

# ORACLE

MAGAZINE

JULY/AUGUST 2017

## GREAT INTEGRATIONS

How will you deploy your organization's IT in the cloud? Reduce complexity and achieve one connected enterprise with Oracle Cloud Platform integration services



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WHERE OF BUSINESS ANALYTICS

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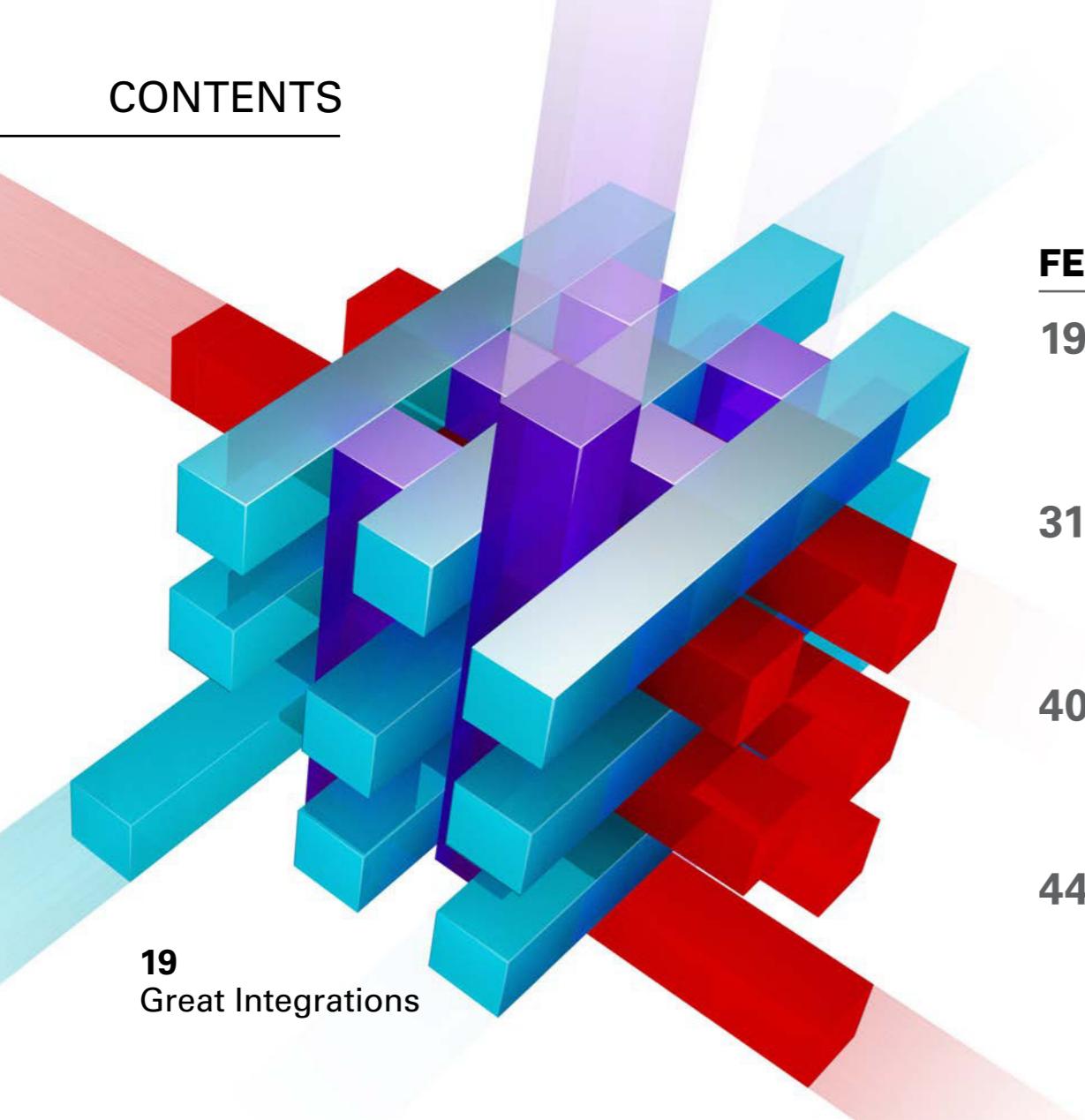
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Great Integrations



**8** Events



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Tom Haunert



# Integrate for Value

Integration puts enterprise technology to work.

**Enterprise integration technology** is about—among other things—combining the old and the new, connecting the local and the cloud, and keeping if not improving on the user experience.

Being able to combine on-premises data and technology with newer data in the cloud delivers value for both the old and new technology investments. Using cloud integration services to connect multiple third-party cloud services and deliver real-time integrated data and transaction support allows organizations to build their own apps—including mobile apps—based on the integrated services and data. Companies can also expose those same cloud service integrations to their users in

third-party software-as-a-service (SaaS) applications.

*Oracle Magazine's* July/August 2017 cover feature, "[Great Integrations](#)," describes the integration journeys of three organizations using Oracle technology, including Oracle Integration Cloud, to combine third-party data-sources and applications, connect on-premises systems and cloud services, and deliver real-time results in mobile apps (built with Oracle Mobile Cloud Service) and in SaaS applications from multiple vendors.

Also in this issue, "[Analytics for Business](#)" describes how organizations are using the features and capabilities of Oracle Analytics Cloud to combine data-

sources and front-office and back-office systems to enable both IT and business users to do their own analytics.

### ISSUE INTEGRATION

*Oracle Magazine* gets email, and since the magazine went all-digital with the September/October 2015 issue, the most popular email topic has been the magazine's subscriber platform. The top requests since we introduced that platform? "Can you send me the print issue?" "Can you deliver a printable format?" "Can you provide a downloadable format, such as PDF, for offline reading?"

We don't have a print issue to send, but this issue of *Oracle Magazine* goes

out to subscribers on a new digital platform. Use the new platform to print articles from your browser and download a PDF of the issue for offline viewing. There's full-text search, direct social sharing is available on all devices, and no password is required.

We've got plans for even more magazine platform updates this year, so if you don't already, [subscribe](#) and check back often.



Tom Haunert,  
Editor in Chief

Emails and posts received by *Oracle Magazine* and its staff may be edited for length and clarity and may be published in any medium. We consider any communications we receive publishable.

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**TRY** Oracle Analytics Cloud.

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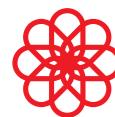
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## INTERVIEW

John Hagerty, vice president of product management for business analytics at Oracle, sees organizations asking new questions about datasources they haven't tapped into and how to use that information to refine and enrich decisions.



# The Who and Where of Business Analytics

Business users create self-service reports and predictions, and technology joins data in the cloud with Oracle Analytics Cloud. **BY TOM HAUNERT**

**Organizations demand significant capabilities from their business analytics tools.** From enabling business users to create self-service data visualizations and reports to moving technology to the cloud and adding support for unstructured information, users are driving business analytics to do more. *Oracle Magazine* caught up with John Hagerty, vice president of product management for business analytics at Oracle, to talk about the state of business analytics, how the cloud is changing business analytics operations, current data integration challenges, and more.

**Oracle Magazine:** What is the state of business analytics today?

**Hagerty:** Business analytics has largely been about on-premises enterprise reporting where a very well-trained group of people, largely in IT, would establish an environment, model all the data, and then produce a whole series of dashboards and reports that get distributed to the masses. And while that is where business analytics has been, it is now being augmented with self-service business analytics. With self-service analytics, individuals—business users—can do their own analyses, do their own visualizations,

and do their own projections. This self-service business analytics model has really become a focus for a lot of enterprises.

While more and more business analytics capabilities have been deployed within the enterprise and targeted toward different types of users, most of those deployments have been on premises. But now business analytics is increasingly headed toward the cloud for a couple of reasons: number one, for business agility, and number two, to work with data that is already located in the cloud. Organizations are putting analytics in the cloud alongside that data and mixing both on-premises and cloud data to do the types of analysis they need to do.

**Oracle Magazine:** How is cloud changing the technology and operations of business analytics?

**Hagerty:** With all the business analytics technology on premises, it was a responsibility of the organization to procure the hardware, deploy the hardware, configure the hardware, implement the software on the hardware, and then maintain the environments. So a lot of the work around business analytics was also part of IT operations and focused on answering the question, “How do I manage and configure all

of the hardware and software to be able to do what I want to do?"

With the cloud you eliminate a lot of that on-premises work. You don't have to procure and upgrade your hardware on an ongoing basis, and you don't have to install software if you don't want to. With Oracle Cloud, for example, Oracle

**"We're seeing that integrating data is not necessarily *only* an IT task—it's also a business analyst task."**

provides the computing and storage platform as a service; all you need to do is use it.

Because you don't have to worry about a lot of hardware considerations in the cloud, you don't have to plan, configure, and purchase for peak capacity—a capacity you need infrequently, maybe only a couple of days a week or month. And that makes a huge difference in terms of forward planning, cost management, and maintenance.

**Oracle Magazine:** How are business analytics technologies and processes integrating

and addressing today's data volumes and data variety?

**Hagerty:** Data integration has largely been the province of data integration specialists who aggregate, manipulate, and model data. But we're seeing a change; we're seeing that integrating data is not necessarily *only* an IT task—it's also a business analyst task. There are data preparation capabilities within the Oracle analytics software and services that do data preparation, and a business analyst can use that technology to get information from different sources and meld it together, rather than having to go through an IT process to make that happen. IT professionals still manage the regular integration of big sources of data, but the business analyst can now pull things together on the fly and mix and merge data to support a specific analytic need.

Historically, when people think of business analytics (or business intelligence), they tend to think of structured data, such as their data warehouse. This information is well known and well trusted, but over the last few years there has been an explosion of different sources of data.

People are trying to get their arms around that new data, regardless of where it sits. So when people think about an enterprise business analytics strategy, they tend to think about a highly structured view of the enterprise data, but they need to ask new questions, such as, "What other sources of data haven't I tapped into? How do I use that information to refine and enrich the decision that I need to make?" And getting those answers requires getting at all types of data, be it structured, unstructured in Hadoop, in a relational database, or in a flat file.

**Oracle Magazine:** Oracle recently announced the availability of Oracle Analytics Cloud. What is it, how does it fit into the Oracle Business Analytics cloud services portfolio, and how does it address the requirements of different businesses, users, and datasources?

**Hagerty:** Oracle Analytics Cloud delivers a collection of business analytics service capabilities.

Oracle Analytics Cloud includes Oracle Data Visualization Cloud Service features for business-led groups; it includes Oracle Business Intelligence Cloud Service, which includes Oracle Data Visualization Cloud Service, but adds a semantic layer that adds governance and control. It includes mobile features with Oracle Day by Day, and it includes scenario modeling with Oracle Essbase.

Oracle Analytics Cloud is a complete solution that includes the capabilities of these services and features. It supports all roles in the enterprise, from business analyst to decision-makers to developers in IT. It scales from personal to work group to department to the enterprise. It delivers secure connections to the right data at the right time and provides a modern platform for team collaboration. And Oracle Analytics Cloud gives organizations freedom of choice for deployment and governance. □

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PHOTOGRAPHY BY **DAVE BRADLEY**

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## NEXT STEPS

**LEARN** more about Oracle Business Analytics cloud services.

**TRY** Oracle Analytics Cloud.



BY STEPHEN CHIN, DIRECTOR OF ORACLE TECHNOLOGY NETWORK COMMUNITY MANAGEMENT



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## Gear Up for Oracle OpenWorld

Oracle Technology Network community leaders, Oracle ACE Directors, and developer luminaries will present developer sessions at Oracle OpenWorld and JavaOne October 1–5. Register today for [Oracle OpenWorld](#) and [JavaOne](#). And follow the Oracle Developers social channels ([Twitter](#) and [Facebook](#)) to stay connected during the conferences.

## ORACLE CODE REDUX

Were you in the wrong city at the wrong time? Fear not! You can see what you missed in replays of select Oracle Code sessions from San Francisco, California; New York, New York; and Washington DC on the [Oracle Code YouTube playlist](#).



# Cloud and the User Group

IOUG members go beyond presentations to deliver experience at COLLABORATE 17.

**People join Oracle user groups** and attend conferences to stay on top of the technology that runs their businesses. At COLLABORATE 17, members of the Independent Oracle Users Group (IOUG) Cloud Computing Special Interest Group (SIG) led the “Cloud Experience” all-day session. Attendees brought their own laptops and signed in to Oracle Cloud trial accounts, and then fellow user group members guided them through using Oracle Cloud services to set up OS secure authentication, create storage containers, and back up data to Oracle Cloud and recover it to on-premises servers. Participants also learned new ways to leverage cloud-based infrastructure and monitor both infrastructure and user experience.

*Oracle Magazine* spoke to three Cloud Experience session leaders about their hands-on experience with Oracle Cloud services and what they learned.



**Tariq Farooq** 

ORACLE ACE DIRECTOR

“In less than 30 minutes we spun up an entire cloud service instance. It’s nothing short of a revolution. It’s point, click, click, you provision services, and it’s ready to go. That process used to take weeks or months.”



**Erik Benner** 

ORACLE ACE DIRECTOR

“Oracle PaaS [platform as a service] provides different components. As an application developer, you can combine them to make a complete application and rapidly deploy it to your users.”



**Kai Yu** 

ORACLE ACE DIRECTOR

“Previously, developers starting a project had to prepare hardware and software and get it all to work together. With [Oracle Cloud] PaaS you have the toolbox as well as the environment, so you can focus on new ideas.”

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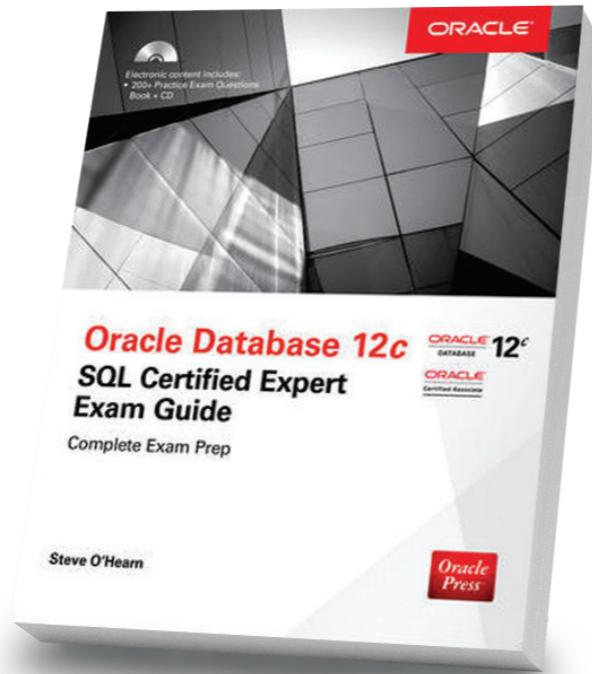
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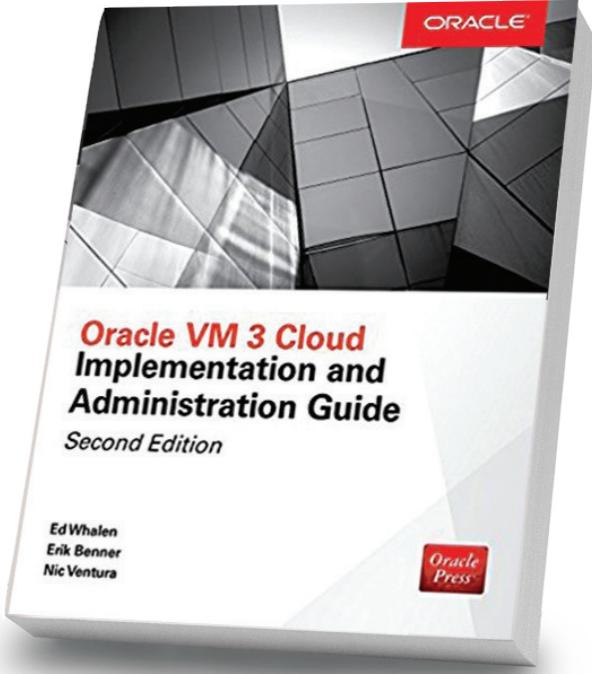
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# In Real Life

Meeting colleagues in person makes all the difference for these three peers.



