers, gateways, and network protocols to deliver a conglomerated information resource. This network stack includes support for several services critical to effectively managing large-scale, enterprisewide, distributed computing environments. The network stack spans various OSI model layers. We cover Session Layer Abstraction and Transport layer. The OSI application level components provided by our group include the Listener and Connection Manager.

NoSQL Database

Oracle NoSQL Database is the newest addition to Oracle's rich offering of enterprise-quality data management software. It is a distributed key-value store with elastic scalability, built-in high availability, ACID transaction properties, scalable throughput, and predictable response time. It is written in Java and uses Berkeley DB Java Edition for local storage on individual nodes. We are extending the system to support secondary indexes, query capabilities, and parallel search. Oracle NoSQL Database is part of Oracle's Big Data initiative. It is tested and certified on Oracle's Big Data Appliance, as well as on standard commercial hardware. Oracle NoSQL Database is offered under an open source license and a commercial license.

Online Analytical Processing (OLAP)

The OLAP Option provides a multidimensional engine embedded in the Oracle Database. Oracle OLAP enables advanced analytic calculations and dramatically enhanced query performance for business intelligence applications. This is the only OLAP technology in the world that is embedded within an RDBMS and blends relational and dimensional models with support for SQL query of multidimensional cubes. We are responsible for a multidimensional, analytical engine that employs advanced indexing for sparse data sets and supports complex business calculations, a rich metadata object model to represent multidimensional objects in the Oracle Database's dictionary, and GUI extensions to Oracle SQL Developer to manage OLAP objects. We work in Burlington, MA.

PL/SQL and Compiler Technologies

The PL/SQL Team provides complete programming language systems for application development, debugging, and performance tuning in the Oracle database. We build languages, compilers, and virtual machines. We create grammars, parser generators, compilers, code generators, optimizers, byte-code interpreters, debuggers, and developer tools. We write and manage large utility libraries. We must minimize application and database downtime, parallelize applications, exploit distributed systems, develop new language features, improve application performance, and increase developer productivity. We solve real-world problems with unique computer language design and compiler tools.

Some of our recent projects include online patching of application code and data; native code generation for PL/SQL (popular chips and platforms); PL/SQL Conditional Compilation (so developers manage one body of source for deployment on many platforms and versions of the Oracle Database); and hierarchical PL/SQL performance analysis. Future work includes profile feedback code optimization, support for event-based programming, support for XML and XQuery embedded in PL/SQL, a development framework for SOA applications, introduction of other language features, and additions to the SQL language. Most development is done in C and PL/SQL on Linux.

Replay Technologies and Workload Intelligence

Adoption of new technology can be cumbersome and risky. The Oracle RDBMS provides effective tools to help with new technology adoption. We have developed technology that allows the recording of production workload containing the full content of real user interaction with a company's IT infrastructure. Using the production workload, our features in Oracle Database allow the replay of the user workload on a system that represents the new technologically more advanced system. Repeated replay sessions can identify and remedy problems. We work on features such as Database Replay and SQL Performance Analyzer. Individuals are involved in the entire development process, from research to design, coding, and release.

Semantic Web Database Technologies

New England Development Center

Semantic Web database technologies make data smarter, allowing machine-driven understanding of the relationships between data and discovery of new relationships. The W3C has introduced languages to standardize the representation, vocabulary, inferencing, and querying of relationships in the data. Oracle Database provides native semantic data-management capabilities. Work is ongoing with C, Java, XML, SOA, database and application server technologies, and W3C standards. Our developers are familiar with W3C graph data languages, including RDF, OWL and SPARQL; reasoning, including first-order logic and description logic; network analytics, visualization, and management of graph data; and domain ontologies, taxonomies, and vocabularies.

Server Technologies Performance

We help make Oracle the world's fastest database. We focus on database algorithms but also investigate operating system, compiler, and hardware issues that affect database performance. We look at all kinds of workloads, including transaction processing, decision support, data mining, OLAP, ERP and CRM applications, Java, and customer workloads. Our projects range from path-length optimizations to algorithm changes that allow Oracle to scale well on the largest systems. We also produce performance-related white papers and demonstrate record-setting benchmark results. We work with the latest hardware architectures—SMP, MPP, NUMA, or clusters—using the most sophisticated database technology.

SHARP

Team SHARP (Scalability, High Availability, Reliability, Performance) focuses on improving scalability, high availability, reliability and performance of Oracle Database Server products, Engineered Systems (Exadata, Exalogic, SPARC Super Cluster, Big Data Appliances), Oracle Fusion Middleware, Oracle Fusion Applications, and Oracle Public Cloud by designing, developing, and carrying out highly concurrent stress, integration, system, and performance tests simulating complex real-world scenarios. We discover critical product defects and work with development groups to resolve them to ensure the highest-quality products.

Text

We develop Oracle Text, part search, information retrieval, and natural language processing platform for Oracle Database. With Oracle Text, users easily and quickly develop applications ranging from keyword search to automatic e-mail response. Oracle Text technology is used today by customers including e-commerce, intelligence agencies, data warehousing, text mining, content management, and enterprise search. As a platform, Oracle Text includes

Projects at Oracle

technologies from full-text indexing to natural language processing, entity extraction, data mining, relational and hierarchical data modeling, document format conversion, ontology, and visualization. We work on faster full-text search and graph search algorithms, advanced natural language processing, and more machine learning-based solutions like information filtering for personalization and recommendation.

Visit oracle.com/technology/products/text/index.html.

TimesTen In-Memory Database

Oracle TimesTen is the industry-leading in-memory database management system. It is deployed by thousands of customers requiring microsecond response times and millions of transactions per second. It is the underlying relational database for the Oracle Exalytics In-Memory Machine designed for real-time analytics. Oracle TimesTen can be deployed as a standalone database or as a scale-out distributed cache against a central Oracle database, allowing in-memory processing for many terabytes of data. You can think of Oracle TimesTen as a high-performance turbocharger on top of the sophisticated Oracle database engine to greatly accelerate Oracle applications. We work on the next-generation in-memory data management platform featuring data distribution across very large clusters. There are many focus areas in this effort, including query optimization, new memory-optimized storage mechanisms, new indexing mechanisms, new compression schemes, distributed query and transaction processing, fast recovery, new APIs, and management mechanisms.

Virtual Operating System

We build modules that provide process/thread management and scheduling, memory management, synchronization support, CPU and I/O resource management, intercluster and interprocess communication, high-performance file I/O, and more. We ensure Oracle Database is a market leader on all platforms, from clustered Linux blade servers to the largest NUMA servers. We define interfaces to the platform-specific layer that exploit OS-specific functionality, such as NUMA-aware memory allocation, dynamic reconfiguration, user-mode threads, and virtualization. Our evaluations of leading technologies such as InfiniBand as a high-throughput, low-latency interconnect and leading-edge microprocessors such as Niagara, Power, and IA-64 often lead to enhancements that result in record TPC benchmark results. We work with operating system and storage vendors to introduce new interfaces for Oracle Database. We collaborate with hardware/OS/storage vendors to understand their roadmaps and to propose improvements that lead to better database performance and functionality. Our developers interface with other database developers to gather requirements for improving the database kernel, designing and developing kernel modules to introduce new functionality or improve performance, collaborating with OS/hardware vendors and the performance group on high-profile benchmarks, and providing systems expertise to the Database Division. We analyze and problem solve using skills in operating systems and computer architecture coursework, C, and C++.

Windows Technology

We design and build various features for Oracle Database on Windows platform and make it easy for Microsoft developers to use Oracle Database. We make Oracle a well-integrated product with Windows OS and .NET technologies; develop Oracle Data Provider for .NET, which is a highly scalable and available data access driver that is fully integrated with Oracle database technologies; and focus on providing tight integration with Microsoft Visual Studio and Oracle Database for doing complex application development with ease. We work closely with several companies to solve real enterprise issues and also work closely with several

groups at Microsoft to make sure Oracle has the best database solution for Windows and .NET. Responsibilities include evaluating Microsoft .NET technologies and operating systems; performing competitive analysis, defining product direction, and rolling out Windows products; designing and developing new products and components and taking advantage of Microsoft .NET technologies; and interacting with documentation and QA teams. We use C/C++ and strong software design skills.

XML Database Group

Our team extends database technology to manage and access XML documents. Programming in Java and C, we provide multiple methods for storing XML in the database (as binary XML objects or as XML views over relational tables); advanced indexing methods for XML objects; an XML Repository that allows access to XML content using a file/folder paradigm via SQL, FTP, HTTP or WebDAV; XML schema validation; and support for XQuery. We are currently working on projects including semantic-Web-based information grids, enhanced XML indexing techniques, and advanced XML-based search technologies.

