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MARCH/APRIL 2018

MAGAZINE



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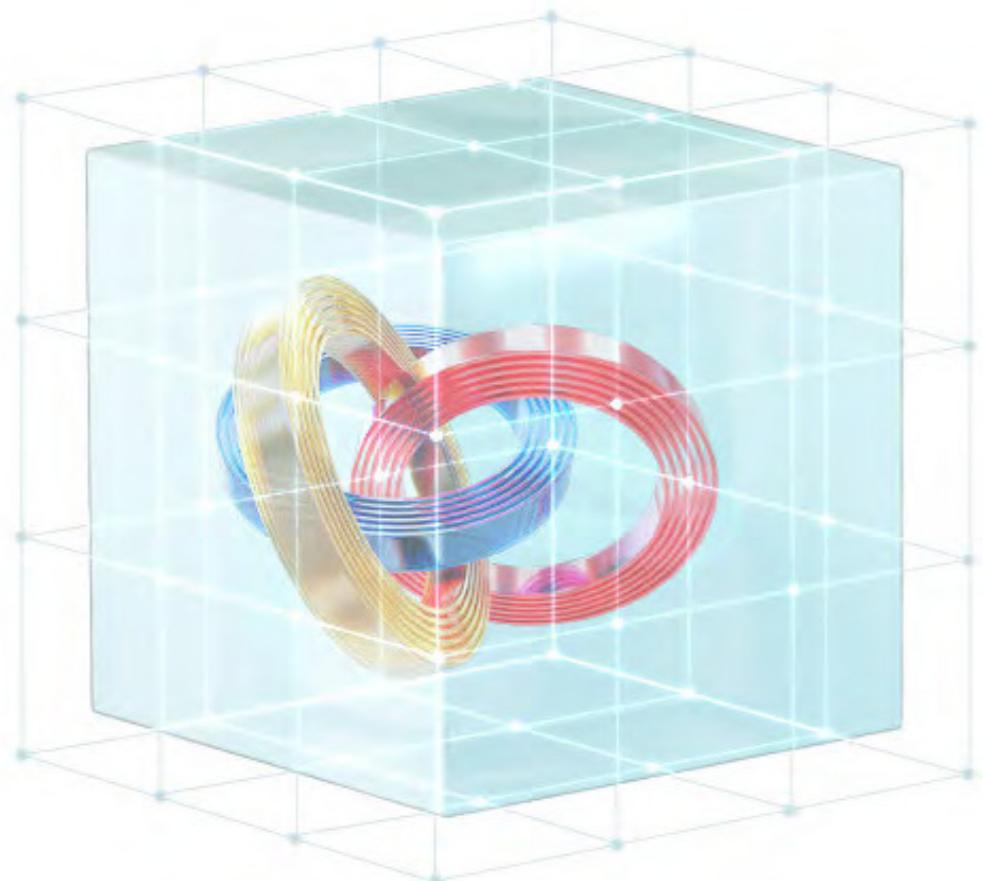
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Tom Haunert



# Blockchain: Much Bigger Than Bitcoin

It won't fill your newsfeeds like Bitcoin, but blockchain will do a lot more for your business.

**Blockchain is not Bitcoin, and Bitcoin is not blockchain.** People understand the difference, in principle, but the cryptocurrency and the distributed digital ledger technology have a connected history. Add to that the fact that almost all descriptions of blockchain technology feature Bitcoin as the use-case example. And then throw in the news-feed-filling drama that surrounds Bitcoin. Breaking the links between blockchain and its proof-of-concept project, Bitcoin, can be confusing.

But that confusion is fading: blockchain is distancing itself from its origins, and businesses are seeing that blockchain can do much more.

And that potential of blockchain is getting the attention of technology creators and consumers. Given blockchain's initial use case, some businesses are looking quite closely. So closely, in fact, that in "[Cloud Predictions 2018](#)," Oracle predicts that blockchain will be the disruptive standard in modern commerce and that 30 percent of blockchain proof-of-concept projects will get the green light by 2020.

## THE ISSUE OF TRUST

In this issue's cover feature, "[It's All About Trust](#)," author Alan Zeichick and Mark Rakhmilevich, product management director at Oracle, move the

blockchain conversation beyond cryptocurrency, commerce, and financial services. Zeichick describes blockchain as a technology for trustworthy transactions and touches on use cases for blockchain across industries in areas including financial transactions, supply chain management, contract management, pharmaceutical trials, digital identity management, and more. “Blockchain doesn’t have to just be used for accounting ledgers,” says Rakhmilevich.

The cover story also discusses Hyperledger, a blockchain-focused industry initiative hosted by the Linux Foundation, and Oracle Blockchain Cloud Service, which is built on Hyperledger Fabric, a permissioned blockchain plat-

form and Hyperledger project. Why use Hyperledger Fabric? Hyperledger Fabric-based blockchain services can talk to each other. If one transaction partner is using Oracle Blockchain Cloud Service and another is using a different Hyperledger Fabric-compliant service, the partners can transact directly.

This service compatibility is sure to help blockchain become the disruptive standard in modern commerce—and many other industries.