## Sandra Flores

Mexico City, Mexico



**Company:** [DevX](#)

**Job title:** SOA architect

**Oracle credentials:** Oracle

Service Oriented Architecture

Infrastructure 11g Certified

Implementation Expert and

Oracle Unified Business Process

Management 11g Certified

Implementation Specialist

**Length of time using Oracle**

**products:** Five years

**How did you get started in IT?** Prior to university, I was considering a career in robotics. I went to a university expo, and I met a group of IT students and teachers from the most recognized software engi-

neering school in Mexico. They talked about the possibilities of the technology field, and that was the moment I began to fall in love with IT. Right then and there I changed my mind about robotics, and I ended up enrolling in that university.

**What's your favorite tool on the job?** Oracle Service Bus. We normally use it as a communication medium between applications, and it's continuously improved upon in order to adapt to customer demands. I see it as a pillar for middleware

implementation that may ease the developer's job, as well as quickly delivering value to the customer.

**Which new features in Oracle Fusion Middleware are you currently finding most valuable?** Inside Oracle SOA Suite 12c there are some very interesting features, such as Oracle Enterprise Scheduler, which makes it easy to use calendars for jobs. Another one that I find very useful as a developer is the XSLT [XSL Transformations] debugger.



## **Yenugula Venkata Ravi Kumar**



St. Petersburg, Florida



**Company:** [Raymond James Financial](#)

**Job title:** Lead DBA

**Oracle credentials:** Oracle Certified Master (Oracle Database 10g) and Oracle Certified Performance Tuning Expert (Oracle Database 11g)

**Length of time using Oracle products:** 15 years

### **What advice do you have about how to get into database development?**

Keep learning every day. Look at Oracle blogs for technical tips, and attend the Oracle sessions provided by Oracle user groups in every corner of the world. Attending user group meetings and other such networking events is a great way to learn about the technol-

ogies and the people that use and administer them. Learning from colleagues and experts in the field is a very good way to jump-start one's learning journey.

### **You've taken Oracle University [OU] classes in the past. What led you to do this?**

I wanted to learn in a structured manner in a classroom, and also earn my Oracle Certified Master certification, so I took two courses from OU. I wanted to focus and completely get away from my daily work, in a classroom environment, in order to truly learn. I prefer the classroom, but I do appreciate all of OU's different training format options—live

virtual classes, training on demand, classroom training, and corporate training.

### **What green practices do you use in your DBA work?**

In my opinion, IT consolidation and monitoring real-time database performance should now be considered green practices. I strongly recommend server consolidation, replacing older servers with the latest servers for ease of use and less consumption of resources. Oracle Cloud can play a big role in this space, given the fact that it's faster to deploy, more agile, simpler to run, requires fewer IT skills, and has a lower total cost of ownership.



## Philippe Fierens

Brussels, Belgium



**Company:** [Fierens Consulting](#)

**Job title:** Oracle DBA and architect

**Oracle credentials:** Oracle Certified Professional (Oracle Database 10g)

**Length of time using Oracle products:** 16 years

**How are you using social media in your work these days?** I'm active on Twitter and try to blog when time permits, both of which allow me to share my technical knowledge and keep in touch with the Oracle community. When I started speaking at Oracle user group conferences, I already "knew" quite a few people on Twitter, and meeting them in real life was a really fan-

tastic experience. I have some great friendships that began on Twitter. It's so nice to see how much people want to help each other.

**What's the next big thing driving change in your industry?** The DBA role is evolving at a high speed. If all you're qualified to do is upgrade and install databases and do backup and restore operations, you'll soon be out of a job, due to the cloud. It's necessary to invest time learning about aspects of the job that will be needed in the cloud era, such as tuning and security. You'll need to go beyond GUI performance tuning

and DevOps to keep yourself relevant.

**What's your go-to Oracle reference book?** I really love Christian Antognini's book *Troubleshooting Oracle Performance* [Apress, 2008]. It's very good for performance tuning. And I still have the first edition of Tom Kyte's *Expert Oracle Database Architecture* [Apress, 2005]. It was one of the first Oracle books I bought, and it got me started with Oracle Database and taught me the basics—basics I soon learned some seasoned DBAs had never mastered. It may be "old" in IT terms, but it's still very relevant.



# GREAT INTEGRATIONS

Cloud-based integration reduces complexity and connects the enterprise.

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BY DAVID BAUM

Integration technology is fundamental to business operations, but connecting information systems is becoming progressively more complicated as data pours in from so many types of systems, applications, and devices—from on-premises data centers as well as from an incredible variety of third-party applications and services.

"Today's IT professionals must contend with everything from legacy applications to IoT [Internet of Things] sensors to mobile messaging apps using chatbots," points out Amit Zavery, senior vice president of integration products at Oracle. "Companies need a centralized, well-architected integration hub to deal with it all, as both structured and unstructured information flows from multiple sources to multiple targets. Today, the most versatile integration hubs reside in the cloud."

For example, Oracle Integration Cloud simplifies the creation of application-to-application (A2A) and business-to-business (B2B) interfaces, Zavery explains. Developers can use this cloud service to develop new interfaces and upload existing ones, but they don't have to deal with maintaining and managing the integration platform itself—not to mention keeping

it current and scaling it as traffic increases. "Oracle handles the infrastructure so customers can focus on core integration tasks and scale their systems as needed," Zavery adds.

### **Hybrid Cloud Integration: Calix**

For many Oracle customers, part of the journey to the cloud involves figuring out how to connect on-premises enterprise systems with new cloud services from Oracle and other vendors. Consider Calix, a provider of broadband communications access systems and software. When this US\$500 million telecommunications product and solutions company set out to create a self-service ecommerce environment that would allow telecommunications companies and other service providers to easily order their communications equipment and software, it used Oracle Integration Cloud to tie it all together.

According to Doug Berringer, business solutions architect at Calix, these telecommunications companies and other service providers need to obtain price quotes before they can purchase Calix' communications gear. Calix' existing commerce tools did not allow customers to self serve and required the Calix sales team to be involved in every transaction—leaving the



Doug Berringer, business solutions architect at Calix, says the prebuilt adapters in Oracle Integration Cloud allowed his company to create new interfaces in just a few hours, versus the weeks similar projects required in the past.

## CALIX

Petaluma, California

**INDUSTRY:**  
Communications

**ORACLE PRODUCTS:**  
Oracle Integration Cloud  
Oracle Process Cloud Service  
Oracle Configure, Price, and Quote Cloud (Oracle CPQ Cloud)  
Oracle Commerce Cloud  
Oracle E-Business Suite

team with less time overall to pursue high-value-add selling activities. For its new self-service ecommerce system, Calix' IT team decided to use Oracle Integration Cloud to speed up this workflow and simplify the connections with the company's existing commerce systems so service providers could purchase equipment with little or no intervention by sales personnel.

# **“We made the decision to move away from a third-party integration product and centralize all of our integrations around Oracle Integration Cloud.”**

—**Doug Berringer**, Business Solutions Architect, Calix

“When we rolled out Oracle Commerce Cloud, one of the requirements was that it needed to be very tightly integrated with Oracle CPQ Cloud, Salesforce, and ultimately our Oracle E-Business Suite ERP [enterprise resource planning] system to streamline these processes,” explains Berringer. “We made the decision to move away from a third-party integration product and centralize all of our integrations around Oracle Integration Cloud.”

Now, Oracle Integration Cloud manages the exchange of data between Oracle Commerce Cloud and Oracle CPQ Cloud as customers configure, quote, and price their orders via a nimble self-service environment. Oracle Integration Cloud references customer relationship management data from Salesforce, and will soon log orders in the Oracle E-Business Suite system as

part of a complete quote-to-order process.

Previously Calix used legacy on-premises integration technology from a third-party vendor, but Berringer says it was slow and inflexible. “The software could talk to Salesforce through a built-in connector, but we couldn’t use it to create arbitrary REST endpoints,” he explains. “And because it could only do scheduled integrations, quotes were transmitted in batch mode every 20 minutes, rather than in real time and on the fly.”

Using Oracle Integration Cloud, Berringer’s team consolidated the interfaces created by that vendor and two other third-party integration tools into a single, cloud-based integration platform. They used the prebuilt adapters in Oracle Integration Cloud to create new interfaces in just a few hours, versus weeks for similar development projects in the past.

"Whether the data comes from the cloud or the data center is no longer a big concern," Berringer says.

### **Greenfield Integration: The Factory**

Oracle Integration Cloud works hand in hand with Oracle Mobile Cloud Service to connect front-end apps with back-end services handling security and data management, as well as to simplify federated authentication with third-party applications such as Facebook Messenger and WhatsApp. These unified cloud platform services enabled The Factory to revolutionize one of the world's largest B2B markets: the automotive auctions that move approximately 22 million vehicles in the United States each year.

According to Lynn Clark, CEO at The Factory,

## **Seeing Is Integrating**

The Visual Integration Designer in Oracle Integration Cloud lets you drag and drop components to develop integrations. Configure adapters, model data mappings, and activate integrations—all with zero coding.

most auto dealers acquire vehicles and sell off unwanted inventory through auction houses, an unpredictable process that hasn't changed much since the days of the horse and buggy. Buyers attend these auctions to physically inspect, appraise, and bid on vehicles, a cumbersome process that is fraught with delays and excessive paperwork. The Factory created a software-as-a-service (SaaS) app to streamline these transactions—not only during automotive auctions but whenever buyers want to evaluate used car inventory.

Working with Oracle Platinum Partner Sunera Technologies, The Factory used Oracle Cloud to create an online marketplace to simplify wholesale vehicle sales among automotive brokers and dealers. "Our mobile app standardizes the appraisal process and gives dealers all the information they need to make buying decisions," she notes. "It's a lot easier than carrying around a clipboard to appraise vehicles, and it allows dealers to appraise vehicles in a standardized way."

Each appraisal record contains 4 pictures and 24 points of description, along with as many as 9 text or voice descriptions. Oracle Integration Cloud interfaces with third-party cloud services



"Oracle Cloud is absolutely the way to go, especially for a startup," says The Factory's Director of Technology and Development Jerry Clark (right), shown here with CEO Lynn Clark.

## THE FACTORY

Vero Beach, Florida

### INDUSTRY:

Dealer platform, automotive

### ORACLE PRODUCTS:

Oracle Integration Cloud  
Oracle Mobile Cloud Service

Oracle Database Cloud

Oracle Database Backup Cloud Service

Oracle Storage Cloud Service

Oracle Java Cloud Service

Oracle Sales Cloud

from Black Book and AutoCheck to give buyers a good handle on the condition and value of each vehicle.

"Data from all appraisals automatically flows to Oracle Database Cloud, so if another dealer is looking for a particular car, the information is often already available in the system," explains Jerry Clark, director of technology and development at The Factory. "They can use the app to make offers on vehicles, and the owners of those vehi-

**“Oracle offers an integrated cloud stack that includes business intelligence, analytics, big data preparation, and other services, which will be valuable in the future. It’s plug-and-play, so we can add cloud services as we go.”**

—Lynn Clark, CEO, The Factory

cles can either accept, decline, or counter the offers. It's easy to conduct appraisals, send buy-figure requests, and receive alerts on their phones about the status.”

Jerry Clark says The Factory decided to use Oracle Cloud technology to develop and deploy this native app because Oracle offers cloud platform services that are fluid and adaptive. “We don't have to own the equipment. Oracle Cloud is absolutely the way to go, especially for a startup,” he says. He describes Oracle Integration Cloud and Oracle Mobile Cloud Service as the backbone of the new SaaS app. “These platform services do the heavy lifting by governing where the data flows and how calls are routed,” he explains.

According to Zavery, Oracle Cloud includes all the tools that customers need to develop the

front-end portions of their mobile apps as well as to connect them with external applications and services. For example, The Factory used Oracle Integration Cloud to create APIs that integrate data from CDK Global, a dealer management system, and with Experian, which runs credit checks and background histories on each car.

“API management is central to cloud integration,” Zavery adds. “Oracle Integration Cloud includes an API portal that governs the creation, exchange, management, and reuse of APIs among developers and third parties, with gateways that can run in the customer's data center or in the cloud. This helps customers create unified experiences by seamlessly pulling data from multiple applications.”

And because Oracle Cloud can scale on demand, The Factory's SaaS app can handle

a burgeoning volume of traffic. “On a busy weekend, a thousand dealerships could appraise 20 cars per day, which means 20,000 vehicles passing through the system in a short time period,” Jerry Clark says. “We’re confident we can handle the load. Everything flows automatically. Dealers can review appraisal logs on iOS and Android devices, as well as through web portals on their desktops.”

“Oracle gives us credibility as the best database in the world, and now we have a cloud version of that database to anchor our mobile app,” adds Lynn Clark. “Oracle offers an integrated cloud stack that includes business intelligence, analytics, big data preparation, and other services, which will be valuable in the future. It’s plug-and-play, so we can add cloud services as we go. We’re happy we standardized on a complete Oracle stack in the cloud. Oracle was very responsive and quick to understand our business requirements.”

### **Connecting Supply Chains: Silver Spring Networks**

Silver Spring Networks looked to Oracle’s cloud-based integration platform to simplify integration among its cloud and on-premises

information systems as well as to forge stronger links with contract manufacturers for shipping orders, returning orders, and fixing and redelivering devices. The company, which calls itself the trademarked “enabler of the Internet of Important Things,” provides cities, utilities, and companies on five continents with a cost-effective, high-performance IoT network and data platform to operate more efficiently, get greener, and empower innovative services that can improve the lives of millions of people. For example, Silver Spring Networks powers wireless networks for utility companies to provide smart metering solutions that facilitate efficient, two-way information flow between consumers and power generation facilities to help improve energy management and service reliability.

Silver Spring Networks’ primary information systems include Oracle E-Business Suite applications handling financials and supply chain, along with one of Oracle’s Agile Product Lifecycle Management applications and Oracle Human Capital Management Cloud. The company also depends on SaaS vendors such as Salesforce for sales automation and Concur for expense management and travel management.



"Oracle Integration Cloud enables us to integrate new functionality very quickly," says Harihar Jobanputra, director of Enterprise Applications and Services at Silver Spring Networks.

## SILVER SPRING NETWORKS

San Jose, California

### INDUSTRY:

Utility, smart city, and other industrial IoT infrastructure

### ORACLE PRODUCTS:

Oracle Integration Cloud  
Oracle Human Capital Management Cloud  
Oracle Configure, Price, and Quote Cloud  
Oracle SOA Suite  
Oracle E-Business Suite  
Agile Product Lifecycle Management

Previously, Silver Spring Networks used an on-premises version of Oracle SOA Suite to create interfaces that route data and messages among these disparate application environments. However, according to Harihar Jobanputra, director of Enterprise Applications and Services at Silver Spring Networks, the company became dependent on an old version of the software that was no longer adequate for the

**“One of our IT principles is cloud first. Because our integration platform is now in the cloud, it is very easy to integrate new SaaS or PaaS applications. We can move fast to accommodate new business needs.”**

—Harihar Jobanputra, Director, Enterprise Applications and Services, Silver Spring Networks

company's security, auditing, and growing compliance requirements. Rather than upgrading its on-premises version of Oracle SOA Suite, Silver Spring Networks subscribed to Oracle Integration Cloud platform as a service (PaaS). “We were able to provision our integration environments and migrate existing integration code without any issues,” says Dinesh Khurana, lead Oracle and SOA administrator at Silver Spring Networks.

The company used Oracle Integration Cloud to streamline important business activities that require interfacing with Oracle E-Business Suite, such as managing expenses and simplifying human capital management. It also used the cloud software to establish new B2B integrations for configuring, pricing, quoting, and fulfilling orders, allowing secure communications

with contract manufacturers to build and deliver the network equipment that connects the company's utility meters and IoT routers.

“We rely on Oracle Integration Cloud to synchronize information among business systems for HR systems, employee self-service, and expense management,” says Khurana. He adds that the implementation proceeded quickly because the company didn't have to develop new interfaces; it simply migrated the ones it had to the cloud and used out-of-the-box adapters to connect to the Oracle E-Business Suite modules.