ORACLE TECHNOLOGY DEVELOPMENT: FUSION MIDDLEWARE

Fusion Middleware continues to be among the fastest-growing product areas at Oracle and is also the development platform for the next-generation Fusion Applications. Oracle has focused on delivering a full-featured, top-quality, open, modular, modern infrastructure and set of tools that is the foundation for applications delivering strategic business value. This platform is used in Oracle's current and planned application portfolio and has been adopted as a standard by many. Oracle Fusion Middleware is also the foundation for Oracle Cloud services. With Oracle Fusion Middleware, organizations can enhance productivity and simplify and improve IT environments. This can even be used with another vendor's products to deliver innovations in the software infrastructure space.

We focus on Cloud computing, extreme transaction processing with engineered systems, social network and mobile computing in the enterprise, and support for real-time insight and big data. Oracle stands out for openness and standards support. We also have a commitment to natively support a mixed IT environment including third-party components instead of Oracle ones (for example, run natively on third-party application servers, messaging systems, directories, and so on). We are committed to heterogeneous systems.

In the Fusion Middleware Division, we work on Application Development Tools, Application Server, Business Analytics, Customer Experience and User Engagement, Service Oriented Architecture, Java, and Security and Identity Management products.

Oracle Application Development Tools

Tens of thousands of the most successful companies worldwide use Oracle's development tools and base their applications on Oracle's Application Development Framework (ADF) so they can rapidly develop and maintain their critical business applications. Oracle's development tools also form the basis of Oracle Fusion Applications. The key development centers outside of Silicon Valley include Burlington, Massachusetts; Denver, Colorado; and Reading, UK. Across these centers, developers work on many areas of development and research. For example, we work on the Oracle IDE family, which includes three distinct Java-based development tools: Oracle JDeveloper, NetBeans, and Oracle Enterprise Pack for Eclipse. Oracle ADF is a unique Java EE framework that makes Enterprise Java and service-oriented development

accessible to the broader application development community. Oracle ADF is used by many large corporations and is the cornerstone of the Oracle Fusion Architecture.

We cover the following areas:

Projects at Oracle

(1) *User Interface Development.* Oracle's primary technology for Rich Enterprise Applications is based around the JSF standard, and our team produces components for rich interactive user interfaces with the ADF Faces rich client components, Apache Trinidad, and the ADF Data Visualization components. This toolset provides powerful charts, mapping components, pivot tables, schedulers, calendar controls, active data, and much more. We do modern Web UI development using Java, Javascript, Flash, Ajax technologies, and DHTML.

(2) *Mobile Solutions.* Oracle ADF Mobile enables IT organizations to take advantage of existing expertise in Web-based and Java development by adopting a hybrid application architecture that brings together HTML5, Java, and server technologies integrated in a cross-platform container running natively on mobile devices.

(3) *Desktop Integration.* We marry the disparate worlds of C# and Microsoft Office development with standards-based Java Business services and Java EE programming, allowing developers to extend the functionality provided by a Fusion Web application to desktop applications such as Microsoft Excel.

(4) *Object-Relational Mapping, Bindings, and Task Flow.* A key part of any enterprise framework is the glue bringing architectural layers together. We work on data access and process control.

(5) *User Experience and Developer Productivity.* Sometimes developers need a little support; we work on team collaboration and continuous integration to provide the tools to help automate and simplify those little tasks that developers would rather not do. And our extensive User Experience Team works on product usability and design.

Oracle Application Server: Cloud Application Foundation

Coupled with the power of Oracle Database, Oracle WebLogic Server 12c and Coherence are a reliable, scalable, and secure middle-tier application server infrastructure designed to run business applications in on-premise private Clouds on engineered systems like Exalogic and in public Clouds such as Oracle Cloud. Oracle WebLogic Server 12c is based on a powerful, scalable Java EE 6.0 infrastructure server and provides an integrated environment for development, deployment, and management of enterprise applications. It includes a built-in in-memory data grid using Oracle Coherence for massively scaling out reliably and predictably while enabling workloads with high performance and throughput.

Designed for Cloud computing, Oracle WebLogic Server 12c and Coherence are the key components Cloud-enabling Oracle Fusion Middleware, Oracle Fusion Applications, and Oracle Exalogic Elastic Cloud and are fundamental underpinnings of the Java Cloud Service in the Oracle Cloud. Oracle WebLogic Server 12c conforms to existing (and evolving) standards such as Java, Java EE and drives, uses, and contributes to open source efforts and standards from GlassFish Server, Spring, Eclipse, and Apache. We not only work with cutting-edge underlying technologies, but we also work on areas such as high availability (reliability, availability, and scalability), transactions, security, and performance to ensure WebLogic Server continues to differentiate itself for applications based on quality of service.

A key part of the application server solution is GlassFish Server. This is the premiere open source-based Java Application Server and also Java EE 6.0 reference implementation. We drive forward the industry's number-one commercial application server with WebLogic Server and also execute on Oracle's vision of Java EE in the Cloud with Java EE 7 and Java EE 8.

Projects at Oracle

Cloud Application Group: Application Server Products

We develop the Java and Web tier server infrastructure for Oracle products, including database and middleware. For middleware, we deliver the core Java EE 6.0 container, the Web services and SOA infrastructure, the reliable in-memory data grid infrastructure Coherence, the TopLink Object Relational mapping framework and tools, as well as the traffic management and HTTP server infrastructure with Oracle Traffic Director and Oracle HTTP Server. For Oracle Database, we deliver the Oracle JDBC drivers that implement the latest JDBC specifications and Oracle-specific extensions to support Java persistence on Oracle Database; the embedded Java VM runtime to support Java in the database; and the Universal Connection Pool to support all Java connections types, as well as furnish high availability, load balancing, and connections affinity in RAC and Data Guard environments. We drive open source projects and strategy in the Java world (such as GlassFish Server for the Java EE standard overall, EclipseLink and Eclipse Dali for JPA in Eclipse, Java EE server and Coherence integration with Spring). We also work closely with other companies such as Microsoft, Redhat, IBM, and SAP in defining and establishing standards in the areas of Web services and interoperability. Finally, we coordinate with multiple teams across Oracle.

Business Analytics and Exalytics

Business Intelligence (BI) has rapidly become a critical component for all software solutions by enabling customers to make better informed and on-time decisions. We are focused on delivering comprehensive BI technologies and solutions. With the Oracle Business Analytics product line, end users consume rich analytical data and make decisions while in the office or on-the-go. End users have ubiquitous access to data through interactive dashboards and scorecards, rich ad hoc query and analysis, proactive and actionable alerts, real-time predictive intelligence, and mobile analytics. Our solutions are a core component of Oracle Fusion Applications, Enterprise Performance Management Applications, Industry Applications, and Cloud applications.

Some of the product lines we develop include Oracle Business Intelligence Enterprise Edition (OBIEE), Exalytics, Essbase, Endeca Latitude, Secure Enterprise Search (SES), and Mobile BI. We design, develop, and implement our products using a large variety of technologies, including Java, C++, Flash, HTML5, and XML. We create clean, extensible, object-oriented designs and implementations for partner and customer advantage.

Oracle Business Intelligence Enterprise Edition (OBIEE) is a BI platform delivering analytic and reporting capabilities and is central to the BI offerings. Exalytics is a true in-memory engineered system for analytics continuing to extend BI to broader user communities with speed-of-thought response times, increased functionality, and ease of use. Exalytics takes advantage of the Oracle TimesTen in-memory database and an in-memory version of Essbase OLAP database. At the center of Exalytics is a heuristic adaptive in-memory cache that adapts to changes in the analytics work load and determines what should be stored in-memory. Exalytics works with many of our other BI offerings and also integrates directly with Oracle Exadata via the Oracle InfiniBand high-speed network interconnect.

BI applications are prebuilt analytical solutions built on top of the OBIEE platform allowing customers to rapidly deploy a data warehouse solution with best practice areas of analysis.

Projects at Oracle

Essbase is an OLAP (Online Analytical Processing) server for multidimensional analysis. Users rapidly analyze multidimensional data and model extremely complex scenarios. Endeca Latitude is an agile BI platform that guides users to better decisions and data discovery with diverse, unstructured, and changing data. Oracle Secure Enterprise Search (SES) lets users locate associated data and analysis in a secure, quick way while also maintaining organizational security and visibility rules. Mobile BI applications extend BI analysis to tablet and mobile devices like iPad.

We work globally with customers. We have experience in relational and multidimensional data structures and systems, as well as object-oriented design and well-designed, extensible, reusable components. We design, develop, and implement our products using a large variety of technologies, including Java, C++, Flash, HTML5, and XML. We emphasize teamwork to create clean, extensible, object-oriented designs and implementations delivered to our partners and customers for competitive advantage.

Customer Experience and User Engagement

Our WebCenter software products enable next-generation user experience and engagement. From highly personalized content delivered via multichannel delivery to collaborating in real-time with friends, coworkers, customers, and partners, the Customer Experience and User Engagement products include Oracle's software solutions for enterprise and intranet portals, enterprise content and document management, Web experience management, and enterprise collaboration.