Tom Haunert,  
Editor in Chief

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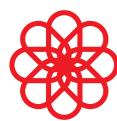
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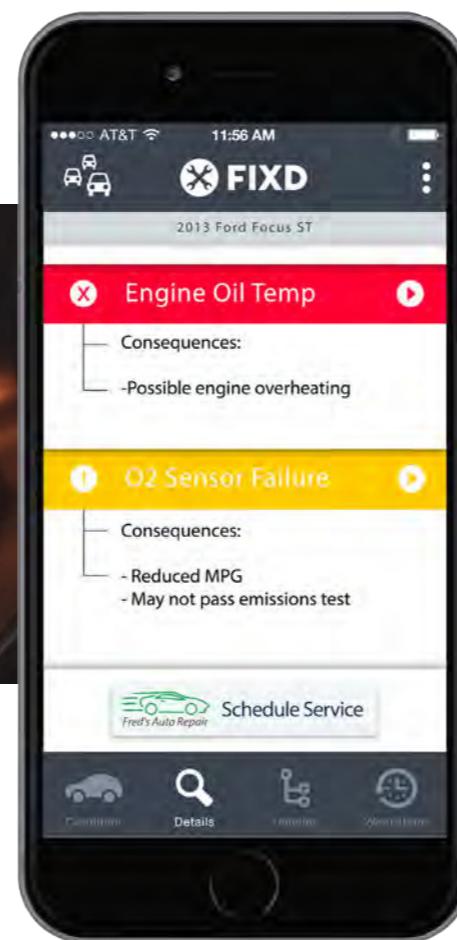


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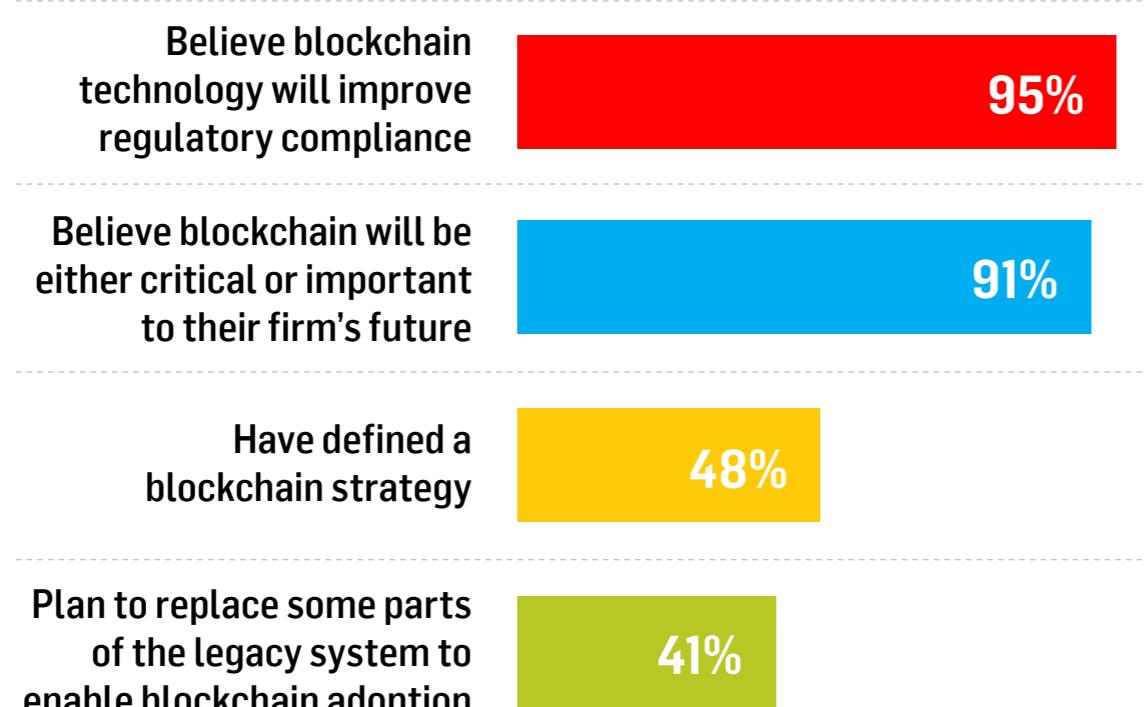


## Time for Blockchain in Finance?

### Global survey report says yes.

Blockchain originated with and for digital currency, so it should be no surprise that a huge percentage (91) of financial services companies expect the technology to transform their industry. Although a recent global survey of 1,520 executives from 578 financial services firms revealed pockets of uncertainty on various topics, its authors warn that those who hesitate will be left behind.

### Expectations and plans



Source: “[Financial Services: Building Blockchain One Block at a Time](#)” (Cognizant, 2017)

## DO YOU SPEAK TECH? QUIZ YOURSELF!

- 1. Which of the following names the process by which transactions are verified and added to a blockchain?**
  - A. Mining
  - B. Consensus point
  - C. Handshake
  
- 2. In the context of blockchain, soft fork refers to**
  - A. A scenario in which someone tries to send a Bitcoin transaction to two different recipients simultaneously
  - B. Software applications that can run without the use of a centralized system
  - C. A protocol being updated in such a way that it still can communicate with previous protocols
  
- 3. Fiat currency is**
  - A. Any money declared by a government to be valid for meeting a financial obligation—USD or GBP, for example
  - B. The name for automaker Fiat’s profit-sharing model
  - C. Digital currency governed by proprietary and seemingly arbitrary rules

Answers: 1. A; 2. C; 3. A

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Maria Colgan, master product manager for Oracle Database, wants DBAs to become advocates for database features, functionality, and technology.

## Driver's Education for the Self-Driving Database

With Oracle Autonomous Database, DBAs can avoid the mundane, embrace strategy, and schedule those meetings. **BY TOM HAUNERT**

**If DBAs are the drivers of databases,** what happens to DBA responsibilities on a self-driving database?

*Oracle Magazine* sat down with Maria Colgan, master product manager for Oracle Database, to talk about how Oracle Autonomous Database will change the role of the DBA and how the DBA will in turn improve business processes and application development.

***Oracle Magazine:*** At the highest level, what is Oracle Autonomous Database?

**Colgan:** Oracle Autonomous Database combines the flexibility of the cloud with the power of machine learning to deliver data management as a service.