Of course, as Jobanputra points out, because Oracle Integration Cloud is a PaaS, not a SaaS, offering, his team is still responsible for monitoring and maintaining the interfaces and environments—an effort that is essentially

equivalent to what they were doing before with Oracle SOA Suite. However, Oracle Cloud gives the company elasticity to expand as necessary. And because Oracle ensures that Silver Spring Networks is always running the latest versions of its software, Silver Spring Networks has an easier time staying current with the latest security and compliance requirements—and it's easy to scale as traffic increases. "Our growth patterns indicate that we need to get ready for highly available as well as redundant server additions, which are also justifications for moving to Oracle Cloud," Jobanputra adds.

Vamshi Lakkakula, lead integration and SOA developer at Silver Spring Networks, says the cloud service is in full production mode, handling between 300 and 500 messages per day and orders with many thousands of lines. He

and other members of the integration team can use their current Oracle SOA Suite skills to create new interfaces, and they encountered no issues migrating their on-premises Oracle SOA Suite interfaces to the new environment.

"One of our IT principles is cloud first," Jobanputra concludes. "Because our integration platform is now in the cloud, it is very easy to integrate new SaaS or PaaS applications. We can move fast to accommodate new business needs. Whether it's a third-party service such as Salesforce or another Oracle Cloud application, Oracle Integration Cloud enables us to integrate new functionality very quickly." □

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*David Baum is a freelance business writer specializing in science and technology.*

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**BOB ADLER/THE VERBATIM AGENCY AND  
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## NEXT STEPS

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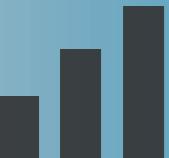


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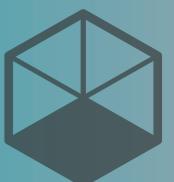
# ANALYTICS FOR BUSINESS



Organizations look to the cloud to make mission-critical decisions.

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BY DAVID BAUM



**A**s the digital universe expands to include vast new constellations of data, yesterday's data warehouses and decision support systems no longer offer the flexibility organizations need for effective decision-making. Forward-looking businesses are turning to cloud-based tools to discover unique insights hidden in the deep fields of the extended enterprise.

"The evolving domain of business intelligence now extends beyond your four walls," points out Vasu Murthy, vice president of analytics product management at Oracle. "You need to be able to meld internal data with external data from partners, web interactions, and third-party sources to obtain a complete picture of your business. Information is everywhere, and you need an analytic environment that gives you lots of flexibility."

According to Murthy, Oracle Analytics Cloud makes that easily possible, enabling users of every stripe to import data from multiple sources and quickly combine datasets—while providing enterprise capabilities for developing analytic applications that can be deployed

on premises or in the cloud, with automated backups, recovery, and data migration. (See the sidebar "[Now I See.](#)")

### **Melding On-Premises and Cloud Assets**

Oracle Analytics Cloud services are not only powerful but accessible, bringing analytic capabilities that were formerly sequestered in the back office to the front lines of the business. For example, OUTFRONT Media is using Oracle Business Intelligence Cloud Service, part of the Oracle Analytics Cloud portfolio, to distinguish itself in the highly competitive out-of-home media industry. The company's diverse portfolio of properties includes more than 400,000 digital and static displays that reach millions of commuters every day in more than 150 markets across the United States and Canada. Since spinning off from CBS Corporation three years ago, OUTFRONT Media, an early adopter of Oracle Business Intelligence Cloud Service, has embraced a cloud-first strategy to deliver compelling data visualizations to users at all levels of the company and produce new degrees of analytic insight.



Derek Hayden, vice president of application development at OUTFRONT Media, wants the business to focus on improving intellectual property, not on what happens in the data center.

Previously, OUTFRONT Media users relied heavily on the IT department to deliver cross-platform reporting. Despite having access to reporting tools within each system, employees

found it cumbersome to consolidate the information needed to perform their jobs. So Apps Associates, an Oracle partner, helped the company deliver a quick win for sales reporting

## OUTFRONT MEDIA

New York, New York

### INDUSTRY:

Advertising

### EMPLOYEES:

2,200

### REVENUE:

US\$1.5 billion

### ORACLE PRODUCTS:

Oracle Business

Intelligence Cloud  
Service

Oracle Sales Cloud

Oracle Fusion  
Applications

by creating interactive dashboards that had two years of historical data on sales and customer trends.

"Because there was no need to provision hardware or install software, we went from data

to deliverable in five weeks," says Derek Hayden, vice president of application development at OUTFRONT Media. "Daily efficiency immediately improved, since people no longer had to spend time creating and running reports."

## Now I See

The Oracle Analytics Cloud platform provides a broad set of capabilities for visual analysis, discovery, advanced analytics, reporting, and forecasting.

According to John Hagerty, vice president of product management for business analytics at Oracle, in the old world of decision support, you would first create a data warehouse, and then build dashboards and reports—a lengthy process that often took months or years to complete. With Oracle Analytics Cloud, business users have self-service tools to instantly move data to the cloud and visualize it using drag-and-drop techniques.

Oracle Data Visualization Cloud Service, for example, makes easy yet powerful visual analytics accessible to employees at every level of an organization. Individuals can combine data from a variety of sources—including software-as-a-service applications from Oracle and other vendors, on-premises systems, external sources, and personal files, and can author and access data visualizations on any mobile device with no extra work. Drag-and-drop capabilities allow workers to visualize data, change layouts, and present new insights.

"Now with data visualization, we

have something that is as visually compelling as it is easy to use," says Conny Björling, head of enterprise architecture for Skanska AB. "The storytelling functionality is a pivot point in terms of being able to explain your insights effectively."

In addition to Oracle Business Intelligence Cloud Service and Oracle Data Visualization Cloud Service, Oracle Analytics Cloud includes Oracle Day by Day and Day by Day Mobile Assistant and other Oracle Day by Day features, Oracle Synopsis, and Oracle Essbase Cloud Service. For more information about Oracle's cloud and on-premises analytics solutions, visit [oracle.com](http://oracle.com).

**“Because there was no need to provision hardware or install software, we went from data to deliverable in five weeks.”**

—Derek Hayden, Vice President, Application Development, OUTFRONT Media

After completing the initial sales dashboard, Hayden and his team used Oracle Business Intelligence Cloud Service to create real estate dashboards that allow lease reps to analyze lease portfolios, and financial dashboards that enable the finance team to view key performance indicators such as gross margin, revenue, expenses, pricing, budget to actuals, and year-over-year performance. Managers now have easy access to performance measures that compare budgeted with actual expenses, and they can quickly generate year-over-year performance graphs to identify areas of improvement. Within six months, dashboards were available to more than 150 users, utilizing a role-based architecture that ensures users see only the information that they are authorized to view.

The company next used Oracle Business Intelligence Cloud Service to replace a legacy on-premises revenue forecasting system, enhancing reporting capabilities with drill-downs and data visualizations. “We now have 250 people using cloud-based dashboards for sales, real estate, finance, and field operations,” Hayden says. “We used Oracle’s out-of-the-box visualizations, yet it was easy to reinforce our brand identity through the tool.”

OUTFRONT’s success using Oracle Business Intelligence Cloud Service has created a demand for additional value-added deliverables to a wider audience. The user base was expected to expand to 700 during the first half of 2017, and dashboards will include pricing analytics and account-executive book-of-business views. Each

user will see slices of data relevant to him or her—from the same core data.

Hayden values Oracle's platform-as-a-service (PaaS) strategy and offerings, which include tools for big data preparation, big data discovery, data integration, and event management. The company plans to use these tools to incorporate data from third-party sources, as well as to use real-time data to enhance its understanding of how an advertiser's target customers interact with OUTFRONT's inventory.

The company still uses some on-premises software, but it now looks to the cloud for new hardware and software functionality. "We have no interest in creating an on-premises environment to support new initiatives," Hayden says. "We want to focus on improving our intellectual property, not on what happens in the data center. Using Oracle Cloud means easier administration, lower capital investments, fewer DBA chores, and the opportunity to make quick wins with relatively small investments."

### **Global Insight from a Unified Platform**

Managers at Skanska AB, a world-leading project development and construction group,

came to this same conclusion when they set out to establish a comprehensive analytics strategy for Skanska's 41,000 employees throughout North America, Central Europe, the Nordic countries, and the United Kingdom.

Conny Björling, head of enterprise architecture at Skanska AB, reports that he was drawn to Oracle Analytics Cloud services not only for their advanced functionality, but also because of the high degree of integration with other Oracle Cloud services, from turnkey application integration to mobile application development. "I wanted an enterprise platform that we could build on," he reports. "Oracle offers a broad palette of cloud services, which makes it a strategic partner and strategic vendor for us."

Skanska's first major cloud analytics initiative involved repurposing an important monthly financial report, which helps the finance team report and analyze the consolidated monthly financial results. Previously the team had to manually prepare data from an Oracle Hyperion Financial Management system, and then reformat it in Microsoft Excel with the help of an external partner. Data-entry personnel had to manually add annotations



Conny Björling, head of enterprise architecture at Skanska AB, reports that he was drawn to Oracle Analytics Cloud because he wanted an enterprise platform that Skanska could build on.

from all the different business units.

Working with just one developer, Björling used Oracle Business Intelligence Cloud Service to re-create the monthly financial report with added analytic capabilities in the cloud,

including adding the annotation functionality directly into the solution. “One developer completed this project in 17 days, with me working half time as the business analyst,” he says. “We didn’t have to provision hardware or buy

## SKANSKA AB

Stockholm, Sweden

### INDUSTRY:

Engineering and construction

### EMPLOYEES:

41,000

### REVENUE:

US\$17.2 billion

### ORACLE PRODUCTS:

Oracle Business Intelligence Cloud Service

Oracle Fusion Applications

Oracle Database Cloud Service

Oracle Hyperion Financial Management

**“We didn’t have to provision hardware or buy on-premises licenses or put a software infrastructure in place. We simply subscribed to the BI service and started developing right away. Oracle’s BI cloud service makes it incredibly fast to make progress.”**

—Conny Björling, Head of Enterprise Architecture, Skanska AB

on-premises licenses or put a software infrastructure in place. We simply subscribed to the BI [business intelligence] service and started developing right away. Oracle’s BI cloud service makes it incredibly fast to make progress.”

Once per month, and multiple times per month during the reporting close period, data is transferred from the Oracle Hyperion consolidation solution to Oracle Database Cloud Service via the data sync module that comes with Oracle Business Intelligence Cloud Service. Skanska uses Oracle Application Express to add an annotation form directly to the BI dashboards. “It used to take three or four days every month to run these processes,” Björling says.

“Now we load our on-premises data to the cloud in five minutes.”

According to Björling, Oracle Business Intelligence Cloud Service’s visualization tools give all types of users a rich sense of what is happening with the business, whether they prefer simple drag-and-drop functionality or wish to delve into advanced statistical functions. In the future, Skanska plans to delve into more of these advanced functions. For example, the company wants to use Oracle analytics capabilities to visualize as many as 10,000 projects ongoing at any given time in its home markets. Björling also foresees utilizing equipment sensors to monitor the status of thousands of

projects. This big data analytics initiative could open new revenue streams for Skanska.

"With Oracle's cloud-based analytic services, data visualization, BI, and data preparation are all on the same platform," Björling concludes. "Competing vendors are more focused on

front-end solutions, but Oracle gives us one unified platform to tie it all together." □

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*David Baum is a freelance business writer specializing in science and technology.*

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## NEXT STEPS

**TRY** Oracle Business Intelligence Cloud Service.

**READ** about Oracle Data Visualization Cloud Service.

**LEARN** more about Oracle business analytics products.



Falkonry Founder and CEO Nikunj Mehta works with customers who are looking to apply advanced analytics to their operations data and need a powerful, elastic, and scalable infrastructure.

## GO BIG, GO METAL

Falkonry chooses Oracle Bare Metal Cloud Services to support its pattern-recognition software. **BY LINDA CURREY POST**

**B**ig, powerful software solutions require powerful infrastructure. Falkonry, a Silicon Valley startup, is delivering an eponymous software offering to its customers on Oracle Bare Metal Cloud infrastructure services to unlock data-rich insights and improve industrial and operational processes.

By evaluating huge amounts of data transmitted by engines, motors, thermometers, and pressure gauges on production lines, the software uses pattern recognition and machine-learning technologies to hunt for data patterns that predict trouble. Plant managers can then take corrective action and avoid costly plant shutdowns.

This kind of predictive problem-solving requires a computing environment capable of quickly and accurately analyzing “mountains of data,” says Nikunj Mehta, founder and CEO at Falkonry.

“Our customers are looking to apply the advanced analytics in Falkonry software to their operations data,” he says. “They need powerful processors and an infrastructure architecture

that is elastic and scalable.”

That’s why Falkonry tuned its pattern recognition software to run with maximum efficiency on [Oracle Bare Metal Cloud Services](#).

Using Oracle Bare Metal Cloud Services, companies can quickly increase their compute, storage, and networking capacity to fit the requirements of the job at hand, without having to invest in or maintain equipment, explains Marc Levy, vice president and architect for the Oracle Bare Metal development group. The flexible platform offers organizations unmatched performance and availability, rock-solid security, and an economically attractive alternative.

“They want the most-direct access to raw infrastructure; they want big, beefy processing boxes; they want lots of very fast storage; and they want a very, very fast network,” Levy says.

### **Benefits in Bare Metal Infrastructure**

With Oracle Bare Metal Cloud Services, organizations can run on isolated hardware, virtual machines, or containers—without the traditional “hyper-

#### **FALKONRY**

Sunnyvale, California

#### **INDUSTRY:**

Computer software

#### **ORACLE PRODUCTS:**

Oracle Bare Metal Cloud Services



"By using Oracle Bare Metal Cloud Services, we are able to add a very large amount of computing power in a very short amount of time to explore the data around our customers' problems and provide very quick responses."

—Nikunj Mehta,  
Founder and CEO,  
Falkonry

visor penalty," in which a virtual server runs more slowly than the hardware allows. And they can have granular control of their services and security, while reaping the benefits of the elastic access to more resources, high performance, high availability, and cost-effective infrastructure services of Oracle Bare Metal Cloud Services.

The innovative infrastructure options, Levy suggests, offer customers the best of two worlds, marrying the benefits of traditional infrastructure with the flexibility of the public cloud.

Falkonry CEO Mehta says the design of the Oracle Bare Metal Cloud infrastructure meets the needs of his customers perfectly.

"By using Oracle Bare Metal Cloud Services, we are able to add a very large amount of computing power in a very short amount of time to explore the data around our customers' problems and provide very quick responses," Mehta says.

And Mehta, who has pushed for the "democratization" of analysis that extracts insights in complex operational data, has designed Falkonry so that it elastically scales on Oracle Bare Metal Cloud Services to accommodate business users.

"You don't need an advanced degree in data science to benefit from this technology," he says.

### **From Perfecting Industrial Processes to Saving Lives**

Manufacturers and mining companies are already using Falkonry software to stop trouble

on the production line before it starts. In the future, CEO Mehta envisions geologists using Falkonry software on Oracle Bare Metal Cloud Services to find patterns in electronic signals from deep in the earth that presage earthquakes and warn communities in harm's way. And he believes physicians will use the technology to recognize electrical "storms" in the human brain that foretell the onset of epileptic seizures and strokes, so they can intervene with drugs and surgery.

The combination of Falkonry software running on Oracle Bare Metal Cloud Services, Mehta says, "is a great fit" for these important interventions. □

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*Linda Currey Post is a senior writer with Oracle Content Central.*

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**BOB ADLER/THE VERBATIM AGENCY**

### **NEXT STEPS**

**TRY** Oracle Bare Metal Compute Service.

**LEARN** more about Oracle Bare Metal Cloud Services.

Paul Zajdel, vice president at Meta7, sees cloud changes driving organizational shifts.



## LESSONS LEARNED

Meta7 shares three top tips for moving to the cloud. **BY JEFF ERICKSON**

**M**eta7 knows firsthand how cloud computing is changing organizations and careers. Persistent requests from clients prompted the firm, an Oracle Platinum Partner, to purchase more than US\$1.3 million worth of Oracle platform and infrastructure services to deepen its own expertise in helping customers procure and implement Oracle Cloud solutions.