We help design and implement Oracle's user-interaction products, setting user experience directions for Oracle and the software industry. We use the latest Web 2.0 and Java EE technologies, and we lead and participate on several industry standards groups, including JSR-168 & 286, WSRP, JSR-170, CMIS, JSR-227, OpenSocial, and OpenStream. Development projects range from technical infrastructure projects requiring architectures focused on performance, scalability, and security to projects that revolve around solving complex user interface challenges by using the latest JSF, JSP, and component UI technologies. Developers design and implement functionality that will ultimately reach customers through a service oriented architecture (SOA)-based development framework, a set of RESTful interfaces, or a set of APIs used through tools and applications.

WebCenter portals and applications allow users to interact directly with services like instant messaging, documents and content, activity streams, discussion forums, wiki and blogs to form social networks within organizations and across partner and customer communities. The user can easily share information and tag or link information. Commenting and rating what people share provides users with real-time recommendations and makes use of a rules-based personalization engine. We also deliver a set of mobile interfaces, including our iPhone and iPad Spaces application, for sharing information on the go.

Oracle Enterprise Content Management (ECM) is our unified content management platform providing all aspects of ECM—document management, Web content management, digital asset management, records management, and image management—within a single application. Using the service-oriented architecture of the Oracle content management platform, organizations can manage, secure, and retain critical information. Our developers understand Oracle Fusion Middleware technologies and methodologies (Java, Java EE, JSF, XML, SOA).

The Oracle Social Network Team develops mobile, tablet, Web, and desktop clients on top of our highly scalable real-time server using and pushing the latest technologies to their limits. We build simple, elegant, and clean solutions for getting teamwork done efficiently

in a modern social environment. Oracle Social Network provides the social collaboration solution within Oracle Fusion Applications. Our developers deliver rapidly evolving software through the Oracle Cloud in a software-as-a-service environment.

Exalogic

Projects at Oracle

The Exalogic Elastic Cloud is an integrated hardware and software system designed to provide the best platform for Oracle business applications and Fusion Middleware. It is designed to support Infrastructure-as-a-Service (IaaS) deployments, in which application owners consuming datacenter resources (compute, memory, storage, networking, security) manage their deployments without knowing details of the physical datacenter infrastructure underneath. Conversely, the experts managing the physical datacenter may perform day-to-day work installing, upgrading, and maintaining physical systems without needing to coordinate with the application owners or to be aware of the application lifecycle. Exalogic is designed around the principle of scale-out, grid architecture and uses advanced technologies like sub-LUN tiering with flash solid state memory, InfiniBand-based Remote Direct Memory Access (RDMA), type I hypervisors with Single Root I/O Virtualization (SR-IOV) and advanced heuristics and system-level self-diagnostics/self-healing.

Exalogic is a complex system built by integrating other products, and in the course of that integration, optimizing and enhancing those products so that they offer peak performance and utility in the context of an Exalogic deployment. Exalogic drives projects in areas ranging from performance and reliability architecture development to storage, networking, virtualization and management innovation. Exalogic is a core platform for the Oracle Public Cloud and is extensively used with Oracle as a platform of choice for internal IT and for peer produce development. Key Exalogic technologies include SAS, SATA, SSD, FLASH, SES, SAF-TE, IPMI, Java EE, SNMP, RDS, C/C++, IB, UDP, HA, LVM, RAID, 10GE, TOE, RDMA, CHAP, IPsec, OFED, SDP, IPoIB, Linux, Solaris, RDMA, SR-IOV, IaaS, PaaS, SaaS, OpenStack/CloudStack, TCP, UDP, EoIB, IPoIB, VLAN.

Fusion Middleware Platform Product Management

Our team defines the product strategy, cross-platform common architecture concerns and the product lifecycle of Oracle Fusion Middleware. We define go-to-market strategy, including sales initiatives such as cross-selling into users of other Oracle products. We develop product positioning, product packaging, and pricing for product suites and bundles. We work closely with customers and partners to gather feedback for our developers. Feedback is converted into requirements for developing the next release of our product. Product managers recruit customers and partners for the beta program and coordinate customer training and beta testing. When the product is rolled out, we present product positioning to customers and partners through a variety of channels. We use project planning, management, execution, and communication skills; have a strong grasp of Internet and related languages/technologies like Java, XML, SOA, and BPM; and understand middleware, Enterprise Java, and application integration. We work closely with analysts, press, and other external influencers to evangelize the Fusion Middleware platform. We also coordinate cross-platform competitive analysis for the primary Fusion Middleware competitors—both to support the product teams and guide sales teams to compete better with other platform vendors.

Integration Products

Oracle develops many products focused on data integration, from Business Process Management to Oracle Event Processing and Service Oriented Architecture products.

Business Process Management (BPM)

BPM is all about managing the efficiency and effectiveness of business processes throughout the organization by modeling, automating, managing, and optimizing any business process. At core, BPM is about ensuring that the line of business has the capabilities to perform the bulk of these activities themselves. BPM projects typically run a spectrum from process automation focused on human workflow and the use of Web forms to combining human workflow with system-to-system integration. We have developed the most comprehensive software product for BPM. Oracle puts the power of Fusion Middleware into the hands of business users to rapidly implement projects that don't require deeper system integration. Our new BPM products are based on open standards, provide extensibility and reusability using Web services/XML, and take advantage of all the benefits of an SOA-based composite application. Oracle BPM Suite is offered via user-friendly process modeling tools, a process engine based on BPMN and BPEL4people standards, process portals using modern Web technologies including support for mobile devices, rich process monitoring, and the use of event processing for process optimization and analytics. We participate in new product initiatives, learning the latest Web technologies and standards.

Oracle Data Integration

Our products are central to Oracle's data integration and data warehousing platform. Oracle's products for data integration include Oracle GoldenGate (OGG), Oracle Data Integrator (ODI), Oracle Warehouse Builder, Oracle Data Quality, Oracle Data Profiling, and Oracle Data Service Integrator. At the heart of these solutions, ODI automates and simplifies integration of data from an array of sources and enables users access to the data warehouse platform through a Java-based GUI. Oracle GoldenGate supplies real-time data integration capabilities enabling businesses to ensure maximum availability of their databases and up-to-the-second accuracy of their data warehouses. OGG and ODI ensure information quality, metadata management, and data modeling. Because these solutions integrate with many core database features, our developers learn technologies including database features such as partitioning, parallel load capabilities, Oracle RAC, analytic SQL, OLAP, and data mining. Oracle's Fusion Applications also use ODI and OGG. We develop Oracle data integration products using Java, C++, and the latest technologies. We also use SQL, PL/SQL, UML (Unified Modeling Language) object modeling, HTML, and XML technologies.

Oracle Event Processing (OEP)

OEP is a critical part of Oracle's integration products and is being developed on Linux using Java. OEP is an approach that correlates and aggregates information from distributed and seemingly unrelated event streams in real time to discern patterns and trends that would otherwise go unnoticed. It can be used to correlate, aggregate, enrich, and detect patterns in real time over high-speed streaming data. Currently, OEP is hot in a variety of research settings and is rapidly becoming a critical infrastructure with a broad range of applications across technology (examples include BAM, RFID, and security) and industry domains (finance, manufacturing, healthcare, and so on). The wave of Big Data is also providing another avenue for customers to analyze the incoming data feeds in real time and detect changes in well-established patterns.

Our approach to OEP has been to build a generic stream data processor and a declarative interface in the form of a continuous query language (a language similar to SQL with some extensions). We have created a solid foundation based on a strong theoretical framework; several product features are based on many patent-pending ideas. Included in this is the first commercial implementation of an emerging ANSI standard extension to SQL that deals with

regular expression-based pattern matching over streaming data. We have also influenced the standardization efforts towards a language for stream processing. Ongoing, we expect to work on query processor and optimizer enhancements to improve performance and scalability, real-time data mining over streaming data, newer ideas related to regular expression-based pattern matching, real-time scheduling algorithms, and cache-aging-out algorithms as well as clustering support. We use modern techniques from research and work on query processing, compilers, data mining, automata theory, pattern matching, online/approximation/randomized algorithms, data structures, real-time operating systems, Java, Java EE, Web services, and XML. We own modules and participate in the complete life cycle of new features.

Service Oriented Architecture (SOA)

SOA has dramatically changed the way software vendors and enterprises compose their applications and solutions. Oracle SOA Suite allows customers to deliver SOA-based application-to-application integration, build and assemble composite applications made up of the consumption of Web services, or extend their packaged applications through the introduction and integration of new modules built within the suite. In addition, customers want to understand what is happening not only at an operational level but also from a business level. This means that for all SOA-based solutions, analytics needs to be part of their DNA. Our developers focus on key product areas such as connectivity, service virtualization and mediation, orchestration, and analytics. We are involved with all Oracle technology, applications, and industry groups, and we work closely with large corporate customers and Oracle user groups. We build user-friendly HTML and Java-based user interfaces, design XML-based Web services, and work with our architecture team to improve Oracle products.