It will allow businesses to safely run their mission-critical database workloads on the most secure, most available, and most performant platform—Oracle Database 18c on Oracle Exadata.

Beyond Oracle Database 18c and Oracle Exadata, Oracle Autonomous Database includes machine learning and other features (or “secret sauce,” if you will) to deliver this high level of service. Oracle Autonomous Database customers will simply define the service level they

need and Oracle Autonomous Database will make it happen.

***Oracle Magazine:*** How does Oracle Autonomous Database affect the role of the DBA?

**Colgan:** If you look at what a DBA does today, you can probably divide the tasks into two buckets: generic database and infrastructure tasks would be in one bucket and the other bucket would be more application-focused or business-focused tasks.

With the transition to Oracle Autonomous Database, the generic database and infrastructure tasks go away, because the cloud provider—Oracle—is going to take care of them. These tasks include provisioning new database systems, upgrading or patching existing databases, and making backups.

Those tasks are going to go away because DBAs are simply going to select the service levels they want, and Oracle Autonomous Database will take care of it for them. But that doesn’t mean the other DBA activities—the application- and business-focused activities in that second bucket—go away.

Anything that’s business-driven or application-focused is still in the hands of the DBA. These

areas tend to be the ones that fall off the DBA's plate right now when DBAs focus on those more generic database and infrastructure tasks. Removing those tasks allows the rest of the DBA's world to expand.

**Oracle Magazine:** What kind of new or different opportunities does the self-driving database offer to DBAs?

**Colgan:** Oracle Autonomous Database gives DBAs an opportunity to really spread their wings and learn some new skills.

For example, we believe that DBAs working with Oracle Autonomous Database are going to become more involved with their development teams and work hand in hand with them, as well as with the business, to execute more projects, reduce backlogs, and get more value from their company's data. The DBA role will transform to include defining things such as the data model, optimizing data access, and improving end user experience.



With Oracle Autonomous Database, application- and business-focused DBA activities do *not* go away, says Maria Colgan, master product manager for Oracle Database.

DBAs can help developers use the features that are included with Oracle Autonomous Database so that the developers can make the best use of the database technology and get their projects up and running much faster.

DBAs who are not currently experts in data modeling, security, data lifecycle management, or application tuning will have an opportunity to move into those areas.

**Oracle Magazine:** What can DBAs who want to plan for what's next in the autonomous database world do now?

**Colgan:** One of the things I'm always telling DBAs is that you need to get familiar with the features and functionality in the latest versions of Oracle Database and how to use them, and that's still the case with Oracle Autonomous Database.

DBAs need to start educating themselves on the areas I mentioned, including security,

performance tuning, data modeling, and architecting a full solution with a development team. These are areas they may not currently operate in, but they're going to have to grow into them.

And when it comes to which database service a company needs, the business and the developers are going to look to the DBA to know that. Do you really need Oracle Autonomous Database based on your latest requirements? Sometimes the answer may actually be no, and a service such as Oracle Exadata Express Cloud Service might be sufficient.

As far as working with developers, DBAs should get ready to be the advocates for the features, functionality, and technology that are in the database that can *improve the agility of development teams* so that developers are not spending months and years reinventing the wheel in their application code. □

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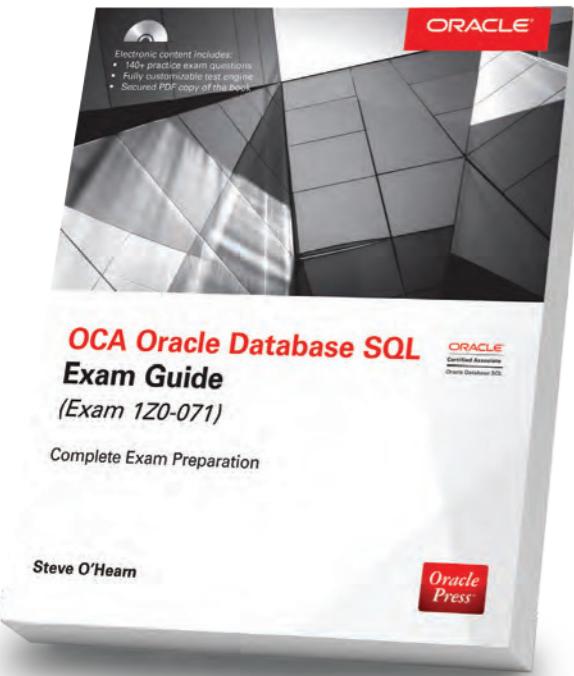
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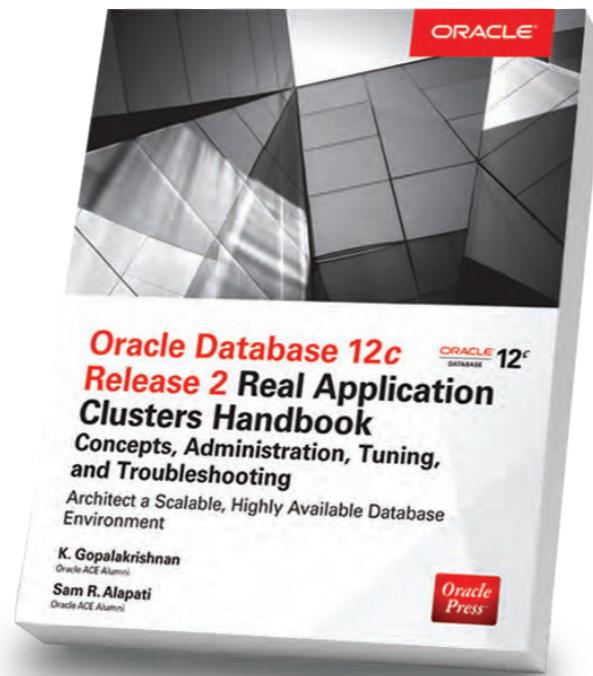
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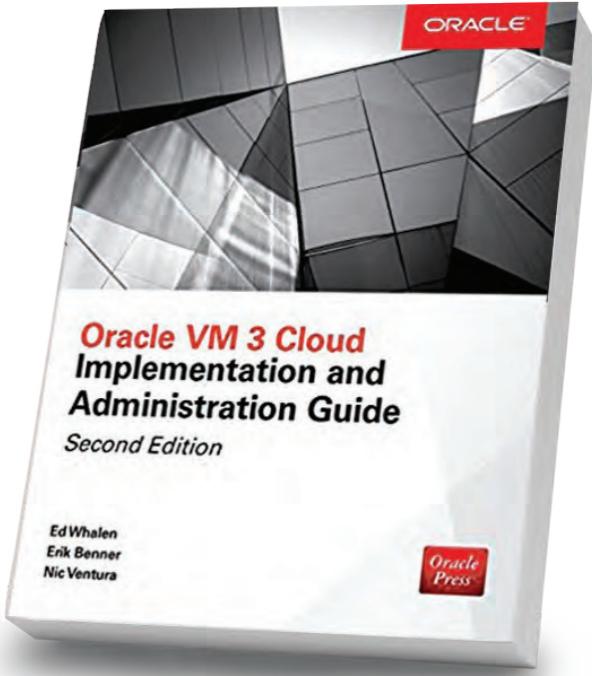
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"With many more content channels and ways that users get information and engage, we need to rethink how to implement content management for use across multiple teams throughout the enterprise," says Mariam Tariq, senior director of product management at Oracle.