Since then, the company has migrated some of its own business processes to the cloud and built many models and demos based on scenarios at clients of various sizes. “We’ve worked to understand everything from how a third-party on-premises application leverages Oracle Database Cloud to what’s involved in a complete lift-and-shift of Oracle E-Business Suite to Oracle Cloud,” says Paul Zajdel, vice president at Meta7, a division of Forsythe Technology that is dedicated to the Oracle stack.

What the Meta7 team learned goes well beyond cloud service features and functions. Team members have stretched their

skills with new technologies and have taken on new roles to accommodate cloud services in application architectures.

That kind of change is nothing new for Meta7 and Forsythe, which began in the early 1970s as a technology hardware leasing company. “We’ve reinvented ourselves several times throughout our 45-year existence,” says Zajdel. It started with leasing, then reselling, then adding services, then adding security, and now adding managed services. He adds, “We’re in an industry that shifts. Each time the industry shifts, we have to shift, too.”

Today, “many of our customers have a mandate from senior management to explore the cloud and move at least some operations there,” says Zajdel. Some clients “have been told to use the cloud to get out of the data center business altogether.”

But the move to the cloud is not just a switch of one technology for another. “We see skill sets, roles, governance, and scalability changing—all of those things are different in a

## META7

Skokie, Illinois

### INDUSTRY:

Technology consulting and implementation

### ORACLE PRODUCTS:

Oracle Cloud platform-as-a-service, infrastructure-as-a-service, and software-as-a-service applications



Paul Zajdel (left), vice president at Meta7, and Robert Dawson, a master consultant at Meta7, have seen the cloud drive change in IT careers. In the cloud, DBAs “need to go back and grow their skills in new ways,” says Dawson.

cloud environment,” says Zajdel. And if you look at your cloud services through the same lens as your on-premises technology, “you’re going to get your toe stubbed or worse,” he adds.

Here are the top three things Zajdel and his team want you to know about moving operations to the cloud.

**1. Discipline Pays Off.** Achieving the touted benefits of the cloud takes discipline—in a couple of different ways, says Zajdel. First, communicate what you’ve bought—and what you haven’t—to people who work with your cloud services. “You need to have discipline, because all the services are right there, ready to use. You could

**“All the deep-dive tuning and performance work, all the spinning up instances, the time it takes to understand how the new release handles things and explain how it’s different— that’s high-value, time-consuming work that DBAs don’t have to do when the database is in the cloud.”**

—Paul Zajdel, Vice President, Meta7

just click a box and add additional capacity or a new feature, and now you’re paying for it,” Zajdel says.

Robert Dawson, a master consultant at Meta7, agrees that it’s easy to go overboard. He’s been guilty of it himself, adding extra database instances one day to test a governance issue and discovering he added more than Meta7 had contracted for. “Services are like Chiclets,” he says. “You just want to grab a handful.”

Next, says Dawson, you will also need discipline when setting up automated processes. “We’ve really enjoyed the automation that cloud deployments offer. You can build out consistent, tightly integrated application envi-

ronments and then start them up and shut them down when you want,” he says.

But it works out only if you bring discipline early on. For example, Meta7 spent time developing a standardized specification for its Oracle Database Cloud environments. “For the next database we need, there’s no install. There’s no configuration. There’s no setting up anything,” says Dawson. “You just deploy it.”

**2. Expect Resistance.** With the change to the cloud, as with any change in technology, there will be resistance within the organization. Meta7 consultants quickly recognized the institutional resistance to cloud computing, because they’d seen it in their early implementations of

Oracle Exadata Database Machine. “There were a lot of skill set gaps—a lot of the adoption fears,” says Dawson.

Like the cloud, Oracle Exadata was hard for customers to get their heads around, he says, “because it’s server and storage and networking and database.”

Faced with a machine that included all those different IT functions, many customers resisted. The questions, Dawson recalls, were good ones: “Who’s responsible for it? Who upgrades it? Who monitors it? Who tells you when it’s down?” The cloud can engender many of the same questions.

When a company is working with on-premises and cloud technology, someone needs to understand the cloud environment, “but also things like networking, VPN [virtual private network] access, security, basic tenants of infrastructure, and database as well,” says Zajdel. He notes that in large enterprises, all the skill sets are usually available, “but they’re spread to the four corners of the earth,” he says.

The answer, in Meta7’s experience, is to define new roles and have existing people move into them.

**3. Cloud Is an Opportunity to Grow Careers.** As more organizations moved to Oracle Exadata, a new role emerged: engineered systems administrator. “It was somebody you could point to who understood all the parts and pieces, plus database,” says Dawson. “They could patch it, they could manage it, and they could manage change and govern change.” Many engineered systems administrators started as DBAs, he says, “and we think many cloud administrators will come out of that same discipline.”

DBAs are highly skilled people with fewer demands on their time as databases move to the cloud, adds Zajdel. “All the deep-dive tuning and performance work, all the spinning up instances, the time it takes to understand how a new release handles things and explain how it’s different—that’s high-value, time-consuming work that DBAs don’t have to do when the database is in the cloud,” he says.

What do you do with the “found” time? “You have to redefine yourself as a DBA,” he says.

Dawson agrees. “There’s a level of frustration because DBAs are used to being responsible for the most-complex stuff, such as installing Oracle Exadata, installing Oracle RAC [Oracle

**“ You need to have discipline, because all the services are right there, ready to use. You could just click a box and add additional capacity or a new feature, and now you’re paying for it. ”**

—Paul Zajdel, Vice President, Meta7

Real Application Clusters], or doing version upgrades,” he says. “Now they need to go back and grow their skills in new ways.” But as Zajdel and Dawson have seen in their own firm, the opportunities are boundless.

“You can explore open source tools like Docker or Ansible, and learn to use REST services,” says Dawson. “Now you’re growing again. You might have been doing the same

thing for the last 10 years, and now you’re opening up an O’Reilly book and reading about infrastructure as code and automation in cloud environments. That’s empowering,” he says. “That’s career growth for DBAs.” □

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*Jeff Erickson is editor at large for Oracle Publishing.*

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PHOTOGRAPHY BY PAUL S. HOWELL

## NEXT STEPS

TRY Oracle Cloud  
PaaS and IaaS.



# Asynchronous Processing in Node.js

By Dan McGhan



Here's Part 1 in a four-part series on asynchronous Node.js development.

**JavaScript has been called the most popular programming language.** Why is it so popular? It likely has something to do with the fact that JavaScript is the programming language of the web and that web browsers are so ubiquitous and websites and apps are more popular than ever.

JavaScript was first released in 1995 as an event-driven language. As users interacted with content in a web page, events were triggered and JavaScript code registered with those events was executed.

A platform for running *server-side* JavaScript, Node.js was introduced in 2009. Node.js uses an asynchronous, event-driven I/O model that makes it efficient and scalable. But what exactly does that mean, and how are developers supposed to write asynchronous code? This *Oracle Magazine* article series will answer these questions and provide readers with a solid foundation for doing asynchronous work

with Node.js. Here's a list of the topics that will be covered in this Node.js series:

1. Introduction to asynchronous processing in Node.js
2. Using the Async module
3. The promise of promises
4. Async done right with `async/await`

In this first installment in the series, you'll learn some of the basics related to asynchronous processing with Node.js. Subsequent articles will build on the concepts covered in this article to do some more-complicated tasks.

The code in this article will be somewhat simple, enabling you to focus on core concepts. If you'd like to set up a test environment that you can use to work through the examples, check out "[Creating a Sandbox for Learning Node.js and Oracle Database](#)" on the Oracle and JavaScript blog.

## BEGINNING AT THE BEGINNING

Let's start with an overview of the Node.js architecture. Once Node.js is installed, you can run it from the command line as "node." Running "node" without any arguments starts the Node.js interactive mode, which is basically a read-eval-print loop (REPL).

```
$ node
> 1 + 2
3
> console.log('Hello world! ');
Hello world!
undefined
```

```
> process.exit(0);  
$
```

As you can see, JavaScript code can be entered and executed interactively. Note that `process.exit` is used to exit the REPL (pressing Ctrl-C twice will also exit). The “process” object is a global object that provides programmatic access to the currently running Node.js process. It is important to understand that Node.js runs as an operating system process.

Although Node.js is often described as a single-threaded environment, that description isn’t exactly complete. In fact, as shown in **Figure 1**, just by running Node.js and looking up the process with Activity Monitor on my Mac, I can see that the Node.js process is running 10 threads!

Most of these threads are created by two open source libraries that Node.js depends on: V8 and Libuv. V8 is the high-performance JavaScript engine that’s used by the Chrome web browser, and Libuv is the cross-platform framework that provides the evented architecture that makes Node.js so efficient.

When Node.js is described as a single-threaded environment, it’s because only one thread will be dedicated to running Libuv’s event loop. This thread is often referred to as the main thread, and it’s where all the JavaScript code in a Node.js

**Figure 1:** Single-threaded Node.js and its 10 threads

Activity Monitor (My Processes)						
Process Name	Memory	Compressed M...	Threads	Ports	PID	User
node	9.1 MB	0 bytes	10	29	64344	danielmcghan

application will run. And because all JavaScript code shares the same thread, it's very important that no application code consume much time on the thread. Enter asynchronous Node.js code.

## GETTING TO ASYNCHRONOUS

Many languages have features that allow for asynchronous programming, and JavaScript is particularly adept at this, due to its event-driven nature. Let's get into some code examples that demonstrate the difference between synchronous code and asynchronous Node.js code.

Here's that "hello world" you knew was coming:

```
console.log('hello');
```

```
console.log('world');
```

Add those lines to a file named sync.js. To run this script with Node.js, open a terminal, change directories to where sync.js was created, and run the following command.

```
$ node sync.js
hello
world
```

As you can see, "hello" appeared first in the console, followed by "world"—completely synchronous. So how can the code be made to run asynchronously? The answer is to use one of the asynchronous APIs provided by a built-in or third-party

module. Node.js has asynchronous APIs for many different types of operations, including timers, disk and network I/O, and CPU-intensive tasks (such as encryption and compression). These operations should all be done asynchronously.

Here's an example of asynchronous code that uses a simple timer:

```
setTimeout(function () {
    console.log('hello');
}, 3000);

console.log('world');
```

Save the script to a file named `async.js`, and run it with Node.js (as you ran the `sync.js` script before). You should see "world" appear immediately and "hello" appear three seconds later.

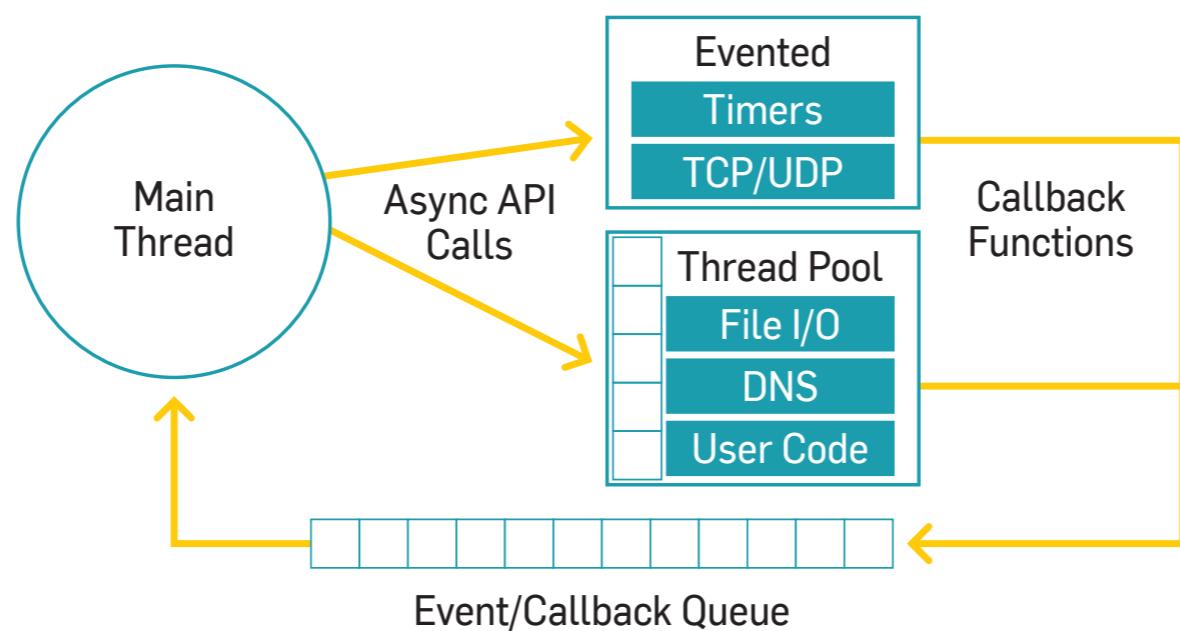
```
$ node async.js
world
hello
```

Surprising, no? The `setTimeout` function is an asynchronous API that takes two parameters: a callback function and the number of milliseconds to wait before running the function. `setTimeout` was implemented as an asynchronous API because pausing on the main thread would prevent all JavaScript code from running for the specified length of time. When `setTimeout` has finished doing its work (just waiting, in this case), it places the callback function in a queue to be executed ASAP.

**Figure 2** illustrates how asynchronous APIs work in Node.js.

Now that you have a better understanding of how asynchronous work is handled in Node.js, let's talk about an issue newcomers sometimes run into: the pyramid of doom! The pyramid of doom, aka callback hell, results from the nature of how anonymous callback functions are often nested and indented to help keep the code maintainable.

**Figure 2:** How asynchronous Node.js APIs work



Here's a Node.js example that makes three asynchronous API calls nested within each other to control the order of execution:

```
setTimeout(function () {  
    console.log('1: three seconds after the start');
```

```
setTimeout(function () {
    console.log('2: two seconds after 1');

    setTimeout(function () {
        console.log('3: one second after 2');
        }, 1000);
    }, 2000);
}, 3000);
```

Save the script to a file named `pyramid-of-doom.js`, and run it. You should see the following output, with each timer's start relative to when the timer before it finished.

```
$ node pyramid-of-doom.js
1: three seconds after the start
2: two seconds after 1
3: one second after 2
```

Looking back at the example code, do you see the horizontal pyramid (with white space on the left) beginning to take shape as you nest callback functions? That's the pyramid of doom. In this example, it's not so bad, but in real-world applications, this issue can become difficult to manage.

Fortunately, there are many solutions that can help developers avoid this problem. The simplest way to avoid the pyramid of doom is to avoid nesting anonymous callback functions by using named functions instead. The previous example can be rewritten as follows:

```
function doWork1 () {
    setTimeout(function () {
        console.log('1: three seconds after the start');

        doWork2();
    }, 3000);
}

function doWork2 () {
    setTimeout(function () {
        console.log('2: two seconds after doWork1');

        doWork3();
    }, 2000);
}

function doWork3 () {
    setTimeout(function () {
        console.log('3: one second after doWork2');
    }, 1000);
}

doWork1(); // Starts the function chain
```

Save the script to a file named named-functions.js, and run it as before. The timing should work as in the previous example.

```
$ node named-functions.js
1: three seconds after the start
2: two seconds after doWork1
3: one second after doWork2
```

Although they're effective at limiting the level of indentation, named functions alone can help you only so much with respect to asynchronous programming. For example, this technique can be used only for sequential processing. For more-complex flows, such as those involving parallel processing, you'll need some better tools.

In the articles that follow, I will explore more-robust solutions for handling asynchronous flows in Node.js, including the Async module, promises, and a new feature of JavaScript that builds on promises and greatly simplifies asynchronous code: `async/await`. I'll explore each of these solutions in the context of a database query. □

---

*Dan McGhan is the Oracle developer advocate for JavaScript and HTML5. He enjoys sharing the passion he's developed for JavaScript and HTML5 with others.*

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## NEXT STEPS

**LEARN** more about  
JavaScript and Oracle.



By Chris Muir



### ORACLE MOBILE CLOUD SERVICE

## Maps Within Reach

Use your business data and Oracle Mobile Cloud Service to provide useful maps to your mobile staff.

**Maps play a pivotal role in many successful mobile applications.** Apps such as Uber; Airbnb; and, of course, Google Maps and Apple Maps are used daily by millions, if not billions, of people. For mobile app users, knowing where the things they are interested in are located is a great benefit.