Java Products Group

We develop the platform and APIs used by millions of developers and deliver the product releases installed across hundreds of millions of computers and many more embedded devices. We continue to innovate from creating world-class virtual machines with the latest in diagnostics and troubleshooting technology running on the latest hardware and operating systems to efficiently running dynamic languages such as JRuby and Scala. On the client, we are working to allow developers to easily create rich, compelling, hardware-accelerated user interfaces that also support the latest Web technologies; in the device space, we are partnering with the chip and device manufacturers who are working to cut down the cost of development with Java. We develop skills in a variety of technologies, from memory management, the latest CPU/GPU architectures, network protocols, language design, installation and deployment across millions of computers, and accessibility interfaces to quality assurance, UI design, release management, and security.

Security and Identity Management

Our software enables all applications to be secure. Every application needs security to succeed, particularly as more applications move to the Cloud and social networking within the enterprise becomes mainstream. Our developers focus on key product areas such as these:

- (1) Web Services Security, which ensures that access to Web services is properly authenticated, authorized, and managed.
- (2) Access Management and Federation provides Authentication, Single Sign-On (SSO), Federation, and Authorization services and moves key security decisions from application logic into the service layer. We develop products using Java/Java EE, LDAP, PKI, XML, Web Services Security, WS-Trust, Federation (SAML, Liberty Alliance/Kantara, WS-Federation), XACML, RBAC, and other standards and leading technologies.
- (3) Security Infrastructure and Java Platform Security provide common security infrastructure across Java EE Application Server, Web Services, and Enterprise Applications and define security direction

Projects at Oracle

for various other Oracle products. Key projects include Java2 security Java Authentication and Authorization (JAAS), Java EE Application Server Security, Integration with Enterprise Single Sign-On systems, LDAP, RBAC, PKI, Web Services Security, XML Security, Audit Framework, Cryptography, Network Security, and other security technologies.

The Oracle Identity Manager Team designs and develops products that help our large enterprise customers, including global, public sector, and educational, do identity administration, role management, user provisioning, and compliance automation. We are building advanced user interfaces and back-end algorithms for identity management, security policy definition and enforcement, business process definition, and execution using Java EE technologies such as JAAS, JMS, JCA, JMX, Web Services, and Ajax for a rich user interface. We also use industry standards such as XACML, SPML, BPEL, and SAML. Directory services provide access via key standards such as LDAP and SOAP to important enterprise identity and entitlement information. Directory services at Oracle includes two market-leading LDAP servers, a virtual directory, and a metadirectory. Oracle Entitlements Server provides both distributed policy enforcement and centralized policy management by externalizing security logic embedded in services and applications. We learn about and use technology standards including XACML, SAML, JAAS, LDAP, RBAC, PKI, X.509, and SSL.

User Productivity Kit

Organizations maximize enterprise applications investment, increase employee productivity, and mitigate risk through all phases of the project lifecycle using Oracle User Productivity Kit (UPK). UPK provides a simple, comprehensive content development, deployment, and maintenance platform specifically designed to be used by project team members and line-of-business owners. Organizations can rapidly produce materials that provide value throughout all phases of the software lifecycle—from test scripts, system process documents, and interactive simulations to job aids, instructor manuals, and in-application performance support. UPK enables one to create engaging interactive transactional and conceptual content with enhanced sound recording, editing, and playback capabilities to enhance knowledge transfer and ensure best practices. You can rapidly produce interactive transaction simulations, classroom and Web-based training materials, and in-application performance support. With the creation of user test scripts, the system transactions can be defined and tested before go-live, providing the necessary materials to ensure user adoption.

ORACLE TECHNOLOGY DEVELOPMENT: SYSTEMS AND APPLICATIONS MANAGEMENT

We build Oracle Enterprise Manager, our central, Web-based management solution. We are responsible for providing management for every Oracle product. We influence every system management area, from business performance monitoring to Cloud computing. We work with Java, Java EE (JSF), Ajax, Perl, Python, C, PLSQL, XML-RPC, REST, HTML5, Flex, and XML. We apply our work to application servers, databases, operating systems, networking, storage systems (SAN and NAS), and virtualization and work with rich user interface technologies, advanced Java EE and SOA. We write complex, high-performance algorithms.

Application Management

Oracle Enterprise Manager manages business-critical applications in their entirety, from the business view (including transactions, real user experience, and SLAs) to all the infrastructure components that support the application: databases, application server and other middleware services, hosts (physical and virtual), and more. We work closely with all teams delivering

business applications to ensure Enterprise Manager delivers unparalleled visibility, productivity, and reliability for applications.

Cloud Computing and Virtualization

We provide solutions for customers to automate building their own private Clouds: we automate the entire tedious, complicated, error-prone process. Customers can then expose their infrastructure as a service for their end users: they can dynamically provision prepackaged or customized virtual environments and appliances, define policies for the amount of computing resources (compute power, storage, memory, and so on) to allocate across user communities, and charge users for resources consumed and for self-service administration.

Projects at Oracle

Enterprise Configuration Management

We use problem-solving and analytical abilities to deliver real-world management solutions to the enterprise. These solutions create IT cost savings and keep companies in compliance with in-house security practices and external frameworks and reporting measures like ITIL, SOX, and PCI. Solutions track, enforce, and report on system and application configuration information, including a comprehensive configuration management database (CMDB).

Enterprise-Ready Infrastructure

Do we have what it takes to manage our manager? We mean managing the Oracle Enterprise Manager product, which in turn manages all products Oracle develops. We work with a global team based in the US and India on developing everything from back-end core pieces to front-end UI. We design the user experience and user interfaces and build the latest customer-facing applications. We learn domain knowledge, including databases, storage, and configuration, and to become expert in system management products. We create a suite of sophisticated sensors and tracers to help diagnose, analyze, and troubleshoot a range of enterprise products. We work on a robust, fault-tolerant, and scalable system capable of processing large numbers of events quickly and providing correlated information to customers. This visible area is the first, most fundamental feature that is used in EM, and it has to work flawlessly.

Knowledge Management

We go beyond search engines, offering secure, customized content based on intent, information, and customer needs. We invest in new search technologies such as semantic search, decision-based search engines, and enhanced content engineering. Our technologies include Oracle Secure Enterprise Search, Oracle Text, Flash, Java EE, ADF, HTML, XML, Ajax, and SOA. We operate worldwide, use advanced Web analytics, and enhance search performance and precision.

Middleware, Application Performance Management

Oracle Enterprise Manager works hand in hand with the middleware product team. Management is provided by Enterprise Manager for the middleware infrastructure and applications running on it. Going beyond basic monitoring, we collaborate from the early stages of product design to provide a management experience that is optimized and well-integrated with all other aspects of the IT infrastructure. We provide a unified view of business transactions across all tiers of the composite application. We use advanced technology and innovative methods to efficiently observe, collect, and process performance information, allowing administrators to diagnose and correct complex performance issues.

Software Provisioning and Installation Technologies

We develop the adaptive IT management infrastructure. Our products deliver a high degree of automation and pinpoint accuracy in problem detection. Our software management tools deploy, configure, optimize, and protect system resources, reducing cost of complexity of IT operations. We develop applications including provisioning, security, patching advisers, and a data center designer and BPEL-based automation framework that quickly and easily maintains a standardized environment and enforces security best practices with adaptable policies. We define the initial customer experience when using Oracle. We build Java-based tools used to install and configure all Oracle software on systems ranging from large clusters to single machines.

Ops Center, Performance, Quality Assurance

Oracle delivers management for the hardware, firmware, and operating systems running our software. We learn about the physical machines that are the backbone for company data centers. We take Enterprise Manager to the next level. We perform reliability, robustness, performance, scalability, and stress tests in large-scale environments to ensure Enterprise Manager meets customer requirements. Our Quality Assurance (QA) engineers routinely work on testing one of the most complex pieces of software in the industry. Our QA Teams work together and with developers on myriad activities, including writing test plans for new product features, coding automated regression test scripts, and executing manual and automated tests across the complex, distributed environments supported by the product.

Testing as a Service

We are working on next-generation software testing products for and in the Cloud. We combine Oracle's virtualization platform and monitoring and testing capabilities to offer end users software testing process and end-to-end QA lab automation. Users can use the Cloud to speed up application development and provide highly performant applications with superior quality. With this product offering, users will virtualize entire application stacks and store their testing assets centrally. At the time of running a test, virtual machines will be spawned and functional and performance tests kicked off, all in the Cloud, while all results of the test along with monitoring data will be available for users to analyze centrally via a browser. We work on Oracle Virtual Server, Oracle Virtual Manager, Enterprise Manager, and Oracle Application Testing Suite to define, design, and implement unique product offerings. For our highly challenging work, we use technologies ranging from PL/SQL to J2EE.

ORACLE TECHNOLOGY DEVELOPMENT: SERVICES

From building demos to writing technical training content, our teams provide unique services across Oracle.