# Put Your Content Everywhere and Center

Content management keeps changing, and a data hub supports that change.

BY TOM HAUNERT

**Content management is not new**, but where and how you access applications that depend on content has changed significantly—and quickly—in the last couple of years.

*Oracle Magazine* sat down with Mariam Tariq, senior director of product management at Oracle, to talk about the changes in content management technology, content management challenges, and the latest solution from Oracle.

***Oracle Magazine:*** What is driving change in content management today?

**Tariq:** One of the most recent changes in content management is that we're no longer only talking about the web. With the advent of mobile applications, voice-activated devices such as Google Home and Amazon Alexa, and other custom applications, there are many places where content gets consumed. And with the addition of all of those channels, the thinking around content management needs to be broader than the web. It is also important to consider the customer journey across channels to create a consistent and connected experience through all stages of engagement.

With many more content channels and ways that users get information and engage, we need

to rethink how to implement content management for use across multiple teams throughout the enterprise.

***Oracle Magazine:*** How, specifically, do these new channels affect content management strategies and systems today?

**Tariq:** One of the most critical concepts is having a content management system that's agnostic of presentation. In the web world, content typically was tied very heavily to templates and specific page layouts for presentation, but with all of these new engagement channels, the content needs to be cleanly separated from the presentation.

*Headless* or *decoupled* content management is a new term that describes a kind of channel-agnostic content repository with API access to the content. Most traditional web content management systems have added API access to content in the repository. But there are other options that are built from the ground up to be channel-agnostic.

This leads to the idea of a content hub where all content is centralized for access across the enterprise. Web marketers, campaign managers, merchandizers, and social channel man-

agers all have one central place to access approved content. Likewise, content authors contribute that content into this same hub. This idea extends beyond marketing and could include content used by Sales, Service, HR, and other departments.

**Oracle Magazine:** What are the major content management challenges in the enterprise that you see today?

**Tariq:** One challenge comes from companies that have either acquired other companies that use other content systems or that have many different departments within the same company that are using separate technologies for content.

**“One of the most critical concepts is having a content management system that’s agnostic of presentation.”**

Therefore, a challenge for content hubs is how to work with, curate, discover, and aggregate content from other systems.

Another challenge is how to connect content with data. How do you take that content that you’re managing in your content hub and con-

nect it with data that could include pricing data or description data stored in other systems? This is important because this data helps make the content more informative and useful.

One more challenge is how to deliver the best content that is specific to each individual’s interests and channel of interaction in order to drive a personalized experience. In retail, a customer’s past purchases can drive product recommendations the customer sees in a future engagement. In media, news articles or videos could be highlighted or suggested based on past content views. Personalization could extend to other industries such as manufacturing, financial services, and more. The goal is to make experiences more relevant and more personalized as well as context-specific based on the channel.

Part of the solution for personalizing content is to make the content smarter by using machine learning and artificial intelligence (AI) to tag content. This enables the ability to find the right content to target. In addition, analytics are important in providing essential guidance and reports to the business users about the success of these strategies as well as guided input to make improvements.

**Oracle Magazine:** What is Oracle's solution for content management?

**Tariq:** Oracle Content and Experience Cloud is Oracle's core content management solution. It supports the idea of a centralized content hub with all of the content created and located in one place plus the supporting content management features that comprise a content management system, including content creation, collaboration, metadata management, content workflows, and publishing. To account for content that exists outside this hub, content can be discovered from other systems, which include other content management systems, databases, catalog data, and more. All of the content is accessible via this hub through APIs, SDKs, and direct integration into other systems used to deliver experiences.

The content experiences can be built using the website build-



"Part of the solution for personalizing content is to make the content smarter by using machine learning and artificial intelligence to tag content," asserts Mariam Tariq, senior director of product management at Oracle.

ing tools included with Oracle Content and Experience Cloud, but also through custom and mobile applications, voice-activated devices, and more. You can just grab content out of your repository via APIs and use it wherever you need to use it.