I've discussed maps before in this article space in a rather trivial use case of a [single location on a map based on a human-readable address](#). Given the importance of maps in mobile apps, however, this is an area I want to revisit. With a combination of Oracle Mobile Application Accelerator and Oracle Mobile Cloud Service, this article will explore how to build an application that enables users to run spatial queries that return multiple locations within a radius of their current location. This might sound a bit dull and technical, but in a business context, this could be an app that enables you to query all the customers within 5,000 meters of your current location and a very handy thing for salespeople to know when they're on the road and

have time to visit other customers to make more sales.

As described in my previous map article, Oracle Mobile Application Accelerator supports the ability to plot maps. Oracle Mobile Cloud Service location-based services go beyond map plotting to enable mobile developers to store and retrieve information about *places*, such as physical addresses that might represent places of interest to a business; *devices*, such as iBeacons, Eddystone, and altBeacons, that an app can interact with as the user approaches a location not easily identified by GPS; and moving *assets*, which users may want to track to know the assets' position relative to their current locations.

In this article, I'll use Oracle Mobile Cloud Service's location-based services capabilities and Oracle Mobile Application Accelerator's map capabilities to support a solution to the traveling sales force's customer location problem.

## PREREQUISITES

To follow the steps in this article, you will need access to Oracle Mobile Cloud Service, which you can obtain by clicking the **Free Trial** button on the [Oracle Mobile Cloud Service home page](#). (You have the option to sign up for a trial account or free cloud credits.) After signing up for the trial and receiving approval, watch and follow the instructions in [this video](#) on how to set up and provision your Oracle Mobile Cloud Service instance. You will also need to set up two users with appropriate roles to build and access the application. First, you'll need Jeff the developer, who will build a small application with Oracle Mobile Cloud Service and Oracle Mobile Application Accelerator. Second, you'll need Mary the mobile user, who will actually use the Oracle Mobile Application Accelerator application built by Jeff. Review this [small video on how to create both users](#). Finally, [download the demo zip file](#) that contains the files for this article, and unzip it on your desktop.

## LOCATION-BASED SERVICES

As mentioned earlier, location-based services within Oracle Mobile Cloud Service support the concepts of places, assets, and devices. At the most fundamental level, Oracle Mobile Cloud Service provides several REST APIs that enable you to create, manage, and query these data objects by ID or spatially relative to a latitude, longitude, and radius. Simply put, your business may have 1,000 customers located at different places identified by latitude and longitude, and Oracle Mobile Cloud Service will enable you to run the spatial query “Tell me all the customers within 5,000 meters.”

For the purposes of this article, because I can’t tell where you, the reader, reside, you’re not going to be able to build an app returning customers in your locality. Rather, you’re going to build an app with customers located around San Francisco, California, and assume you’re also located close to these customers. As such, the first task is to load the location-based services’ places data object with these San Francisco customers.

1. Log in to Oracle Cloud as Jeff the developer.
2. From the Oracle Cloud My Services Dashboard, select **Mobile Environment Service**, and on the resulting screen, click **Open Service Console**.
3. For the purposes of testing in this article, you need to create an Oracle Mobile Cloud Service mobile back end. Click the hamburger menu, expand **Applications**, and click **Mobile Backends**. Select **New Mobile Backend**. In the resulting dialog box, enter **OraMagTest** for the name, enter the same for the description, and then click **Create**.
4. In the Oracle Mobile Cloud Service UI, click the hamburger menu, expand **Applications**, and select **APIs**. Scroll to the bottom of the new page, and select **Location Management**.

The resulting screen exposes the REST endpoints for maintaining places, assets, and devices in Oracle Mobile Cloud Service. By default, these will be empty for a new Oracle Mobile Cloud Service account or trial. Next, you'll see the **POST Add Places** endpoint to create three customers located at different latitudes and longitudes for the Oracle Mobile Cloud Service application to use.

5. Select **POST Add Places**.
6. From the downloaded and unzipped file, copy the contents of the customers.json file into the body field of the **POST Add Places** request.
7. In the Authentication section below, for **Mobile Backend**, select the **OraMagTest** mobile back end you created earlier, enter the username and password for Jeff the developer, and click the **Test Endpoint** button. The resulting status code 200 response will include the places you just successfully inserted into the location-based services.

## BUILDING AN API FOR ORACLE MOBILE APPLICATION ACCELERATOR

For Oracle Mobile Application Accelerator to display the location-based services places you just inserted into Oracle Mobile Cloud Service, it must access this data through a REST API. Unfortunately, Oracle Mobile Application Accelerator can't talk directly to the location-based services REST API to extract places, so you must create your own custom API in Oracle Mobile Cloud Service to wrap a call to the places API. I've covered how to create REST APIs in previous articles in *Oracle Magazine*, so I'll avoid covering this again. Instead you'll import a prebuilt API that will do the work for you.

8. In the Oracle Mobile Cloud Service UI, click the hamburger menu, expand **Applications**, select **Packages**, and then select **New Import**.

9. In the first step of the Import wizard, click **Choose a package file**, and in the dialog box, select the **package-spatial.zip** file from the collection of files you downloaded and extracted.
10. In the remaining steps of the wizard, click **Next** and **Finish** to complete the wizard.
11. In the Oracle Mobile Cloud Service UI, click the hamburger menu, expand **Applications**, and select **APIs**. On the resulting screen, enter **spatial** in the **Filter APIs** field, and then press Return. Select the **spatial** API in the resulting list, and then click the **Test** button.
12. In the resulting test page for the newly created API, you will see an endpoint pre-selected to GET /customers. This requires three parameters: latitude, longitude, and radius. These three parameters are fed into the following Node.js code you just imported:

```
module.exports = function(service) {  
  
    service.get('/mobile/custom/spatial/customers', function(req,res) {  
        var sdk = req.oracleMobile;  
  
        var latitude = parseFloat(req.query.latitude);  
        var longitude = parseFloat(req.query.longitude);  
        var radius = parseInt(req.query.radius);  
  
        const spatialQuery = {"inGeoFence": {"gpsCircle": {  
            "latitude": latitude, "longitude": longitude, "radius": radius}}};  
    });  
};
```

```
    sdk.location.places.query(spatialQuery).then(  
      function (success) {  
        res.send(success.statusCode, success.result);  
      },  
      function (error) {  
        res.send(500, error.error);  
      });  
    });  
};
```

As shown in the Node.js code, for the specific GET /mobile/custom/spatial/customers endpoint router function, the three query parameters are extracted from the request and then wrapped in a JSON object and fed into the SDK location.places .query method, which runs a spatial query on places within the radius of the latitude and longitude.

**13.** Still on the test page, enter a latitude of 37.66, longitude of -121 (note the negative), and radius of 70000 meters (enter the number only, not the units). As you can see, two places are returned within that radius. Locate the latitude and longitude of each place within the JSON payload (provided in the customers .json file), because this information will be used in the Oracle Mobile Application Accelerator app map screen you will build in a moment.

## BUILD YOUR ORACLE MOBILE APPLICATION ACCELERATOR APP

With the places API (named “spatial”) in place, you can now build your Oracle Mobile Application Accelerator app with a map. The goal will be to display on a map all the location-based services places within a radius of your current location.

However, as explained earlier, there is one snag for demonstration purposes, and that is that I simply don't know where you are located. As such, when you created the places earlier in this article, they may be nowhere near you. For this demo app, you're going to hardcode your latitude and longitude, but while proceeding through the steps, I'll show you how to remove the hard coding and use your current location for the real application you may choose to build after reading this article.

14. In the Oracle Mobile Cloud Service UI, click the hamburger menu; and this time, rather than expanding the **Applications** menu, select it.
15. On the resulting screen, select the mobile apps blue icon/box.
16. Choose **New Application** when Oracle Mobile Application Accelerator prompts you to, and enter the application name **Customers** in the first step of the wizard.
17. In the next step of the wizard, "First Screen," ensure that the **Simple Screen** option is selected, and then click **Next**.
18. For **Screen Title**, enter **Customers**; click **Next**; and then complete the wizard by clicking **Next** and then **Create**.
19. On the resulting Oracle Mobile Application Accelerator designer screen, under **Components**, drag the map icon into the mobile app. By default, the map will display Oracle's headquarters, in Redwood Shores, California.
20. With the map selected, select the **Properties** tab on the right and make sure **Best Fit for Points** is selected.
21. Still on the right, select the **Data** tab. In the resulting options, make sure **Multiple Points** and **Geolocation Code** are selected.
22. Still on the **Data** tab, click the **Business Object** list and select **Browse Service Catalog**.

In Oracle Mobile Application Accelerator, APIs are called business objects. In the following steps, you will bind the map to your places API, mapping the data

fields of the map to the data supplied by the API as well as supplying values for the parameters.

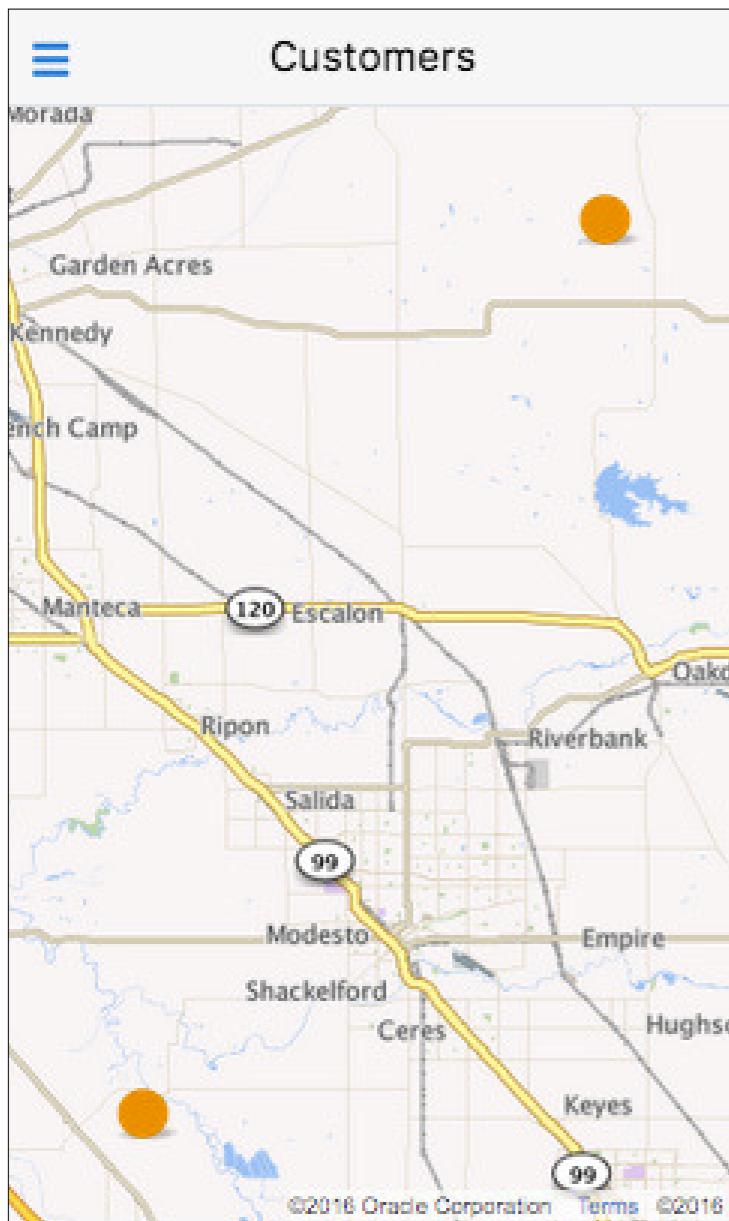
23. In the resulting dialog box, locate and select the **spatial v1.3** API you just imported and click **Next**. On the resulting screen, select **customer** as the business object and then click the **Select** button.
24. In the the wizard, make sure **I want to use location** is selected and then click **Next**.

The resulting wizard page is used to bind the API (aka business object) to the map. The first tab represents the mapping of the API's returned payload to the required fields of the map on the right. The second tab represents the query parameters required by the API, which you must satisfy in some form. As you'll recall, the API requires the user's current latitude, longitude, and radius to search for places.

With the **Data** tab selected, note that the map wants a location value on the right. A location value is made up of a latitude and a longitude. With the **Business Object** option selected, note the data fields available from the API. Latitude and longitude are available in the **address** and **gpsPoint** fields.

25. Select the **address** and **gpsPoint** fields until you see the **latitude** and **longitude** fields. Drag and drop the **latitude** field into the **Location value** field, and then drag and drop the **longitude** field into the **Location value** field. Ensure that the order of the fields is **latitude** and then **longitude**.
26. Click the **Live Preview** button, and note that the map shows one marker on a very boring background. This unimaginative location in the hills of San Francisco is derived from the "mock" data of the spatial API, which currently returns only a single latitude and longitude value. You'll see more-exciting data in a moment.
27. Click the **Next** button, which will take you to the API query parameter screen, showing latitude, longitude, and radius.

**Figure 1:** Two customers appear on your app map.



To satisfy the original requirements for this app to show places within a radius of the user's current location, you would select the **Device Service** option and then copy in the device's **Current Latitude** and **Current Longitude** fields. However, as explained earlier, for demo purposes, you'll hardcode these values.

28. To hardcoded the values, select the **Fixed Value** box (on the left) and drag and drop the **Fixed Value** field into all three fields (latitude, longitude, and radius).

Then enter **37.66** for **latitude**, **-121** (note the negative) for **longitude**, and **70000** for **radius**.

29. Click **Finish**.

On returning to the Oracle Mobile Application Accelerator designer, you may be a little disappointed to discover the single marker against a boring background again. By default, like the **Live Preview** option, the Oracle Mobile Application Accelerator designer shows only test data derived from the API. To see live data, you must run the application.

30. Click the **Test** button (the gray right arrow at the top right); when prompted, enter Mary the mobile user's username and password; and click **Sign In**.
31. The resulting app displays the map, and given the virtual location of your app user, you can see the two places within the 70-kilometer radius of your current latitude/longitude, 37.66/-121, as shown in **Figure 1**.

## CONCLUSION

What excites me most about the mapping and spatial functionality provided through Oracle Mobile Application Accelerator and Oracle Mobile Cloud Service is that I've visited absolutely loads of customers who have address and location data in their enterprise databases but have never actually been

able to display the data on a map. It's mostly raw data, and it comes alive only when it's on a map. As you saw in my previous article, where I plotted [human-readable addresses on a map](#), and in this article, where I plotted numerous markers based on latitude and longitude, this simple-to-build functionality is now within reach, literally, of your mobile users. ◎

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*Chris Muir is a senior principal product manager for mobility, cloud, and development tools at Oracle.*

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By Steven Feuerstein



ORACLE DATABASE 12c

# Fine-Tune Privilege Management

Improve PL/SQL security in Oracle Database 12c.

Oracle Database 12c offers several enhancements to improve security in your PL/SQL program units. These features include the following:

- **Code-based access control.** Apply the “least privilege” principle by *granting roles to program units*, rather than—or in addition to—granting roles to schemas.
- **Privilege escalation avoidance.** Use the INHERIT [ANY] PRIVILEGES privilege to make it impossible for a lower-privileged user to take advantage of a higher-privileged user via an invoker rights unit.  
In this article, I will introduce you to the PL/SQL features that help you fine-tune privilege management.

## APPLYING THE LEAST PRIVILEGE PRINCIPLE

Securing your database—and properly restricting access to the data and data structures within it—ranks at the very top of the “most important things to do” list when building applications.

The best way to avoid unintended access or actions is to apply the least privilege principle: give a user the smallest number of (and most narrowly defined) privileges on database objects and the data inside those objects.

Oracle Database has always offered a very robust security mechanism: you can access only objects you own or those to which you were granted access. Within a PL/SQL program unit, you can choose the definer rights model (users execute your code with your privileges) or the invoker rights model (users execute your code with their privileges). But the granularity of this mechanism operates at the schema level, making it difficult to apply the least privilege principle.

With Oracle Database 12c, you can now restrict privileges as tightly as you would like, right down to the individual program unit, by granting roles to program units, not just to schemas. I'll explore this feature for both definer rights and invoker rights program units.