Demonstration Solution Services

Our group builds, administers, and supports hosted demos for Oracle's sales consultants. These realistic, enterprise-class demos showcase Oracle Database, Fusion Middleware, Oracle Applications, and Management products to potential customers. We work on highly visible projects that directly impact sales of Oracle products. Our Development/Build Team works with sales consultants and the base product groups to build demos that promote the business benefits of Oracle's products. Our Technical Services and Support Teams ensure our mission-critical systems are always fully operational and provide 24x5 assistance to Oracle sales consultants worldwide.

Product Development Information Technologies

We are responsible for the implementation, operations, and support of the infrastructure necessary to build, test, and release the entire Oracle product line. We also implement and support the infrastructure necessary to run Oracle's business. This includes Financials, HR, Supply Chain, Support, Sales & Marketing, Consulting, eMail/collaboration systems as well as content management. And finally, we implement and support the infrastructure required to power the Oracle Cloud that includes Software as a Service (SaaS), Platform as a Service (PaaS), and Storage Service. Key initiatives currently underway include technology refreshes using the Exadata and Exalogic platform, Private Development Cloud, VDI/Sunrays, Fusion Apps Implementation, Cloud Regional build outs, Oracle Social Network, Warehouse solutions to Exalytics, ERP system to SuperCluster, and continued showcasing of Oracle products and technologies.

Server Globalization Technology

We are the central provider of globalization infrastructure and expertise for all products and technologies under Oracle Technologies. Globalized Internet applications service a diverse world population with vastly different cultural and linguistic conventions. The emergence of the Unicode Standard has made it possible to develop centralized server applications that support multiple languages simultaneously. Meanwhile, the quickly growing multilingual market keeps posing challenges ranging from storing and processing texts in different languages and character set encodings to formatting information in the user's local conventions, collating data in the native linguistic order, rendering complex scripts such as Arabic and Hebrew, and providing multilingual content management, just to name a few.

We work on the entire product lifecycle. Product managers interact with internal and external customers to refine product definitions and requirements and lead product evangelism. Consultants ensure projects comply with our globalization standards and adhere to our architectural guidelines. We also work closely with Oracle Consulting and Support to address specific customer issues. Our developers design and implement the globalization runtime library and development kits (C, Java, and JavaScript) forming the foundation of Oracle's globalization features. We support a variety of utilities and new language technologies used by all product stacks. The Quality Assurance Team certifies all Server Technologies products for the global market and builds testing tools and frameworks to improve testing process and efficiency. We also offer training and participate in standards activities to promote best globalization practices.

Server Technologies Curriculum Development

We create technical training content for Oracle Server Technology products. By working very closely with product development (from early on in the product release cycle), we gain a solid understanding of new features and enhancements. This allows us to create comprehensive instructor-led and online training content in a timely manner to meet the needs of our internal and external stakeholders. Also, because we work with the products hands-on, we are able to provide feedback to development on product usability and functionality. We cover Oracle Database Server, Fusion Middleware, Enterprise Manager Grid Control, ECM, Java, Service-Oriented Architecture, Business Process Modeling, and Secure Enterprise Search. To do so, we create courseware and course practices, test practices against product builds, write questions for certification exams, train the trainers, and transfer technology to the field.

Server Technologies Information Development

We write highly technical documentation for diverse products and audiences. Integral to the development effort, we are responsible for Oracle Database, Oracle Fusion Middleware, Oracle Cloud, and Oracle Enterprise Manager documentation. From functional and design review to product delivery, we use technical knowledge and writing skills. We make information easy to find so products are easy to use. We provide information online, in books, or through online help integrated with products. For example, our Web-based search tool lets you search for product information across the entire documentation library and construct a virtual book that covers only information relevant to your needs.

BUSINESS APPLICATIONS DEVELOPMENT

We design and develop Oracle's applications software (also known as business software). In our division, several engineering teams code and develop Oracle Application products, including Oracle Fusion Applications, Oracle E-Business Suite, Oracle's JD Edwards EnterpriseOne, Oracle's JD Edwards World, Oracle's PeopleSoft Applications, Supply Chain Management, CX (Commerce, Customer Relationship Management, Knowledge Management), and Oracle Cloud Services (includes Oracle Talent Cloud).

We also have teams to support the design, development, positioning, marketing, and selling of the applications products. These include Oracle Applications Labs, Functional Architecture, Technical Architecture, Product Marketing, Product Management, Strategy, User Experience, Customer Management, Information Development, and Learning.

Applications Portfolio Development

Oracle Cloud Services (Talent Cloud)

Oracle Talent Cloud, formerly known as Taleo, is in the Applications division adjacent to the Oracle HCM Cloud. Our Talent Cloud Team develops talent management SaaS solutions for small, medium, and large businesses. Our solutions strive to empower people and organizations to reach their potential and succeed by supporting world-class talent acquisition, talent management, and talent development capabilities. We use standards-based technology, including Java, JavaScript, XML, HTML 5, OBIEE, and much more. We are helping to define successful applications in the Cloud by delivering a world-class SaaS offering worldwide. We are investing in mobile applications (iPad, iPhone, Android) to transform how managers and candidates interact throughout the talent acquisition and management experience. The Oracle Talent Cloud has amassed more than 50 terabytes of data, which is more than the Hubble telescope accumulated in its first 20 years in space. We are creating new customer value through innovative use of Big Data concepts. Our team is as relevant as the Cloud itself.

Oracle Customer Experience (CX)

Commerce

Oracle Commerce was formed by combining the ATG and Endeca Teams specializing in online commerce, merchandising, and customer experience. Our business aligns with both the Oracle CRM offerings and the Oracle Retail Global Business Unit. This highlights the role we play delivering both business-to-consumer and business-to-business commerce products. We help merchants drive selling and customer experience initiatives. We also support consumers (shoppers) as they engage with their favorite brands or shops. Our products help businesses sell products and engage customers across multiple channels. We deliver commerce Web sites, drive mobile apps, provide call center tools, and offer in-store

selling capabilities to customers in many industries across the globe and a particularly strong customer base in retail, brand manufacturing, and telecommunications. We use diverse technologies, including Java, HTML, JavaScript, Objective-C, C++, and others.

Customer Relationship Management (CRM)

Oracle's Siebel CRM is part of Oracle's broad and deep CRM Applications portfolio. The CRM products in the portfolio provide organizations with great customer experience by managing the complete life cycle of the user journey. Customer interactions are captured through multiple channels that include the Web, contact center, mobile devices, field sales/service force, branch/retail network, and indirect and partner distribution channels. Our Siebel CRM solution supports end-to-end business processes across many different industries. Our applications platform provides a stable, flexible, extensible, and performant architecture that is developed using C++ and Java. It also provides the Applications Development Team with a common platform to build and configure solutions, which includes platform support for multiple operating systems, databases, browsers, and devices. Our solutions are integrated across other Oracle products, including Fusion Middleware, WebCenter, Social Media, Oracle Commerce, and Oracle Knowledge Management, as well as desktop products, such as Microsoft Outlook or Lotus Notes. We have expertise in C++, HTML5, JQuery, JQueryMobile, Web Services, XML, and the latest in Java technologies (including JAAS, JDBC, JCA, JMS, Java EE, EJB, standard protocols, and Java APIs).

Knowledge Management

Oracle Knowledge Management is part of Oracle's product portfolio in CRM and combines products from the acquisition of InQuira and RightNow. Knowledge Management is about creating and delivering answers quickly and easily for consumers looking for how-to information or FAQs via a company's support site or community forum. It's also used by contact center agents who are contacted via call/email/chat when users can't find answers by themselves. We solve highly visible problems and our work has the opportunity to get showcased and be integrated into the Web presences of the world's most prominent companies. In fact, you might have used the Oracle Knowledge Management products if you searched the Web or Apple's site for answers about your favorite iDevice, if you looked up a FAQ when buying something from Overstock.com, needed instructions on posting photos on Yahoo-Flickr, or had questions about booking a flight on KLM. Under the hood, the products are built on highly scalable architectures; the core platform uses Java/J2EE or C++, and the Web applications use JSP/Javascript or PHP. The core IP employs advanced search and query analysis technology with natural language processing (NLP), dictionaries, and machine learning to understand a user's intent and deliver answers.

Oracle E-Business Suite

Oracle E-Business Suite helps organizations around the world manage their business more efficiently. We provide the most comprehensive suite of integrated, global business applications for financial management, people management through human resources, procurement, inventory and order management, manufacturing and distribution through supply chain, as well as marketing, sales, and services through customer relationship management. Our customers include some of the largest companies in the world to smaller midsize organizations. They span across all industries, such as automotive, communications, consumer goods, higher education, financial services, manufacturing, health and life sciences, media and entertainment, retail, public sector, services, and high technology.

Oracle Fusion Applications

Oracle Fusion Applications is the newest product suite in the Oracle Applications portfolio. It is the only Oracle Applications offering available to customers both on premise and in the Cloud. Oracle Fusion Applications is one of the largest projects in software history. We built Fusion Applications from scratch largely using a collection of Web 2.0 technologies. It is the first and only set of applications solutions built natively on Oracle Fusion Middleware.