With Oracle Content and Experience Cloud, Oracle is doing all of this in the cloud, taking

care of all of the heavy lifting of scaling, content delivery, network integration, and all those things that are challenging in maintaining a content management system. And by making it cloud native, the focus can be more on content creation and delivery—and not on maintenance of the software. □

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**JASON ANDREW/THE VERBATIM AGENCY**

## NEXT STEPS

**TRY** Oracle Content and Experience Cloud.

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**WATCH** Oracle Content and Experience Cloud in action.



# Changing It Up

These peers delve into IaaS and PaaS, trade accounting for IT, and soak up foreign cultures.



**Francis Mignault** 

Montreal, Canada



**Company/URL:** [Insum Solutions](#)

**Job title:** Chief technology officer

**Length of time using Oracle products:** More than 30 years

**What advice do you have about how to get into web and database development?** The best way is by using a low-code development tool such as Oracle Application Express. You can start creating applications without any web knowledge. Once you gain knowledge using the tool, you can learn to use JavaScript and CSS, and do more coding.

**How are you using cloud computing in your work these days?** Currently we have a lot of clients moving to Oracle Cloud instead of renewing and buying hardware. Infrastructure as a service [IaaS] might currently be the cloud service that appeals to customers the most, for its flexibility and capacity of provisioning new services. We're also using platform-as-a-service [PaaS] solutions from Oracle, because we specialize in web application development.

**What would you like to see Oracle, as a company, do more of?** I believe that user groups and real-life networking are important, and I'd love for Oracle to get more involved in local user groups and encourage the creation of those local user groups. The internet made it easier to find technical information, but I believe people should still meet, attend conferences, and network. *[Editor's note: Find local user groups, including how to find a group in your area and a list of upcoming local events, [here](#)].*



## Kiran Tailor

London, England



**Company/URL:** [The Association of International Certified Professional Accountants](#)

**Job title:** Senior enterprise data architect

**Length of time using Oracle products:** 20 years

**How did you get started in IT?** Before I went to university, I wanted to be an accountant. I seemed to excel in computing rather than numbers, which made me opt instead for a degree in business and information systems. Once I left university, I started to work at an IT consultancy company using Oracle Forms, Oracle Reports, and Oracle databases. Ever since then, I've been using Oracle technology.

**What's your favorite tool on the job?** Currently it's the Data Sync feature of Oracle Business Intelligence Cloud Service, which is a great tool for extracting information from Oracle Fusion applications. Say you're using a cloud enterprise resource planning [ERP] solution integrated with an on-premises customer relationship management [CRM] system. You process payments in your CRM system and send these to the ERP system. How do you know that everything you've sent has been processed or received by the ERP system? With Data Sync we can automate a download of data from our cloud ERP system into

our data warehouse, and thereafter have some sort of exception report that checks this data to validate the integrations and raise exceptions so that problems can be identified.

**What technology has most changed your life?**

Cloud computing. We no longer have to think too much about installations, because now with a few clicks, your machine is ready. At my organization, our financials, HR, and marketing applications are all run in the cloud. That's allowed me to move away from certain operational issues and concentrate on how our technologies can be applied to business and ensure better operations.



## Ronald Francisco Vargas Quesada

San José, Costa Rica



**Company/URL:** [Novacomp](#)

**Job title:** Consultant

**Length of time using Oracle products:** More than 20 years

**Which new features in Oracle technologies are you currently finding most valuable?** Right now my focus is on artificial intelligence and machine learning—not because these technologies represent some distant future, but because they are now embedded in the new applications we use every single day. Since last October's announcement of Oracle Database 18c and its autonomy characteristic, I'm now developing and improving my knowledge of machine learning within

the database and the creation of bots.

**What's the most common cause you see when IT projects go wrong?** The lack of defined objectives, goals, and properly managed expectations. The client can have expectations raised by sales personnel who aren't ultimately responsible for the technical work involved—so it's not until the project is already underway that they realize that technically, it's going to take a lot more work to achieve that goal than they thought. As a result, the client is already frustrated by the time the results finally come. And this

detracts from what should be the focus: the benefits of the new solution.

**What's your favorite thing to do that doesn't involve work?** Travel. The person who travels is not the same when he or she returns. In the course of participating as a speaker on the Latin American OTN Tour since 2012, I've visited Guatemala, Honduras, Panamá, Colombia, Perú, Chile, Ecuador, and Argentina. For other work reasons, I've gone to México and Brasil. Being able to exchange thoughts, observe foreign traditions, and engage with new communities is a massive experience.



# Start Early, Don't Stop

Oracle Developer Champion Robert van Mölken didn't wait for school and doesn't wait to share with the community.

**Gamers start young.** But young gamers can also become young game *developers*, and that's certainly the case with Oracle Developer Champion Robert van Mölken, who first experimented with game development in the early 1990s at age nine, using QuickBASIC on the same Schneider computer he used to play storytelling games.

By 2000, van Mölken, then 15 years old, was earning money to spend on his girlfriend and audio equipment by building web pages. "It was better than a paper route," he says.

Van Mölken earned a bachelor's degree in computer science from Hogeschool van Utrecht



For Oracle Developer Champion Robert van Mölken, a good day is one in which he gets to work with Internet of Things (IoT) and blockchain.

and had a six-month internship with a company that created websites and graphics for various clients; there, he gained practical experience working in PHP, MySQL, and Flash.

Degree in hand, van Mölken's career working with Oracle technologies began at a consulting company, and his work there involved Java, XML, and a government project to develop a SaaS application that allowed citizens to access various government services. "The application ran on Oracle," he explains. "The front end was built in PL/SQL. Then we had Oracle middleware, and the back end was Oracle Database with a lot of PL/SQL for the logic."