First, with definer rights, suppose that the HR schema was initially granted just two privileges: CREATE SESSION and CREATE PROCEDURE. I could then compile the following procedure in HR:

```
CREATE OR REPLACE PROCEDURE create_table (
    table_name_in IN VARCHAR2)
AUTHID DEFINER
IS
BEGIN
    EXECUTE IMMEDIATE
        'CREATE TABLE ' || table_name_in || '(n NUMBER)';
END;
```

But when I try to create a table using the procedure, I see an error:

```
CONNECT HR/****

BEGIN
    create_table ('my_table');
END;
/

ERROR at line 1: ORA-01031: insufficient privileges
```

Prior to Oracle Database 12c, the only way HR could use this procedure was to grant the CREATE TABLE privilege to the schema itself. But that meant that *any* program unit defined in HR could then create a table, which the chief security officer would find unacceptable.

With Oracle Database 12c, however, I can take a much more fine-grained approach, by granting privileges to the procedure itself and not its owning schema. Here's how:

1. Create a role from a schema with the authority to do so and grant it the CREATE TABLE privilege.

```
CREATE ROLE create_table_role
/
GRANT CREATE TABLE TO create_table_role
/
```

2. Grant the role to the procedure. This can be done as SYSDBA. It can also be done from the HR schema, if the role is granted to HR with the admin option. Here's the grant as SYSDBA:

```
GRANT create_table_role TO PROCEDURE hr.drop_table  
/
```

To grant it from HR, first execute this as SYSDBA:

```
GRANT create_table_role TO hr WITH ADMIN OPTION  
/  
  
ALTER USER hr DEFAULT ROLE ALL EXCEPT create_table_role  
/
```

Then execute the grant from HR:

```
GRANT create_table_role TO PROCEDURE create_table  
/
```

And now I can execute the procedure and successfully create the table:

```
BEGIN  
    create_table ('my_table');  
END;
```

/

PL/SQL procedure successfully completed.

But if I try to create the table directly, I see the same, earlier privileges error:

```
CREATE TABLE my_table2 (n NUMBER)
/
```

ERROR at line 1: ORA-01031: insufficient privileges

The only way to create a table from the HR schema is by calling this one procedure: a very targeted assignment of privileges.

Now let's take a look at using code-based access control with an invoker rights module. With invoker rights, the privileges of the invoking schema are used to determine what the module will be allowed to do.

I need to give users the ability to display nonconfidential information about employees: namely, they can see employee names and emails but not salary information. I can do this by creating a view on top of the EMPLOYEES table and granting only SELECT on the view. But I can also achieve this effect through code-based access control, thereby avoiding the need to create a view.

Here's the invoker rights procedure for displaying appropriate employee information owned by HR, which also owns the employees table.

```
CREATE OR REPLACE PROCEDURE show_employees (department_id_in IN INTEGER)
AUTHID CURRENT_USER
```

```
AS
BEGIN
    DBMS_OUTPUT.put_line (
        'Employees in Department ' || department_id_in);

    FOR rec IN (SELECT e.last_name, e.email FROM hr.employees e
                 WHERE e.department_id = department_id_in
                 ORDER BY e.last_name)
    LOOP
        DBMS_OUTPUT.put_line (rec.last_name || ' - ' || rec.email);
    END LOOP;
END;
/
```

I'll let everyone execute the procedure:

```
GRANT EXECUTE ON show_employees TO PUBLIC
/
```

No other schemas have been granted SELECT on employees, so if, for example, a user connected to the SCOTT schema tries to execute this procedure, that person will see an error:

```
BEGIN
    hr.show_employees (10);
END;
```

```
/
```

```
ERROR at line 1:
```

```
ORA-00942: table or view does not exist
```

Prior to Oracle Database 12c, to get this to work, you had to do one of the following:

- Grant SELECT on this table to SCOTT, but that would give SCOTT access to confidential information
- Create a view on top of EMPLOYEES that does not include the confidential information and then grant SELECT on that view to SCOTT

With Oracle Database 12c and higher, I can instead create a role that has the SELECT privilege on the EMPLOYEES table and then assign the role to just that single procedure.

Assuming that HR has the CREATE ROLE privilege, here are the steps:

```
CREATE ROLE view_employees_role
```

```
/
```

```
GRANT SELECT ON employees TO view_employees_role
```

```
/
```

```
GRANT view_employees_role TO PROCEDURE show_employees
```

```
/
```

```
BEGIN
```

```
hr.show_employees (10);  
END;  
/
```

```
Employees in Department 10  
Whalen - JWHALEN@MY_COMPANY.COM
```

Now users can access the employee information appropriate to them, but I have not provided any other opportunities to access the employees table. I have, in other words, kept the attack surface (the number of points through which an unauthorized user can try to get at the table) to a minimum.

### AVOIDING PRIVILEGE ESCALATION

Privilege escalation happens when a lower-privileged user takes advantage of a higher-privileged user via an invoker rights unit. Let's use an example to explore what privilege escalation is, how it can come about, and what sorts of damage it can do.

Suppose that a database instance has a schema named THE\_MANAGER, which is the manager's schema and has lots of privileges on many critical database objects, including the PERFORMANCE\_REVIEWS table.

The instance also has a schema named NEW\_CODER, the owner of which works for THE\_MANAGER. I'll call them NC and TM, respectively, for short.

TM has given NC a new task: create an invoker rights procedure to display a person's to-do list. In this fine company, each schema has its own TODO table, which includes the tasks for the person who owns the schema.

Here's the code to create the database objects in the TM schema:

```
CREATE TABLE performance_reviews
(
    review_for      VARCHAR2 (100),
    star_rating     INTEGER
)
/

BEGIN
    INSERT INTO performance_reviews (review_for, star_rating)
        VALUES ('THE_MANAGER', 5);

    INSERT INTO performance_reviews (review_for, star_rating)
        VALUES ('NEW_CODER', 1);

    COMMIT;
END;
/


CREATE TABLE todo
(
    id      NUMBER GENERATED ALWAYS AS IDENTITY,
    title   VARCHAR2 (100)
)
```

```
/  
  
BEGIN  
    INSERT INTO todo (title)  
        VALUES ('Criticize NC.');
```

```
    INSERT INTO todo (title)  
        VALUES ('Finish next FY budget.');
```

```
    COMMIT;  
END;  
/
```

And here's the code to create the database objects in the NC schema:

```
CREATE TABLE todo  
(  
    id      NUMBER GENERATED ALWAYS AS IDENTITY,  
    title   VARCHAR2 (100)  
)  
/
```

```
BEGIN  
    INSERT INTO todo (title)  
        VALUES ('Write todo procedure.');
```

```
INSERT INTO todo (title)
    VALUES ('Debug the manager''s code.');

COMMIT;
END;
/

CREATE OR REPLACE PROCEDURE show.todos
AUTHID CURRENT_USER
IS
BEGIN
    FOR rec IN (  SELECT title
                  FROM todo
                 ORDER BY title)
    LOOP
        DBMS_OUTPUT.put_line (rec.title);
    END LOOP;
EXCEPTION
    WHEN OTHERS
    THEN
        /* Bad! No re-raise. But just a demo script. */
        DBMS_OUTPUT.put_line (SQLERRM);
END;
/
```

```
GRANT EXECUTE ON show.todos TO PUBLIC  
/
```

Because the `show.todos` procedure is an *invoker rights* program unit, it shows different contents of the todo tables for both TM and NC, depending on the schema in which the procedure is executed:

```
CONNECT the_manager/*****
```

```
BEGIN  
    NEW_CODER.show.todos;  
END;  
/
```

Criticize NC.

Finish next FY budget.

```
CONNECT NEW_CODER/*****
```

```
BEGIN  
    show.todos;  
END;  
/
```

Debug the manager's code.

Write TODO procedure.

You'd think TM would congratulate NC on getting that procedure built so quickly, but no—all NC ever hears is complaints. TM doesn't like NC much, and the feeling is mutual. NC feels like TM is constantly giving her unjustifiably poor performance reviews. A month or two goes by. The `show.todos` procedure is used by everyone, constantly.

NC decides to take action. She modifies the `show.todos` procedure as follows (changes in bold):

```
CREATE OR REPLACE PROCEDURE show.todos
  AUTHID CURRENT_USER
IS
BEGIN
  FOR rec IN (  SELECT title
                  FROM todo
                 ORDER BY title)
  LOOP
    DBMS_OUTPUT.put_line (rec.title);
  END LOOP;

  IF SYS_CONTEXT ('userenv', 'current_user') = THE_BOSS'
  THEN
    EXECUTE IMMEDIATE '
      begin
        update performance_reviews
        set star_rating = -100
      end';
```

```
        where review_for = :username;
          commit;
      end;'
      USING SYS_CONTEXT ('userenv', 'current_user');

END IF;

EXCEPTION
  WHEN OTHERS
    THEN
      /* Bad! No re-raise. But just a demo script. */
      DBMS_OUTPUT.PUT_LINE (SQLERRM);
END;
/
```

That's one mean performance review! Note that the update is performed via a dynamic PL/SQL block. As a result, the procedure compiles just fine, even though NC has no privileges on the PERFORMANCE\_REVIEWS table. In addition, the update will be executed only when the procedure is run by TM.

Okeydokey. The procedure is moved into production. That's right—my fictional company has very lax code review procedures. But before you snicker or tsk-tsk, ask yourself: how solid is *your* code review process?

The very next day, TM decides to check his to-do list.

He runs the procedure and sees pretty much what he expected:

```
CONNECT the_boss/pb
```

```
BEGIN  
    NEW_CODER.show.todos;  
END;  
/
```

Criticize NC.

Finish next FY budget.

Of course, there is no reason for the manager to check the contents of the PERFORMANCE\_REVIEWS table, but if he did, he would see

```
SELECT review_or, star_rating FROM performance_reviews
```

```
/
```

REVIEW_FOR	STAR_RATING
THE_BOSS	-100
NEW_CODER	1

Ha ha, the joke's on you, TM—but probably not for long.

Well, you get the idea, right? Once an invoker rights program unit has been put into place, it can (usually) be more easily and quietly modified. And by using dynamic SQL, one could “slip in” undesirable functionality that depends on *privilege escalation*—the fact that when another schema executes an invoker rights unit, that unit is executed with the privileges of the invoking schema, which could be considerably greater than those of the defining schema.

What's a security-conscious development team to do?

Make it impossible to *inherit privileges* from the invoking schema, unless the program unit is owned by a "trusted user." You can do this with the INHERIT [ANY] PRIVILEGES privilege.

Applying this solution to the TM/NC scenario, TM tells his DBA to *revoke* this privilege from NC:

```
CONNECT system/manager
```

```
REVOKE INHERIT ANY PRIVILEGES FROM NEW_CODER
```

Or TM can be more selective and revoke privileges more specifically (but only if the specific privilege had previously been *granted*):

```
CONNECT system/manager
```

```
REVOKE INHERIT PRIVILEGES ON USER THE_MANAGER FROM NEW_CODER
```

And now when TM tries to see his list of to-dos, he gets an error:

```
BEGIN  
    NEW_CODER.show.todos;  
END;  
/
```

```
ORA-06598: insufficient INHERIT PRIVILEGES privilege  
ORA-06512: at "NEW_CODER.SHOW_TODOS", line 1
```

No more privilege escalation. When TM executes NC's code, the invoker rights setting (AUTHID CURRENT\_USER) cannot take advantage of the privileges of the invoker, in this case TM.

INHERIT PRIVILEGES and INHERIT ANY PRIVILEGES regulate the privileges with which a user (in this case, TM) executes an invoker's rights procedure (owned by NC). When a user runs an invoker's rights procedure, Oracle Database checks it to ensure that the procedure owner has the INHERIT PRIVILEGES privilege on the invoking user or if the owner has been granted the INHERIT ANY PRIVILEGES privilege. If the privilege check fails, Oracle Database will return an error:

```
ORA-06598: insufficient INHERIT PRIVILEGES privilege
```

The bottom-line benefit of these two privileges is that they give invoking users control over who can access their privileges when they run an invoker's rights program unit.

## CONCLUSION

Oracle Database has always offered a very high level of security for DBAs as well as developers. With Oracle Database 12c, you now have available to you an unprecedented level of granularity and protection. By assigning privileges via roles to *program units*, you can follow the least privilege principle and make sure that no user can do anything more than is needed. With the INHERIT PRIVILEGES privilege,

you can avoid privilege escalation and make it even more difficult for malicious users to bypass constraints on behavior in the database. □

---

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By Connor McDonald



**ORACLE DATABASE 12c RELEASE 2**

## Excellent Extensions

New features in Oracle Database 12c Release 2 make external tables even more flexible.

In the next few columns, I'll spend some time looking at new features in Oracle Database 12c Release 2. These features come from the "12 Things About Oracle Database 12c" presentation series that Chris Saxon and I (the AskTom team) gave at Oracle OpenWorld 2016 in San Francisco, California. (You can find the slides for these presentations on [asktom.oracle.com](http://asktom.oracle.com), under the **Resources** tab.) In this article, I'll take a look at some enhancements to external tables in Oracle Database 12c Release 2.

### A POLYGLOT WORLD

The dictionary definition for *polyglot* is "a person who knows and is able to use several languages." This naturally crept over into the IT software world, where the term *polyglot programming* refers to the use of multiple programming languages. More recently the term *polyglot persistence* has come to refer to the use of multiple database technologies to best meet the needs of various business requirements.

For example, to meet the stringent data integrity needs of financial transaction processing applications, Oracle Database is a natural technology fit, but for simpler key/value pair requirements, a business may opt for Oracle NoSQL Database. The fundamental unit of storage in many NoSQL databases is a document, and rather than using multiple relational structures, a NoSQL database stores data in much larger chunks, typically in documents of a proprietary format or an open standard such as JavaScript Object Notation (JSON). It is already possible to query data from, for example, a Hadoop Distributed File System (HDFS) datastore by creating and using an external table definition in Oracle Database:

```
SQL> create table CUSTOMER_RAWDATA
  2  (customer_number number,
  3   customer_name    varchar2(50),
  4   postal_code      char(5)
  5 )
  6 organization external
  7   (type oracle_hdfs
  8     default directory TEMP
  9     access parameters
 10    (
 11      com.oracle.bigdata.cluster    = hadoop_clust
 12      com.oracle.bigdata.rowformat = delimited fields terminated by ','
 13    )
 14    location('hdfs/p1a.dat',
 15              'hdfs/p1b.dat',
```

```
16      'hdfs/p2.dat',
17      'hdfs/p3.dat'
18    )
19 );
```

But using this external table definition may lose the benefits of the parallelism that large NoSQL clusters afford. If the information for customer 150, for example, is contained only in the document p2.dat, a query to the external table will not have that insight and all documents will have to be scanned. Similarly, if the data was natively partitioned in the source system, for example, via hive partitions, the knowledge of the partitions will not be conveyed within the corresponding external table definition within the Oracle Database instance.

## PARTITIONED EXTERNAL TABLES WITH ORACLE DATABASE 12c RELEASE 2

Oracle Database 12c Release 2 removes this previous “missing insight” limitation by introducing *partitioned* external tables to allow a partitioning definition to be included within the external table definition:

```
SQL> create table CUSTOMER_RAWDATA
  2  (customer_number number,
  3   customer_name   varchar2(50),
  4   postal_code     char(5)
  5 )
  6 organization external
  7   (type oracle_hdfs
```

```
8    default directory TEMP
9    access parameters
10   (
11     com.oracle.bigdata.cluster = hadoop_clust
12     com.oracle.bigdata.rowformat = delimited fields terminated by ','
13   )
14 )
15 partition by range(customer_number)
16 (
17   partition p1 values less than (100) location('hdfs/p1a.dat', 'hdfs/p1b.dat'),
18   partition p2 values less than (200) location('hdfs/p2.dat'),
19   partition p3 values less than (300) location('hdfs/p3.dat')
20 );
```

Partitioned external tables are not solely for administrators who need to access nonrelational datasources. They can also be used by relational database developers for accessing local relational datasources to achieve performance benefits, because all the usual optimizations for partitions, such as partition elimination, are available for partitioned external tables. In the following example, I have two datasets of employee data, one file for each region—Australia (AU) and New Zealand (NZ).