While other solutions can take advantage of components and features of Oracle Fusion Middleware and be certified for use with Oracle Fusion Middleware, Fusion Applications has these capabilities built into the heart of its architecture, providing unparalleled adaptability, manageability, and security.

Oracle's JD Edwards EnterpriseOne

Oracle's JD Edwards EnterpriseOne business applications manage a company's finances, people, customers, supply chain, manufacturing, procurement, and assets, including real estate and capital equipment. We use technologies encompassing every significant platform, operating system, and database. Our applications are developed for multiple platforms using various databases, operating systems, and major browsers. We have created and continually enhance a common architecture with robust tools. We work on ERP applications development and integration with Oracle products. We are actively adopting Oracle's Fusion Middleware. Our primary objective is to create an integrated ERP suite with native JD Edwards EnterpriseOne Web services capability based on open technologies, such as Java, SOA, BPEL, ESB, and standards-based interfaces.

Oracle's JD Edwards World

Oracle's JD Edwards World, built for the IBM System i platform (formerly iSeries), offers midsize businesses a Web-enabled ERP environment for world-class management of plants, inventories, equipment, finances, and people as a synchronized, integrated whole. It is tightly integrated and prebundled on a single database, reducing implementation cost and complexity. We are located in Denver, Colorado, so we share resources and skills with the JD Edwards EnterpriseOne Teams. We are a full-service software center with development, strategy, marketing, a global support center, QA program management, customer loyalty, a remote site in Argentina, and remote teleworkers.

Oracle's PeopleSoft Applications

Oracle's PeopleSoft applications are designed and created by our teams primarily located in Pleasanton, California. We built PeopleSoft applications on the PeopleTools technology platform. The product suite includes applications in Human Capital Management, Financial Management, Supplier Relationship Management, Customer Relationship Management, and Supply Chain Management. The applications provide comprehensive business and industry solutions, enabling organizations to increase productivity, accelerate business performance, and provide a lower cost of ownership.

Supply Chain Management (SCM)

To compete effectively, companies must design, develop, source, manufacture, sell, distribute and service products—all globally—faster and cheaper than the competition. Oracle is now recognized as the leader in SCM across a broad range of industries, from high-tech/electronics to healthcare, from manufacturing to retail, and from transportation to utilities. Our solutions cover areas as diverse as planning, product lifecycle management, master data management, logistics, manufacturing, and maintenance.

Support for Oracle Applications Development

Oracle Applications Labs is one example of the teams working to support the applications products. Oracle Applications Labs is the organization responsible for internal deployment and use of Oracle's ERP, CRM, and business intelligence tools. We drive margin and product improvement programs, act as a showcase and early adopter for Oracle products, and fulfill the system consolidation needs of ongoing acquisitions. We run the applications that run Oracle, drive product enhancements based on our experience, and share best practices with customers. For example, Oracle Applications Labs eliminated and replatformed all major Sun IT systems in less than 12 months and \$50 million under budget, resulting in operational savings of \$1.5 billion. Based on our experience using the latest Oracle technology, we also blaze trails for customers to follow by sharing publications that quantify the ROI of key Oracle IT initiatives and the best practices customers need to replicate them.

INDUSTRY-SPECIFIC SOLUTIONS AND PRIMAVERA

Communications. Health Sciences. Primavera. Retail. Utilities.

Oracle has developed unique organizations to focus on particular industries. These include Communications, Health Sciences, Retail, and Utilities. In addition, Oracle has some new designated divisions that are not industry-specific such as Primavera, which offers enterprise project and portfolio management software for project-intensive industries.

Communications

Oracle Communications builds and delivers software solutions that enable the world's leading communications and digital commerce companies to manage their businesses more effectively. Communications companies are evolving rapidly with smartphones and the unprecedented growth of the mobile broadband experience. Service providers are opening up their networks and continually expanding the portfolio of products they offer (voice, video, broadband, digital content, messaging, social networking, and digital commerce) through a growing array of access devices; expanding geographically to provide coverage to more subscribers; and maturing their operations infrastructure to enable fast time-to-market combined with an efficient, predictable cost structure. Oracle Communications combines and integrates software applications and industry experts from leading companies, including Portal Software, MetaSolv, BEA, SUN, Netsure, Net-4-Call, Sophoi, and HotSIP, into a single, unified division supported by Oracle. We are currently using Oracle technology to develop exciting game-changing projects in collaboration with our customers. For example, we support the launch of new prepaid and postpaid services and competitive business models through innovations in order management, billing, rating, payments, and revenue management. And, we help customers strategize through better understanding of customer usage patterns, buying patterns, network congestion, and other dimensions of business intelligence extracted from communication provider network and application data.

Health Sciences

Oracle Health Sciences builds applications for the healthcare and life sciences industry. We enable our customers to deliver innovative therapies, devices, diagnostics, and optimized care processes to improve people's health. We have developed a Cloud-based suite of solutions that is among the largest in the global health sciences industry, used by major healthcare institutions, payers, life sciences companies, and governments worldwide. Entire countries like Singapore and Australia are using our countrywide electronic health record products.

Projects at Oracle

We manage thousands of clinical trials and studies worldwide for the largest life sciences companies in the world in the Oracle Health Sciences Cloud. We developed the Oracle Health Sciences Network (OHSN), an integrated, Cloud-based data service and set of applications enabling healthcare providers and research institutions to collaborate more efficiently with life sciences organizations using de-identified healthcare information. OHSN enables clinical investigators to rapidly identify patient cohorts, determine protocol feasibility, and recruit consenting patients for clinical studies based on clinical and genomic characteristics.

We are a leader in personalized medicine, with platforms like the Oracle Translational Research Center (OTRC), which enables the secondary use of electronic health records, administrative data, and omics data to help accelerate biomarker identification for drug discovery, clinical development, and translational research. OTRC enables patient-centric searches that span phenotype and genotype attributes to quickly identify targeted patient populations. For example, users can set search parameters for a patient's demographics, cost, and treatment timelines, combined with a variety of specific genetic variants in a single search to unlock new insights and advance personalized medicine diagnosis and treatment. We use core Oracle technologies to develop solutions that take advantage of social networks, behavioral graphs, gamification, and mobile applications to enable our customers to better innovate to improve human health.

Primavera Project and Portfolio Management

Oracle's Primavera provides project and portfolio management. Our software foundation enables all types of businesses to achieve excellence in managing their portfolios, programs, projects, and resources. We build solutions for our customers in project-intensive industries. Our applications provide project and portfolio management, contract management, resource management, and risk management solutions used by customers worldwide. Our development practices include empowered teams, continuous build and integration, and a heavy emphasis on automated testing. We tackle planning, requirements analysis, implementation, and testing. Our engineers work with technologies including Java, XML, BI, SOA, BPM, and Web Services.

Retail

Oracle Retail is a full suite of products to help retailers optimize every aspect of their business. Twenty of the top twenty retailers worldwide, including fashion, hardlines, grocery and specialty retailers, use Oracle solutions. From merchandise planning and execution to marketing, inventory, supply chain management, store operations, and cross-channel commerce, Oracle Retail solutions enable retailers to manage their business. Our R&D organization works on creating the best solutions for retailers with a fully integrated set of applications. Technologies such as Java, data mining, OLAP cubes, and Ajax help Oracle Retail customers process billions of transactions, make better business decisions, and increase productivity. Our innovative new projects include iPhone/iPad applications, science-driven models that determine optimal pricing, and the incorporation of social media methodologies into retail communications and messaging.

Utilities

We build solutions for utility companies (including electric, gas, and water). Oracle Utilities combines software applications and utility computing experts from leading companies into a single unified division. One-way centralized networks are being replaced with data-driven intelligent systems built to handle distributed energy resources, greater

participation in energy markets, and multidirectional energy and information flows. Oracle Utilities is a dedicated portfolio of applications, expertise, and people focused on solving key technology problems driven by this significant change—from electricity generation to demand response, from gas transmission to delivery, from water purification to wastewater disposal—and all customer service, maintenance, analytics, and metering processes.

We collaborate with customers to develop interesting projects such as customer and billing modernization (demand management, billing for electric vehicles, and mobile apps for residential consumers); energy and water conservation (data-driven administrative systems to handle both smart meter rollouts and other smart device adoption trends include meter data management, pre-integrated communications gateways, and adaptors for AMI systems); improving grid operations efficiency (network management, field workforce productivity, and operational device management to improve internal operations or protect the power supply during outages); and delivering Advanced Analytic Tools to turn petabytes of data into actionable information (prebuilt analytic dashboards and data warehouse offerings). Our technology ranges from development for Linux, UNIX, and Windows servers running grids, clusters, and other highly scalable, distributed architectures to applications built on Java standards and using open, Web Services-based APIs, delivered on Java EE application servers. Web-based application user interfaces built on Ajax are delivered in configurable portals. We use mobile interfaces on handheld devices and current device platforms including iOS.