In November 2011, van Mölken landed in his current role as senior integration and cloud specialist with AMIS in Utrecht. Most of van Mölken's time at AMIS is now spent working on

a project for the Dutch National Police. "It's all Oracle," van Mölken says. "The middleware is Oracle, the database is Oracle, the front end is Angular, and the back end is Java."

Van Mölken writes code every day, relying on a variety of tools: Oracle JDeveloper 12c for designing and creating XML Schema Definitions, WSDLs, XSLT, and XQuery transformations; NetBeans 8 for Java EE; GIT and SourceTree for corporate projects; GitKraken for open source projects; Visual Studio Code for JavaScript and Node.js apps; Hyperledger Composer for blockchain apps; and Slack for communication on open source projects.

A good day for van Mölken is one in which he gets to work with Internet of Things (IoT) and blockchain. His interest in blockchain began with the purchase of a few Bitcoins after the

## RECOGNIZE

The Oracle Developer Champion program recognizes modern expert developers who blog, write articles, and present on topics including containers, microservices, SQL, NoSQL, open source technologies, machine learning, and chatbots. Learn more about Oracle advocacy programs and follow the Oracle Developer Champions [on the Oracle Developers Blog](#).

**“I had knowledge of cryptocurrencies, but I wanted to know what was behind it.”**

2013 price drop. “I had knowledge of cryptocurrencies, but I wanted to know what was behind it,” he says. So he dug in. In 2016, van Mölken participated in a discussion of technologies to watch at a luncheon that was part of the UK Oracle User Group (UKOUG) Technology Conference and Exhibition in Birmingham, UK. The enthusiastic response to van Mölken’s passionate remarks on blockchain led him to understand that he was on to something. What followed was continued experimentation and research, leading to several blockchain presentations in 2017 at various user group events, including a standing-room-only session at Oracle OpenWorld 2017.

In the spring of 2018, van Mölken’s expanding expertise will hit another milestone with the publication of *Blockchain Across Oracle* (Packt). This follows *Implementing Oracle Integration Cloud Service*, coauthored by van Mölken and

fellow Oracle ACE Phil Wilkins (Packt, 2017).

Looking to the future, van Mölken is both excited and concerned about the rapid evolution of technologies. “There is a lot of cool stuff going on right now—machine learning, artificial intelligence, IoT, streaming analytics, device management, and the changes in AngularJS. As a developer, everything sounds very cool.” But that makes it tough for him to decide where to place his focus.

In his evolution and growth as a developer, sharing within the community continues to play an important role. “When I want to learn something, I don’t pick up a book. I don’t really read books, even though I write them,” he admits, relying instead on blogs and videos other developers create to share their knowledge, experience, and code. “I’m a hands-on person, and for me that’s the most valuable way to learn.”

But van Mölken gives as good as he gets. His contributions to the community earned his confirmation as an Oracle ACE Associate in 2015, advancement to Oracle ACE in 2016, and confirmation as an Oracle Developer Champion in 2017.

Van Mölken still enjoys gaming—when he can find the time. “I own a PS4, including PSVR,” he explains. “I generally play racing games, Zelda, and role-playing games, including

Final Fantasy.” So whether it’s racking up points or pounding out code, the game is very definitely on. □

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*Oracle Architect Community Manager Bob Rhubarb is the host-engineer/producer of the Oracle Developer Podcast series, produces the 2 Minute Tech Tip video series, and interviews technology experts in DevLIVE videos recorded at Oracle events.*

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PHOTOGRAPHY BY **TON HENDRIKS**

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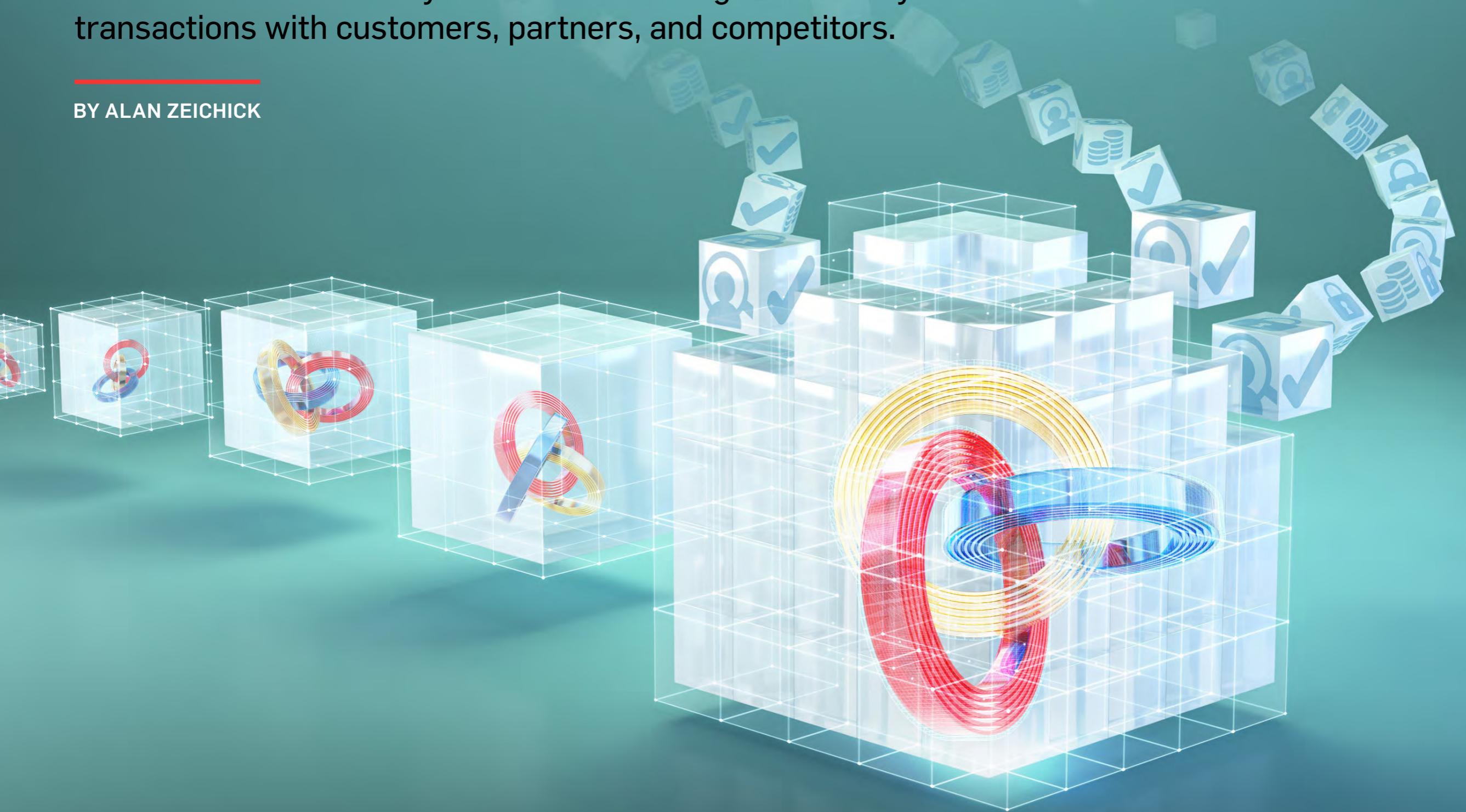
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# It's All About Trust