File: emp\_au.dat

```
"AU",7369,"SMITH","CLERK",7902,17/DEC/80,800,,20
"AU",7499,"ALLEN","SALESMAN",7698,20/FEB/81,1600,300,30
"AU",7521,"WARD","SALESMAN",7698,22/FEB/81,1250,500,30
```

```
"AU",7566,"JONES","MANAGER",7839,02/APR/81,2975,,20
```

```
...
```

File: emp\_nz.dat

```
"NZ",8369,"SMITH","CLERK",7902,17/DEC/80,800,,20
```

```
"NZ",8499,"ALLEN","SALESMAN",7698,20/FEB/81,1600,300,30
```

```
"NZ",8521,"WARD","SALESMAN",7698,22/FEB/81,1250,500,30
```

```
"NZ",8566,"JONES","MANAGER",7839,02/APR/81,2975,,20
```

```
...
```

To obtain the set of all employees in both regions, I can define a partitioned external table by using the conventional list partition syntax:

```
SQL> create table ext_emp
  2  ( region      varchar(2),
  3    empno       number(4),
  4    ename       varchar2(10),
  5    job         varchar2(9),
  6    mgr         number(4),
  7    hiredate    date,
  8    sal          number(7,2),
  9    comm         number(7,2),
 10   deptno      number(2)
 11  )
 12 organization external
```

```
13  ( type oracle_loader
14    default directory temp
15    access parameters
16    ( records delimited by newline
17      badfile 'emp.bad'
18      logfile 'emp.log'
19      fields terminated by "," optionally enclosed by ''' ldrtrim
20      reject rows with all null fields
21      ( region,
22        empno,
23        ename,
24        job,
25        mgr,
26        hiredate,
27        sal,
28        comm,
29        deptno
30      )
31    )
32  )
33  partition by list(region)
34  (
35    partition p_au values ('AU') location('emp_au.dat'),
36    partition p_nz values ('NZ') location('emp_nz.dat')
37  ) reject limit unlimited;
```

If I defined the external table as nonpartitioned with two files defined in a single location definition, all queries would need to scan both files. But with a partitioned external table definition, partition elimination enables access to each file in isolation if the predicates allow it. For example, a query to just the employees in region AU yields the following execution plan, showing that only the first partition, P\_AU, was required to satisfy the query.

```
SQL> set autotrace traceonly explain  
SQL> select * from ext_emp where region = 'AU';
```

#### Execution Plan

---

Plan hash value: 2018056040

---

Id   Operation	Name	Rows	Bytes	Cost(%CPU)	Time	Pstart Pstop
0  SELECT STATEMENT		82	7380	29 (0)	00:00:01	
1  PARTITION LIST SINGLE		82	7380	29 (0)	00:00:01	1   1
2  EXTERNAL TABLE ACCESS FULL	EXT_EMP	82	7380	29 (0)	00:00:01	1   1

---

Note that the database does *not* validate the external data to ensure that it aligns with the partition definition. For example, I added an invalid row (REGION = 'XX') into the emp\_au.dat file. Then when I query for REGION = 'XX', I get no rows returned, because the partition definition, and hence subsequent optimizer

partition elimination, defines that data to be impossible. However, scanning all the data by using a nonpartition key predicate reveals that the data is present in the file. It is your responsibility to ensure that the file data maps correctly to the partition definition.

```
SQL> select * from ext_emp where region = 'XX';
```

```
no rows selected
```

```
SQL> select * from ext_emp where empno = 1934;
```

RE	EMPNO	ENAME	JOB	MGR	HIREDATE	SAL	COMM	DEPTNO
XX	1934	MILLER	CLERK	7782	23-JAN-82	1300		10

## PROCESS CONTROL

As long as software applications have existed, process controls on the management, deployment, and maintenance of those applications have also existed. Entire practice management frameworks such as the Information Technology Infrastructure Library (ITIL), which have established a suite of standards and procedures for any part of the application development lifecycle, are now commonplace in most organizations. As part of current standards and procedures, structural changes to objects via data definition language (DDL) are much more tightly controlled. But unlike the DDL for a standard Oracle Database table, the success of a DDL statement defining an external table is not a guarantee that the definition is valid. As such, there are pros and cons to such tight controls over DDL deployment for external tables.

In this example, I've created an external table to read from a daily extract of employee data:

```
SQL> create table ext_emp (
  2   empno      number(4),
  3   ename      varchar2(10),
  4   job        varchar2(9),
  5   mgr        number(4),
  6   hiredate   date,
  7   sal        number(7,2),
  8   comm       number(7,2),
  9   deptno    number(2)
10  )
11 organization external
12 ( type oracle_loader
13   default directory TMP
14   access parameters
15   ( records delimited by newline
16     fields terminated by ','
17     missing field values are null
18     ( empno,ename,job,mgr,hiredate,sal,comm,deptno )
19   )
20   location ('emp-2016-10-01.dat'));
```

Table created.

Although this definition may appear valid, given that no error was returned, the true test comes when I attempt to query the external table, which is when the column mappings and parsing of the external file take place. In my case, something is awry:

```
SQL> select * from ext_emp;
select * from ext_emp
*
ERROR at line 1:
ORA-29913: error in executing ODCIEXTTABLEFETCH callout
ORA-30653: reject limit reached
```

I have forgotten to add the REJECT LIMIT clause to my table definition, and hence even a single invalid row in the source file data immediately terminates my SQL query. I probably should have taken advantage of the facility in the SQL\*Loader feature of Oracle Database where a control file can be used to generate the DDL for an external table, using the EXTERNAL\_TABLE=GENERATE\_ONLY clause, which would have added the REJECT LIMIT clause for me automatically. (See “[On Better Loading and Fact-Checking](#)” for an example of this facility.)

So my problem is easily resolved; I just need to add a clause to my table DDL. But in a world of strict process control, DDL changes are typically seen as high-risk changes, requiring the full gamut of validations and checks to be exercised before approval. This is a not a criticism of such process controls—they are critical for avoiding the aforementioned scenario of small errors leading to catastrophic consequences—but there should be recognition that all DDL does not present the same risk.

Another external table DDL risk example is the filename attribute. In my example above, the format of the filename emp-2016-01-01.dat suggests that this filename may need to be adjusted in the external table definition every day as a new employee file is generated with a fresh date stamp in the name. But demanding a complete suite of checks and balances for such a small DDL change would be overkill.

### MORE FLEXIBILITY WITH ORACLE DATABASE 12c RELEASE 2

Oracle Database 12c Release 2 recognizes that there are some modifications to external table definitions that can be considered a lower-risk exercise than would be the case with more-typical DDL changes to tables.

In Oracle Database 12c Release 2, without any DDL changes to the table, some external table parameters can be modified directly within the execution of a query against that external table. To solve the problem of my missing REJECT LIMIT clause, for example, I can add an EXTERNAL MODIFY clause directly to my SELECT statement:

```
SQL> select * from ext_emp  
2   external modify ( reject limit unlimited );
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL
7499	ALLEN	SALESMAN	7698	20-FEB-81	1600
7521	WARD	SALESMAN	7698	22-FEB-81	1250
7566	JONES	MANAGER	7839	02-APR-81	2975

Similarly, if the LOCATION filename changes from day to day, I can override the filename each time I query the external table:

```
SQL> select * from ext_emp  
2   external modify ( location ('emp-2016-10-02.dat') );
```

EMPNO	ENAME	JOB	MGR	HIREDATE	SAL
7902	FORD	ANALYST	7566	03-DEC-81	3000
7934	MILLER	CLERK	7782	23-JAN-82	1300
7566	JONES	MANAGER	7839	02-APR-81	2975

The EXTERNAL MODIFY clause permits modification of the external table definition without requiring DDL changes—and the likely resultant process control implications. The EXTERNAL MODIFY clause allows the modification or override of the following clauses only:

- DEFAULT DIRECTORY
- LOCATION
- ACCESS PARAMETERS (BADFILE, LOGFILE, DISCARDFILE)
- REJECT LIMIT

## SUMMARY

With Oracle Database 12c Release 2, extensions to external table functionality provide more-flexible data access across the datasources that are becoming commonplace in a polyglot persistence landscape. Partitioned external tables deliver a more direct mapping to the partitioning mechanism in those nonrelational data-

sources as well as realizing conventional partitioning performance benefits via partition elimination. Also, changing some of the defining attributes of external tables dynamically at query time removes the need for convoluted process controls that can impede developer productivity. □

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*Connor McDonald is an Oracle developer advocate for SQL. His passions are database design, SQL, and PL/SQL, and he can answer your database questions on [AskTom](#).*

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ORACLE DATABASE

# Meta-Access and Repetitive Composition

By Melanie Caffrey

Part 10 in a second series on the basics of the relational database and SQL

This article is the 10th in a series that helps you build on the fundamentals you learned in the [12-part SQL 101 series](#) in *Oracle Magazine*. The previous Beyond SQL 101 article, “[The Cost of Data Retrieval](#),” introduced bitmap indexes. You discovered how to create them and when they might be an appropriate index choice. You also learned how bitmap indexes should *not* be used in a database with regular transaction activity but instead in a data warehouse with occasional bulk loads of data. You were introduced to Oracle Database’s Oracle Optimizer program, SQL statement processing operations, and parsing. You learned what a bind variable is and how it can help reduce parsing activity. Finally, you learned about statistics and the creation and display of execution plans.

In this article, you will

- Learn the difference between static and dynamic data dictionary views
- Discover the USER\_, ALL\_, DBA\_, and V\$ views
- Receive an introduction to Oracle SQL script writing
- See how substitution variables are implemented

To try out the examples in this series, you need access to an Oracle Database instance. If necessary, download and install an [Oracle Database edition](#) for your operating system. I recommend installing Oracle Database, Enterprise Edition 12c Release 2 (12.2.0.1.0). If you install the Oracle Database software, choose the installation option that enables you to create and configure a database. A new database, including sample user accounts and their associated schemas, will be created for you. (Note that SQL\_201 is the user account to use for the examples in this series; it's also the schema in which you'll create database tables and other objects.) When the installation process prompts you to specify schema passwords, enter and confirm passwords for the SYS and SYSTEM users and make a note of them.

Finally—whether you installed the database software from scratch or have access to an existing Oracle Database instance—download, unzip, and execute [the SQL script](#) to create the tables for the SQL\_201 schema that are used for this article's examples. (View the script in a text editor for execution instructions.)

## WHAT LIES BENEATH

Recall from a previous Beyond SQL 101 article, "[Defining, Constraining, and Manipulating Your Entities](#)," that the *data dictionary* is an internally owned and controlled set of tables and views that contains information about your database's metadata. Oracle Database uses the data dictionary internally for many purposes, such as

- Storing statistics about a table (statistics that will be used by Oracle Optimizer)
- Checking whether a column is indexed
- Examining which constraints exist and whether they are enabled
- Determining the validity of table and column names during SQL statement parsing
- Retrieving the privileges of a particular user

The data dictionary includes both dynamic and static sets of tables and views.

The dynamic views are used primarily to examine database performance. The static views store details about database objects such as tables, indexes, and views and are generally categorized into one of three prefixed categories: USER\_, ALL\_, and DBA\_.

Whenever a new database object is created or altered, metadata about the object is recorded in a static data dictionary view. Static views can also be used by Oracle Database to retrieve information about indexed columns and referential integrity constraints. The USER\_ views display information about objects belonging to the currently logged-in user. The ALL\_ views return the same information as the USER\_ views, but they also display information about any objects granted to the currently logged-in user by another user and display any public objects, such as public synonyms. (You will learn about synonyms and how to grant, receive, and revoke access privileges and roles in subsequent articles in this series.) The DBA\_ views provide information about every object in the database. To query any of the DBA\_ views, you need to have special database administrator privileges, such as the DBA role or the SELECT ANY DICTIONARY (as in data dictionary) privilege, granted to you. Consider the query in Listing 1.

**Code Listing 1:** Query the USER\_TABLES static data dictionary view

```
SQL> set lines 10000
```

```
SQL> select table_name, num_rows, to_char(last_analyzed,
```

```
'DD-MON-YYYY HH24:MI:SS') last_analyzed  
2   from user_tables  
3  order by table_name;
```

TABLE_NAME	NUM_ROWS LAST_ANALYZED
ANNUAL_REVIEW	15 05-JUL-2016 01:00:23
DEPARTMENT	4 05-JUL-2016 01:00:24
EMPLOYEE	16 04-JAN-2017 01:00:32
EMPLOYEE_CTAS	2 11-SEP-2016 16:21:22
EMPLOYEE_EXTRA	2 26-OCT-2016 01:00:32
EMPLOYEE_IDENTITY	16 04-JAN-2017 01:00:32

6 rows selected.

Query the USER\_TABLES static data dictionary view to display the names of the tables owned by you (or the currently logged-in user), the number of rows each table contains, and the last time statistics were gathered for each table. Run the DESCRIBE command on the USER\_TABLES data dictionary view to display all the other columns that constitute the view, as the example in **Listing 2** demonstrates. For a description of every USER\_TABLES column and the type of data it contains, refer to [the documentation](#).

**Code Listing 2:** A partial result from the DESCRIBE command executed against the USER\_TABLES static data dictionary view

```
SQL> describe user_tables
```

Name	Null?	Type
TABLE_NAME	NOT NULL	VARCHAR2(128)
.	.	
.	.	
NUM_ROWS		NUMBER
.	.	
.	.	
LAST_ANALYZED		DATE
.	.	
.	.	
.	.	

The dynamic data dictionary views are typically used by a database administrator to monitor the database and its performance. These views have a V\$ prefix (which is why they are commonly referred to as “V-dollar tables”) and are continuously updated by Oracle Database background processes rather than database users. Much as with the DBA\_ views, you need to have special database administrator privileges, such as the DBA role or the SELECT ANY DICTIONARY privilege, granted to you to give you access to the dynamic data dictionary views. Alternatively, a database administrator can grant you privileges to access specific individual dynamic data dictionary views you’d like to query. To learn more about the data dictionary and dynamic performance views, refer to [the documentation](#).

## ALL TOGETHER NOW

Although you know how to write and execute individual SQL statements, it is common for developers and DBAs to insert multiple SQL statements and SQL\*Plus commands into a single script file for executing en masse. The script you used to create the tables for the SQL\_201 schema for this article's examples—SQL\_201\_objects\_setup\_script\_Install\_1.sql—contains data definition language (DDL) statements for creating tables and data manipulation language (DML) statements to insert the data, among other statements. Scripts are useful for tasks that require you to run a set of SQL statements, for example, for the following types of activities:

- Performing ad hoc tasks
- Performing environment setup activities
- Performing environment refreshes, such as readying a production environment once the script has already been tested and executed in development and testing environments

Consider the example in [Listing 3](#). The test\_this\_script.sql script contains two SQL statements: one that creates a table called EMPLOYEE\_SUBSET and one that selects data from the newly created table. You can create this example script in an editor of your choice and save it with the name test\_this\_script.sql. To avoid the error in [Listing 4](#) when you run the script, either navigate to the directory in which you've saved the script before you log in to Oracle Database or fully qualify the directory location of your database script. It is good practice to fully qualify the directory location of your database script. [Listing 5](#) shows the result of running the test\_this\_script.sql database script with SQL\*Plus as the SQL execution environment. Note that the line that invokes and executes the script,

```
@test_this_script.sql
```

begins with an @ symbol. When followed by a filename, this symbol acts as a SQL\*Plus command to execute, or run, the commands inside the file. Alternatively, you could use the keyword START, as in

```
START test_this_script.sql
```

**Code Listing 3:** The test\_this\_script.sql database script contents

```
create table employee_subset (employee_id,
                               employee_name,
                               create_date)
as
select employee_id, first_name||' '||last_name, sysdate
from employee;

select employee_id, employee_name, create_date
  from employee_subset
order by employee_id;
```

**Code Listing 4:** Error received when the SQL environment cannot find your script

```
SQL> @test_this_script.sql
SP2-0310: unable to open file "test_this_script.sql"
```

**Code Listing 5:** The result of running the test\_this\_script.sql database script