ORACLE CLOUD SERVICES ENGINEERING

US, India, Ireland, Romania

We deliver massively scalable, future-proof Cloud enablement and Cloud management solutions for Oracle Cloud Services customers. Engineering solutions are a core foundation for differentiating Cloud Services in the marketplace. Solution scope includes end user and backend delivery applications, Cloud automation frameworks, and end-to-end Cloud management and deployment architectures. These are delivered through new services, next-generation Cloud infrastructures, engineered solutions for IT automation, optimized services, and product enhancements. We work on customer services through innovative statistical methods for diagnosing and resolving problems, predictive monitoring, distributed storage management over heterogeneous platforms, and application energy utilization models. We use collaborative solutions, assisted service solutions, and SaaS architectures.

Our Engineering and Product Management Teams are based in four primary development centers: US, India, Ireland, and Romania. Our service management areas cover On Demand capacity management, monitoring, configuration, change, and problem management. Our vision is to design and develop a holistic Cloud Automation Platform over and above the technology solutions; we are also developing rich mobile applications on iPads and other mobile devices. We have expertise across Oracle products and modern languages and architectures, such as SOA, Web Services, Java, XML, Apple IOS, SQL, and PL/SQL.

ORACLE CHINA

Asia Research and Development Center

Oracle Asia Research and Development Center covers China, Korea, Japan, Singapore, and India. We have centers in Beijing and Shanghai. Hundreds of developers work at three centers in Oracle China. OARDC Shanghai is located in the Knowledge and Innovation Community (KIC) with 14 neighboring major universities and colleges in Yangpu District of Shanghai. OARDC Shanghai conducts innovative R&D on current and emerging technologies for the Digital City. Research areas focus on RFID sensors; digital community; e-Government, and

other location-based services. OARDC Shenzhen was the first Oracle R&D center in China. It is located in Shenzhen Hi-tech Industrial Park, near the Shenzhen and Hong Kong international airports.

Projects at Oracle

We also have our Partner Solution Center for Technology. We aim to provide a base for expansion of development into Asia; support sales teams with product knowledge and proof of concepts (POCs); support partners with better access to Oracle technology; and support customer/partner/government projects requiring a long-term focus. We are also embedded in JAPAC (Japan and Asia Pacific). Our projects such as Digital Cities and Expo 2010 reach a national audience. The new Beijing campus is located at the Zhongguancun Software Park (ZPARK) in Haidian District. It accommodates Oracle (China) Software Systems Co. Ltd, Oracle Asia Research and Development Center, and the Partner Solution Center.

ORACLE INDIA

Gurgaon, Bangalore, Hyderabad, Noida

Oracle India is the only organization outside Oracle's headquarters in California to represent so many divisions and lines of business, effectively mirroring Oracle's global operations based in California. Our combined resources in India contribute to core software development across the entire Oracle product family. We work on new product design, development, technology and feature enhancements, quality engineering, documentation, curriculum for instructor-led and online training, and integration, as well as support and maintenance of existing products. Beyond software development, Oracle India hosts a number of functions critical to Oracle's operations as a global company.

Through six facilities of Oracle India Private Ltd., headed out of Gurgaon near New Delhi, we offer sales, marketing, consulting, education, and support to local customers. We also host a number of global operations so the company can conduct 24 by 7 consulting, finance and administration, support and sales operations, and software development. Our software development engineers work in the India Development Centers (IDC) in Bangalore, Hyderabad, or Noida. We offer some of the largest offshore development outside the USA. The technologies we use include many of those mentioned throughout this book. Our work includes Oracle Applications Operations, On Demand, Oracle Retail, Oracle Communications, and Oracle University. In Bangalore and Hyderabad, we also offer advanced customer services, online DBA services, and global consulting for customers worldwide.

ORACLE MEXICO DEVELOPMENT CENTER

Located in Guadalajara, Mexico's Silicon Valley, Oracle's new Mexico Development Center (MDC) is a thriving nexus of research, development, and production support across Oracle's product line and internal deployments. This includes Applications, Database, Enterprise Manager, and several open source projects. We are doing research and building products in Cloud computing, massive parallelism, distributed systems, in-memory databases, geographic and multidimensional databases, applied artificial intelligence, and how to best manage thousands of machines. We are creating the infrastructure for the world's biggest software projects. We emphasize user experience to make products intuitive through our own UX lab and focused teams. We are also responsible for the internal deployment of ERP, CRM and BI tools, enabling Oracle's rapid growth and massive efficiency. We are early adopters for Oracle products, drive product enhancement, and create best practices to share with customers. Also, we work on the next generation of courseware and product documentation for the Oracle Cloud, Database, Fusion Middleware, and Systems Management.

EUROPEAN DEVELOPMENT CENTRE

Oracle European Development Centre (EDC) is our development organization in Europe headquartered in Dublin, Ireland. We develop and deliver solutions on a range of hardware and software platforms. EDC has representation across a number of product development pillars at Oracle, including Services Engineering, Translation Solutions, Financial Services Applications Development, Development of Database Tools, Porting and Certification Technology, Applications NLS Engineering, and Product and IT Support. We have expertise in building integrated engineered solutions using Oracle's component products. For example, we develop and support the Oracle Translation Platform, a turnkey engineered solution for translation of all Oracle products. Using Oracle technology, this automates translation into more than 40 languages.

USER EXPERIENCE

Several Oracle User Experience Design Teams provide comprehensive usability engineering and interface design support for divisional product lines. Also, centralized usability labs in multiple worldwide locations serve the entire corporation. We work in areas of usability engineering, cognitive psychology, graphic design, interaction design, and computer science with a specialization in human computer interface (HCI) technology. We follow a user-centered design methodology that includes activities such as user requirements research; heuristic evaluations of existing products; definitions of user experience through sketches and interactive prototypes; iterative development and usability testing of interactive and visual design solutions; and formal usability testing and competitive evaluations of products. In our laboratories, we also conduct usability evaluation and research projects in areas such as information visualization. We develop and maintain Oracle-specific look-and-feel standards and cross-platform user interface consistency. Also, we identify and introduce or develop new products. The projects range from products designed for the construction and administration of large databases and database applications directed at highly technical users to end-user analysis and information visualization tools. We also work on enterprisewide application solutions, creating innovative designs that focus on future generations of Oracle products for the Internet. Visit oracle.com/usableapps.

ORACLE CORPORATE ARCHITECTURE

The Corporate Architecture Group (CAG) identifies the areas across Oracle requiring architectural attention, defines technical solutions that cross product group boundaries, and analyzes architectural aspects of planned and to-be-acquired products. Our charter includes creating and implementing corporate controls over areas such as accessibility, industry standards, export compliance, and product interoperability. The group's focus on security encompasses Oracle's physical security, information security, and product security organizations, as well as the National Security consulting practice. The CAG is also home to Oracle's Linux, MySQL, and Virtualization products; Oracle's Axiom Storage and SunRay optimized hardware/software systems; and Oracle's research arm, Oracle Labs. The CAG is led by Edward Screven, Oracle's Chief Corporate Architect, who serves as a strategic technical advisor to Oracle's CEO and copresidents.

Axiom Storage

The Axiom Storage group develops highly scalable, fault-tolerant storage systems. Key attributes of the Axiom product include continuous availability, online hardware/software upgrades, automatic tuning, call home telemetry, tracing and logging, as well as online repair while running. We develop in a Linux environment and achieve high performance through

Projects at Oracle

the use of multicore processors, multithreading, zero copy designs, and hardware acceleration. The Axiom product uses a range of storage technologies, including spinning disk, flash memory, SSD, and non-volatile DRAM. Although Axiom has been deployed at more than a thousand customers, we continue active development in areas such as file systems, network protocols, block protocols, copy and replication services, and support for interconnection hardware. Significant work combines the high performance of flash memory and the low cost per gigabyte of rotating disk with algorithms that automatically select placement according to application access patterns. Another focus integrates the Axiom with management frameworks, virtualization, databases, and other applications. Extensions of our current technology include virtual storage systems, deduplication, compression, and techniques and APIs for storage Cloud management.

Global Information Security

Information Security is one of the major job growth areas worldwide and regularly appears in lists of best jobs. Oracle's Global Information Security Team works with Oracle's lines of business (LoB) right across the company, providing a corporatewide information security strategy to support business objectives and meet threats to the confidentiality, integrity, and availability of our information assets and information we hold on behalf of third-parties. Our specialist teams are responsible for policy development and maintenance (security awareness and education); strategic information security programs and regional security; meeting litigation requirements; forensic investigations; facilitating Oracle LoB certifications in respect of ISO27001, the global information security standard; compliance and risk to ensure Oracle is compliant with policies, global regulations and laws, customer contractual obligations; security assessments and reviewing system deployments to eliminate security vulnerabilities (includes penetration testing and ethical hacking); and data privacy. We also provide support to Oracle's Chief Privacy Officer and the Privacy and Security Legal team.