Blockchain is a secure system for conducting trustworthy transactions with customers, partners, and competitors.

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BY ALAN ZEICHICK



**B**lockchain is a distributed digital ledger technology in which blocks of transaction records can be added and viewed—but can't be deleted or changed without detection.

Here's where the name comes from: a blockchain is an ever-growing sequential chain of transaction records, clumped together into blocks. There's no central repository of the chain, which is replicated in each participant's blockchain node, and that's what makes the technology so powerful. Yes, blockchain was originally developed to underpin Bitcoin and is essential to the trust required for users to trade digital currencies, but that is only the beginning of its potential.

Blockchain neatly solves the problem of ensuring the validity of all kinds of digital records. What's more, blockchain can be used for public transactions as well as for private business, inside a company or within an industry group.

"Blockchain lets you conduct transactions securely without requiring an intermediary, and records are secure and immutable," says Mark Rakhmilevich, product management director at Oracle. "It also can eliminate offline reconcilia-

tions that can take hours, days, or even weeks."

That's the power of blockchain: an immutable digital ledger for recording transactions. It can be used to power anonymous digital currencies—or farm-to-table vegetable tracking, business contracts, contractor licensing, real estate transfers, digital identity management, and financial transactions between companies or even within a single company.

"Blockchain doesn't have to just be used for accounting ledgers," says Rakhmilevich. "It can store any data, and you can use programmable smart contracts to evaluate and operate on this data. It provides nonrepudiation through digitally signed transactions, and the stored results are tamper proof. Because the ledger is replicated, there is no single source of failure, and no insider threat within a single organization can impact its integrity."

### **It's All About Distributed Ledgers**

Several simple concepts underpin any blockchain system. The first is the block, which is a batch of one or more transactions, grouped together and hashed. The hashing process produces an error-checking and tamper-resistant code that will let anyone viewing the block see

if it has been altered. The block also contains the hash of the previous block, which ties them together in a *chain*. The backward hashing makes it extremely difficult for anyone to modify a single block without detection.

A chain contains collections of blocks, which are stored on decentralized, distributed servers—the more the better, with every server containing the same set of blocks and the latest values of information, such as account balances. Multiple transactions are handled within a single block using an algorithm called a *Merkle tree*, or *hash tree*, which provides fault and fraud tolerance: if a server goes down, or if a block or chain is corrupted, the missing data can be reconstructed by polling other servers' chains.

And while the chain itself should be open for validation by any participant, some chains can be implemented with some form of access control to limit viewing of specific data fields. That way, participants can view relevant data, but not everything in the chain. A customer might be able to verify that a contractor has a valid business license and see the firm's registered address and list of complaints—but not see the names of other customers. The state licensing board, on the other hand, may be

allowed to access the customer list or see which jobs are currently in progress.

When originally conceived, blockchain had a narrow set of protocols to govern the creation of blocks, the grouping of hashes into the Merkle tree, the viewing of data encapsulated into the chain, and the validation that data has not been corrupted or tampered with. Over time, creators of blockchain applications (such as the many competing digital currencies) innovated and created their own protocols—which, due to their independent evolutionary processes, weren't necessarily interoperable.

By contrast, the success of general-purpose blockchain services, which might encompass computing services from many technology, government, and business players, created the need for industry standards—such as Hyperledger, a Linux Foundation project.

### **Hyperledger: A Common Ground**

Many tech leaders and startups offer software or services for creating and using blockchain. When their customers want to participate in a shared blockchain application, such as to enable that farm-to-table vegetable tracking, or logistics that use multiple trucking, shipping,

**“Blockchain works because it’s peer-to-peer, it enables trust, and it provides easy-to-track history, which can serve as an audit trail.”**

—Mark Rakhmilevich, Product Management Director, Oracle

and rail lines, there must be a common platform that can serve as the basis for multiple blockchain implementations.

Creating and evolving that common platform is the goal of [Hyperledger](#), a blockchain-focused industry initiative founded in 2016 by 30 corporate members and managed by the Linux Foundation.

As of late January 2018, there were 197 organizations involved with Hyperledger, some of whom are direct competitors, with implementations built on different cloud services or using different programming languages.