```
SQL> @test_this_script.sql
```

Table created.

EMPLOYEE_ID	EMPLOYEE_NAME	CREATE_DATE
1	Don Rose	11-MAY-2017 21:48:06
21	Gerald Sowell	11-MAY-2017 21:48:06
28	Emily Eckhard	11-MAY-2017 21:48:06
37	Frances Newton	11-MAY-2017 21:48:06
1234	Donald Newton	11-MAY-2017 21:48:06
6567	Roger Friedli	11-MAY-2017 21:48:06
6568	Betsy James	11-MAY-2017 21:48:06
6569	michael peterson	11-MAY-2017 21:48:06
6570	mark leblanc	11-MAY-2017 21:48:06
6571	Thomas Jeffrey	11-MAY-2017 21:48:06
6572	Theresa Wong	11-MAY-2017 21:48:06
6573	Lori Dovichi	11-MAY-2017 21:48:06
6574	Marcy Tamra	11-MAY-2017 21:48:06
6575	Sasha Meyer	11-MAY-2017 21:48:06
6576	Mary Streicher	11-MAY-2017 21:48:06
7895	Matthew Michaels	11-MAY-2017 21:48:06

16 rows selected.

The next few lines in the output in [Listing 5](#) illustrate that the first statement was executed; the table, EMPLOYEE\_SUBSET, was successfully created; then the

second statement was executed; and the result of the query against the EMPLOYEE\_SUBSET data was returned.

### A VARIETY OF SUBSTITUTIONS

You might have a requirement to execute a SQL statement over and over again, but one part of the statement—the input to the WHERE clause—must change for different executions. In such a case, that input is variable and is substituted by a different input value each time the statement is executed. You can rewrite this type of statement by using a *substitution variable*. A substitution variable consists of a variable name of your choosing, prefixed with an ampersand (&). The example in **Listing 6** illustrates the use of a substitution variable, &v\_salary, to input a salary value that is compared with salary values in the EMPLOYEE table. By using a substitution variable, you can reduce the amount of writing required for similar SQL statements that are run often.

**Code Listing 6:** A substitution variable for salary values

```
SQL> select first_name||' '||last_name employee_name
  2  from employee
  3  where salary < &v_salary
  4  order by employee;
Enter value for v_salary: 100000
old  3: where salary < &v_salary
new  3: where salary < 100000
```

**EMPLOYEE**

---

Betsy James

Don Rose

Donald Newton

Frances Newton

Matthew Michaels

Roger Friedli

Sasha Meyer

Theresa Wong

mark leblanc

michael peterson

10 rows selected.

The query in [Listing 7](#) demonstrates how to re-execute the [Listing 6](#) statement that is now in the SQL\*Plus buffer. When you use a forward-slash character (/), the SQL statement is reissued to the SQL execution environment and you are prompted for a value for the substitution variable, without having to copy and paste the original SQL statement. Additionally, [Listing 8](#) shows how the use of substitution variables is not limited to the WHERE clause of a statement.

**Code Listing 7:** Re-executing the statement with the forward-slash character (/)

```
SQL> /
Enter value for v_salary: 90000
old   3: where salary < &v_salary
```

```
new  3: where salary < 90000
```

EMPLOYEE

---

Betsy James

Donald Newton

Frances Newton

Matthew Michaels

Roger Friedli

Sasha Meyer

Theresa Wong

mark leblanc

8 rows selected.

**Code Listing 8:** Substitution variables, not just for WHERE clauses

```
SQL> select &v_col1, &v_col2, &v_col3
      2  from employee;
Enter value for v_col1: first_name
Enter value for v_col2: last_name
Enter value for v_col3: hire_date
old   1: select &v_col1, &v_col2, &v_col3
new   1: select first_name, last_name, hire_date
```

FIRST_NAME	LAST_NAME	HIRE_DATE
Marcy	Tamra	04-MAY-16
Sasha	Meyer	04-MAY-16
Gerald	Sowell	29-OCT-16
Emily	Eckhardt	07-JUL-04
Frances	Newton	14-SEP-05
Donald	Newton	24-SEP-06
Matthew	Michaels	16-MAY-07
Roger	Friedli	16-MAY-07
Betsy	James	16-MAY-07
Michael	peterson	03-NOV-08
Mark	leblanc	06-MAR-09
Thomas	Jeffrey	27-FEB-10
Theresa	Wong	27-FEB-10
Lori	Dovichi	07-JUL-11
Mary	Streicher	16-MAY-16
Don	Rose	26-OCT-16

16 rows selected.

```
SQL> select first_name||' '||last_name, salary, hire_date
  2  from employee
  3  order by &v_order;
Enter value for v_order: salary desc
old   3: order by &v_order
```

```
new 3: order by salary desc
```

FIRST_NAME    ' '    LAST_NAME	SALARY	HIRE_DATE
Marcy Tamra		04-MAY-16
Lori Dovichi		07-JUL-11
Thomas Jeffrey	300000	27-FEB-10
Mary Streicher	200000	16-MAY-16
Emily Eckhardt	110000	07-JUL-04
Gerald Sowell	100000	29-OCT-16
Don Rose	95000	26-OCT-16
michael peterson	90000	03-NOV-08
Sasha Meyer	85000	04-MAY-16
Frances Newton	82500	14-SEP-05
Donald Newton	80000	24-SEP-06
Matthew Michaels	70000	16-MAY-07
Theresa Wong	70000	27-FEB-10
mark leblanc	65000	06-MAR-09
Roger Friedli	60000	16-MAY-07
Betsy James	60000	16-MAY-07

```
16 rows selected.
```

Be aware that the SQL\*Plus environment almost always reads the ampersand as a substitution variable. The queries in [Listing 9](#) show the kind of error you might run

into when you include a literal ampersand value or both a literal ampersand value and a substitution variable in your script, followed by a couple of workarounds.

**Code Listing 9:** When you want a literal text ampersand returned in your result

```
SQL> select 'This & That'  
      2    from dual;  
Enter value for that:  
old   1: select 'This & That'  
new   1: select 'This '  
  
'THIS  
_____  
This  
  
--Create a database script called handle_the_ampersand.sql  
set define off  
  
select 'This & That'  
      from dual;  
  
--Execute the script  
SQL> @handle_the_ampersand.sql  
  
'THIS&THAT'  
_____  
This & That
```

```
--Mix substitution variables with literal text ampersands

--Create a database script called variables_and_ampersands.sql
set define on

select 'This '||'&'||' That'
      from &v_table;

--Execute the script
SQL> @variables_and_ampersands.sql
Enter value for v_table: dual
old   2:   from &v_table
new   2:   from dual

'THIS'||'&'

-----
This & That
```

The first line of the database script handle\_the\_ampersand.sql is

```
set define off
```

This is a SQL\*Plus command for disabling the prompting and replacement of substitution variables within the SQL\*Plus execution environment. When this command is issued, ampersands are treated as literal values. However, there might be instances when you want to use both substitution variables and literal amper-

sand values within your statements or scripts. In such cases, you might not want to disable substitution variables. The database script `variables_and_ampersands.sql` sets the SQL\*Plus environment back to accepting and replacing substitution variables and uses string concatenation to ensure that any literal ampersand is correctly read as a literal string value. Note that if you run the `SET DEFINE OFF` SQL\*Plus command, any attempt to access your substitution variable as originally written in your script will result in an error message similar to the following:

```
SQL> @variables_and_ampersands.sql
SP2-0552: Bind variable "V_TABLE" not declared.
```

One of the ways to handle this error is to ensure that you run the `SET DEFINE ON` SQL\*Plus command—the first line of the `variables_and_ampersands.sql` script.

Occasionally you might want to use a named substitution variable more than once in your database script. If your input to the variable is the same for the duration of the script run, you can avoid being prompted for a value each time the variable is encountered by employing double ampersand (`&&`) notation. **Listing 10** shows a script with a substitution variable used in multiple statements where the input is potentially the same for each variable invocation. **Listing 11** demonstrates a similar script that uses double ampersand notation with the substitution variable.

**Code Listing 10:** Substitution variables requiring value input each time they are invoked

```
--Create a database script called resubstitute.sql
select table_name, num_rows, to_char(last_analyzed,
'DD-MON-YYYY HH24:MI:SS') last_analyzed
from user_tables
```

```

where table_name = '&v_table';

select table_name, index_name, column_name, column_position
  from user_ind_columns
 where table_name = '&v_table';

```

--Execute the script

```

SQL> @resubstitute.sql
Enter value for v_table: EMPLOYEE
old   3: where table_name = '&v_table'
new   3: where table_name = 'EMPLOYEE'
```

TABLE_NAME	NUM_ROWS	LAST_ANALYZED
EMPLOYEE	16	13-MAY-2017 14:46:32

Enter value for v\_table: EMPLOYEE

```

old   3: where table_name = '&v_table'
new   3: where table_name = 'EMPLOYEE'
```

TABLE_NAME	INDEX_NAME	COLUMN_NAME	COLUMN_POSITION
EMPLOYEE	EMP_HIRE_DATE_I	HIRE_DATE	1
EMPLOYEE	DEP_WAGE_INCREASE_I	DEPARTMENT_ID	1
EMPLOYEE	DEP_WAGE_INCREASE_I	WAGE_INCREASE_WORTHINESS	2
EMPLOYEE	EMPLOYEE_PK	EMPLOYEE_ID	1

EMPLOYEE	EMP_DEPT_FK	DEPARTMENT_ID	1
EMPLOYEE	EMPLOYEE_WAGE_INC_WORTH_BMI	WAGE_INCREASE_WORTHINESS	1

6 rows selected.

**Code Listing 11:** Using && to avoid repeated prompted user input for substitution variables

```
--Create a database script called substitute_and_reuse.sql
select table_name, num_rows, to_char(last_analyzed,
'DD-MON-YYYY HH24:MI:SS') last_analyzed
  from user_tables
 where table_name = '&&v_table';

select table_name, index_name, column_name, column_position
  from user_ind_columns
 where table_name = '&&v_table';

--Execute the script
SQL> @substitute_and_reuse.sql
Enter value for v_table: EMPLOYEE
old   3: where table_name = '&&v_table'
new   3: where table_name = 'EMPLOYEE'
```

TABLE_NAME	NUM_ROWS LAST_ANALYZED
EMPLOYEE	16 13-MAY-2017 14:46:32

```
old  3: where table_name = '&&v_table'
new  3: where table_name = 'EMPLOYEE'
```

TABLE_NAME	INDEX_NAME	COLUMN_NAME	COLUMN_POSITION
EMPLOYEE	EMP_HIRE_DATE_I	HIRE_DATE	1
EMPLOYEE	DEP_WAGE_INCREASE_I	DEPARTMENT_ID	1
EMPLOYEE	DEP_WAGE_INCREASE_I	WAGE_INCREASE_WORTHINESS	2
EMPLOYEE	EMPLOYEE_PK	EMPLOYEE_ID	1
EMPLOYEE	EMP_DEPT_FK	DEPARTMENT_ID	1
EMPLOYEE	EMPLOYEE_WAGE_INC_WORTH_BMI	WAGE_INCREASE_WORTHINESS	1

6 rows selected.

If you want to reset the value of your substitution variable when using double ampersand notation, delete the current value with the UNDEFINE SQL\*Plus command. For example, to delete the current value of the v\_table substitution variable in SQL\*Plus, use the command

```
undefine v_table
```

## CONCLUSION

This article introduced you to the data dictionary, from the USER\_, ALL\_, and DBA\_ static data dictionary views to the dynamic performance views (the V\$ tables.) You saw database scripts combine multiple statements in a sequence into one file. You learned what a substitution variable is and how it can help in reducing SQL state-

ment writing. Last, you learned how substitution variables can be reused and reset.

In the next article in this series, you'll learn more about SQL statement scripting and SQL\*Plus commands and get an introduction to dynamic SQL. 

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*Melanie Caffrey is a senior development manager at Oracle. She is a coauthor of Beginning Oracle SQL for Oracle Database 12c (Apress, 2014), Expert PL/SQL Practices for Oracle Developers and DBAs (Apress, 2011), and Expert Oracle Practices: Oracle Database Administration from the Oak Table (Apress, 2010).*

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## NEXT STEPS

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## A Fresh Start

Outgoing IOUG President Maria Anderson discusses leadership and change with the incoming president, David Start. **BY JEFF ERICKSON**



IOUG President David Start sees the cloud changing how people look at skills and job roles.

### As cloud strategies shift workloads

away from company-owned data centers, technologists are left to steer their careers through an unsettling transition. As they might with any complex question, members of the Independent Oracle Users Group (IOUG) will look to their fellow members as guides, “because you can’t google this stuff,” says outgoing IOUG President Maria Anderson. “You’ll only get the real information by talking to people who’ve lived it.”

Anderson spoke with the incoming IOUG president, David Start, about his plans for the user group during this “generational shift” in technology. *Oracle Magazine* listened in.

**Anderson:** The cloud is really shaking up the industry, and I feel this is just the beginning. How do you see it?

**Start:** The cloud, in my opinion, is probably the best thing that’s ever happened because it’s shaking up people. People

**“There’s a lot more you need to understand, and it’s not technical. The technical stuff is going to change daily and weekly with the cloud.”**

—*David Start,  
IOUG President*

have been so stagnant saying “I’m going to be a DBA. Let’s just look at the next version of the database.” In the past, you had time because you’d upgrade the database every three years. Now it’s weekly. It’s a faster pace. It gets people on their toes. It gets the data going. It makes everybody step back and ask where do they want to be and where are they going. You can’t just be the Oracle Database administrator with your hands on the keyboard anymore.

**Anderson:** It’s a huge opportunity. That’s why IOUG has been stepping up our strategic leadership program.

**Start:** Right. We’re saying, “Hey, you may become an architect. You may become a manager. You may become other things. You need to think about your career. You need to think about what the world looks like when you’re architecting for the cloud.”

**Anderson:** It’s not about the database. It’s about the data.

**Start:** Exactly. That’s why I say IOUG is the best place to be, because everything

is data-driven. If you look at every tech industry headline, it’s not about an application. It’s not about a server. It’s always about data—data breaches, data security, data governance, data at rest. Every article is about data, and the person who knows the most about the data is going to be a member of IOUG.

**Anderson:** That’s because you need information, not marketing. Your peers know what’s going on.

**Start:** A perfect example is all the new legal regulations in Europe about where data has to sit. These are laws with different levels of flexibility. The only way you’re going to understand them is talk to somebody who’s dealt with them. And where can you go to ask somebody, “What does this mean to me? How do I do this? Can I put my data in Ireland or does it have to be in Germany? Can I publish this data?” Nobody’s going to give you those answers in the detail you need unless they have gone through it or studied it. IOUG is where you find those folks.



Outgoing IOUG President Maria Anderson looks at IOUG as a source of opportunity, peer support, and answers.

**Anderson:** The great part about IOUG is that you'll get your question answered, but you might also start a relationship that lasts a lifetime.

**Start:** Almost 10 years ago I met a few guys during a technical discussion at an IOUG conference. Afterwards we went out for a few drinks and ended up talking the night away. The whole rest of that

year, as technical things popped up, we emailed each other. Then the next year at the IOUG conference, we got together again. Over the years, if somebody was standing alone at a conference, we'd go up and talk to them, and all of a sudden we have another person in the group. Now we've got 25 or 30 people in this group.

We've got a slack channel, and if you want to talk about what's going on in your family or if you have a CECL [Current Expected Credit Loss] 2 initiative, you post it there. A while ago my daughter won a soccer game, and I posted it, and everybody was asking about the game. The next day somebody ran into an Oracle Data Guard issue, and within a minute or two somebody posted a suggestion for what to do. Then everybody jumped in, and they were all helping out: "Did you do this, check this, and check that?" Bam! That database was back up and running.

**Anderson:** As things move to the cloud, your group will have a lot to talk about.

**Start:** The one thing I'd say to folks is to take your hands off the keyboard. It's no longer just about products or services. It's solutions. It's architectures. It's critical thinking. It's communication skills and problem solving. There's a lot more you need to understand, and it's not technical. The technical stuff is going to change daily and weekly with the cloud.

**Anderson:** You sound like just the guy to take the reigns. I wish you the best in your time as IOUG president.

**Start:** Thanks, Maria. I'm a sucker for a challenge. This is an exciting time. I'm ready for it. □

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*Jeff Erickson is editor at large for Oracle Publishing.*

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**GARY CAMPBELL/THE VERBATIM AGENCY**

## NEXT STEPS

**JOIN** IOUG.