Global Product Security

Under the management of Oracle's Chief Security Officer, we are responsible for security assurance for Oracle products—the means by which security is built in, not bolted on—and coordination of cross-product security activities. We write and enforce the Oracle secure-coding standards. We manage the formal security evaluations of Oracle products against standards such as the Common Criteria and FIPS-140. In our team, ethical hackers validate the security of our products using a variety of well-established security assessment techniques. We are responsible for product security program management across all lines of business—including acquisitions—so we interface with many groups within Oracle: all product divisions, marketing, business development, sales, consulting, IT, and legal. We also work externally with the security research community, security vendors, and industry working groups as well as a number of international security organizations.

Global Trade Compliance

We are responsible for import and export oversight, guidance, and enforcement to enable worldwide trade-compliant business processes across Oracle, in order to uphold and protect Oracle's global trade privileges and ensure the success of Oracle's business. We manage Oracle's global trade compliance portfolio and are responsible for global trade regulatory interpretation and coordination of policy advocacy. We also review and resolve global trade compliance matters; serve as the clearinghouse for all global trade compliance information, including product classification; and can take actions necessary to ensure Oracle remains compliant with US and applicable local import and export laws, regulations, and statutes.

Government Security

We implement and enforce Oracle's Industrial Security policy and related operational security (OPSEC) best practices. We submit, maintain, and act as a clearinghouse for Oracle's Security Agreements, and persist a secure environment for the protection of personnel, property, and information as it relates to US Government programs. This includes monitoring classified information systems and controlled areas and investigating and reporting security violations to appropriate government security agencies.

Linux and Virtualization

We are responsible for the Linux operating system (OS) and server and desktop virtualization at Oracle. We work on open source Linux code to develop and enhance the OS for enterprise database workloads. We also work on the Xen hypervisor that provides the basis for Oracle's x86 server virtualization offerings. Our group began as a team of Linux kernel hackers who worked to make Linux perform better under Oracle workloads, and our core focus remains on developing open source products and improving the stability and performance of Linux. Oracle Linux now includes the Unbreakable Enterprise Kernel, a special Linux kernel based on mainline Linux and optimized for use in large data centers. The Unbreakable Enterprise Kernel has allowed Oracle to post world-record benchmarks using Linux servers with 4 TB of RAM and the latest Infiniband hardware.

Oracle VM Server Virtualization brings efficient, enterprise-class server virtualization to the data center. Virtualization allows multiple operating systems to share a single piece of hardware, enabling customers to consolidate their data centers and save on energy, lab space, and administration costs. Oracle VM is x86 server virtualization software using the Xen hypervisor that supports a wide range of Linux and Windows guest operating systems. Developers work on Xen mainline software. In addition to fixing bugs in existing code, we contribute to the Linux kernel and Xen hypervisor communities.

Oracle's kernel contributions include an open-source fully featured cluster filesystem included in the mainline Linux kernel (OCFS2), the new btrfs filesystem project, implementation of the T10DIF data integrity standard on Linux, and two kernel-level debuggers for Xen development. Our open source projects (and the source code) are hosted at oss.oracle.com

MySQL

We develop the world's leading open source database, used by the Web's largest, most innovative properties, Cloud providers, and enterprises, including Facebook, Twitter, eBay, Pinterest, Tumblr, Wikipedia, and YouTube. MySQL is also embedded in the solutions of over 3,000 ISVs / OEMs, including Adobe, Alcatel Lucent, Cisco, GE, HP, and Symantec. Propelled by the adoption of the LAMP (Linux, Apache, MySQL, PHP/Perl/Python) stack as the industry standard for building Web applications, downloads grew to more than 50,000 per day, and installations topped 12 million around the globe. Sun Microsystems acquired MySQLAB through the largest-ever open source acquisition. MySQL became a part of Oracle following its acquisition of Sun Microsystems in 2010. The MySQL team at Oracle drives all aspects of MySQL, including engineering, marketing, sales and support. Product areas include MySQL Server and InnoDB storage engine, MySQL Cluster database, MySQL Workbench, MySQL Enterprise Monitor, and MySQL Connectors. Oracle has accelerated investment into MySQL. With the emergence of Big Data, coupled with the shift to Cloud computing and the growth in mobile, social, and Web technologies, MySQL is ideally positioned to grow in some of the planet's most demanding, innovative startups and enterprises. For more, visit mysql.com.

Projects at Oracle

Oracle Labs

Oracle Labs is the only organization at Oracle dedicated exclusively to research. We identify, explore, and transfer new technologies that have the potential to substantially advance Oracle's business. We employ experts in fields relevant to both hardware and software design, including, for example, mathematics, materials science, and silicon photonics. Most of our projects aim to improve existing Oracle products. For example, the Database Research group is studying the effect of computer architecture and networking on database scalability. We also work on new product ideas that address significant industry problems and opportunities. Java, for instance, originated in Sun Labs (Oracle Labs' predecessor). In several current projects in collaboration with Oracle's development organizations, our goal is to bring new, transformative software and hardware technologies to market. For details on current research projects, visit labs.oracle.com.

Sun Ray Thin Client Technology

Sun Ray is a desktop thin client, employing ultra-low power (just 4 Watt) desktop clients and latency-optimized protocols so users connect individual clients to sessions running on Solaris, Linux, and Windows. Designed for security and performance, Sun Ray devices can be configured to use cryptographic smart cards and two factor authentication to provide instant remote desktop access to existing sessions. Sun Ray developers work on firmware, server software, and device drivers, as well as Sun Ray hardware. Part of the industry's most complete virtualization portfolio, Sun Ray clients are never managed individually. Instead, management is done with Sun Ray software or Oracle Virtual Desktop Infrastructure. Large user communities comprising thousands of Sun Ray client devices can be managed from a single interface with enough individual control to provide a choice of desktop operating systems per Sun Ray client or per user, while still benefiting from virtual machine templates and multiuser operating systems to reduce management overhead.

ORACLE ON DEMAND

IT solutions provided via the Cloud are hot. Oracle On Demand is the premiere Cloud services provider for Oracle systems (hardware and software) seeking to improve business performance. Oracle offers hundreds of on-demand solutions, including hosting and managing applications. Oracle On Demand has millions of users worldwide. We give customers flexibility and choice when we host their solution and take responsibility for managing the IT infrastructure, including hardware, software, and related services. Today, we manage networked storage and thousands of commodity servers. We offer a platform as a service (PaaS) in which we host the middleware and database products and the entire range of Oracle applications. We interact daily with technologies such as Java, XML, symmetric replication, network security and encryption, Internet procurement, Web exchange software, Web development, databases, 4GL programmatic interfaces, ERP, and CRM.

CUSTOMER SUPPORT SERVICES

Oracle Support offers enterprise product support for customers: comprehensive problem resolution for Oracle technology and applications. We provide a range of services, from testing to maintenance of an enormous solutions knowledge base to troubleshooting with proactive, automated diagnostic tools. We interact daily with customers to provide accurate, effective, and proactive solutions, both in the field and through our support centers.

Highlights of Oracle Support include innovation, customer support, proactive support tools, and integrated service. Oracle also offers Global IT and Oracle Advanced Customer Support

Services. Global IT provides worldwide IT infrastructure services, including enterprise and data center connectivity, communications (voice, video), end user support, and risk management supporting a wide range of business and operational requirements to enable Oracle's success. Priorities are to balance business requirements, cost, and risk to ensure Oracle's success. Oracle Advanced Customer Support Services provides global, tailored mission-critical support services to maximize availability to customers with complex IT requirements. We provide customized, proactive solutions for all Oracle applications and technologies: Sun Servers and Storage, Database, Middleware, and Applications. We provide a range of services, from prerelease testing to maintenance of an enormous solutions knowledge base to troubleshooting with proactive, automated diagnostic tools. We interact daily with customers for proactive technology and applications incident resolution.

Projects at Oracle

ORACLE UNIVERSITY

Oracle University delivers training to enhance the adoption of Oracle technologies. As one of the largest corporate training organizations in the world, we offer complete, flexible, and customized learning solutions delivered worldwide. We can help customize a complete training plan that matches the requirements of any organization. We train entire project teams according to their learning needs, timeline, and budget and also help individual learners find the right training through easy job/role learning paths. Our courses are available in a variety of formats to provide students with flexible learning options—in a classroom or through live virtual training, self-study, or custom training. We now offer a new format called Training on Demand; training is offered as a live video stream so the user can learn at their convenience. We back up all training with our 100% Student Satisfaction Program. Oracle certifications are tangible, industry-recognized benchmarks of experience and expertise that can help Oracle customers, partners, and employees succeed in their career. Our courses are created with the guidance of development teams creating the actual products—providing the most up-to-date, accurate Oracle courseware available. With thousands of course titles, we cover all areas of Oracle software and hardware. Visit oracle.com/education.



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Oracle is committed to developing practices and products that help protect the environment

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