The benefit of using Hyperledger Fabric, a permissioned blockchain platform, as a starting point for blockchain solutions is that those solutions can talk to each other. If one trading partner is using [Oracle Blockchain Cloud Service](#) to manage transactions (more about

this below), and another is using a Hyperledger Fabric-compliant blockchain service from IBM or SAP, their systems should be able to transact directly. This will be a significant boon to using blockchain as a distributed ledger.

### **Blockchain Business Models and Use Cases**

Blockchain is well-suited for managing transactions between businesses or organizations that may not know each other well, and where there's no implicit or explicit trust, explains Rakhmilevich.

“Look for blockchain in enterprise boundary use cases, where businesses conduct transactions with other businesses or even governments,” he says. “Blockchain works because it’s peer-to-peer, it enables trust, and it provides easy-to-track history, which can serve as an audit trail.”

What's more, blockchain smart contracts are well suited for automating manual or semi-automated processes that have the potential to be error-prone or might carry a risk of fraud. "Blockchain can help when there might be challenges in proving that the data has not been tampered with or when verifying the source of a particular update or transaction is important," Rakhmilevich says.

A primary benefit is speed. "Customers want to use blockchain to automate business-to-business or government-to-business transactions and share data in real time," Rakhmilevich says. "Those real-time results reduce settlement risk, address cross-ERP [enterprise resource planning] discrepancies, and lower audit costs and complexity."

Vertically, blockchain is appropriate for many industries, including banking, securities, government, retail, healthcare, manufacturing, and transportation. Take healthcare: blockchain can provide immutable records on clinical trials. Think about all the data being collected and flowing to the pharmaceutical companies and regulators, all available instantly and from verified participants.

What's more, blockchain could be used to address the scourge of counterfeit drugs, "which is a huge problem in the developing world, where up to 30 percent of drugs could be counterfeit," says Rakhmilevich, referencing a report from Interpol and the World Health Organization. "Blockchain applications can track the drugs from manufacture all the way through distribution."

### **Getting Started with Blockchain**

Where to start? With a solid, standards-based platform, such as one that is built on Hyperledger Fabric.

Rakhmilevich says that many customers see a number of challenges in implementing blockchain in a production environment. "They are looking for enterprise-grade platforms, and they want to be able to check off all the right features: performance, resilience, scalability, and security," he says.

Perhaps the biggest enterprise challenge is integration—tying blockchain services into their key systems of record, whether it's inventory, logistics, or ERP. Organizations would prefer not to build one-off integrations with each of their core back-end systems—in fact, they simply

can't afford to do that, says Rakhmilevich.

There's also backward compatibility to consider. Many blockchain services are very new and are constantly changing and evolving. Businesses can't afford to have to keep re-integrating blockchain with every release but, says Rakhmilevich, "in the past, open source projects haven't maintained backward compatibility across new versions, so customers are concerned they'll have to relearn the operational aspects of the technology and keep redoing integration."

### **Oracle's Blockchain Strategy**

Oracle Blockchain Cloud Service, a part of Oracle Cloud Platform, was announced at Oracle OpenWorld in October 2017.

The Oracle blockchain service is based on a hardened implementation of Hyperledger

Fabric with Oracle enhancements. "Hyperledger Fabric is a good foundation, and we are integrating all the underlying dependencies into a managed PaaS offering for rapid provisioning," Rakhmilevich explains. "You don't need to spend months setting blockchain up and hardening your implementation."

"Blockchain holds the promise to fundamentally transform how business is done, making business-to-business interactions more secure, transparent, and efficient," adds Amit Zavery, executive vice president for Oracle Cloud Platform. "Oracle Blockchain Cloud Service provides enterprise-grade blockchain capabilities and is able to accelerate innovation for on-premises ERP and cloud-based SaaS and PaaS customers."

Because Oracle Blockchain Cloud Service is provided as an autonomous PaaS offering on

**“Blockchain holds the promise to fundamentally transform how business is done, making business-to-business interactions more secure, transparent, and efficient.”**

—Amit Zavery, Executive Vice President, Oracle Cloud Platform, Oracle

**“Customers want to use blockchain to automate business-to-business or government-to-business transactions and share data in real time. Those real-time results reduce settlement risk, address cross-ERP discrepancies, and lower audit costs and complexity.”**

—Mark Rakhmilevich, Product Management Director, Oracle

Oracle Cloud Platform, Oracle handles patches, fixes, and backward compatibility as standards evolve. Highly available design and autonomous backups ensure resilience and data integrity. “We are integrating Oracle PaaS and SaaS for cloud-based applications using application integration accelerators and also supporting integration from on-premises applications via REST APIs or Hyperledger Fabric SDKs,” Rakhmilevich says.

Security and confidentiality are central to Oracle’s blockchain solutions, he adds. “As a permissioned blockchain platform, Hyperledger Fabric architecture enables a lot of security capabilities out of the box,” he says, “and we are extending Oracle Blockchain Cloud Service

with the Oracle Identity Cloud Service plug-in to provide authentication and role-based access control when onboarding new members.” In addition, Oracle customers will benefit from built-in data-at-rest encryption and certificate revocation management to prevent the use of compromised certificates.

#### **Blockchain for All**

Blockchain is the trusted distributed digital ledger system that organizations need to manage transactions with external partners, customers, competitors—and even governments. Based on industry standards, blockchain can greatly simplify transaction management, streamline operations, improve transparency,

and reduce risk by allowing trusted transactions with parties those organizations might not trust, and without any need for oversight from third parties.

The technology is making a real difference to real organizations. It makes it possible for businesses to raise cash quickly by demonstrating that they have actual, verifiable outstanding invoices that can be leveraged or sold. It can help grocery stores verify that perishable groceries were shipped in refrigerated containers, with data from IoT sensors showing that the temperature stayed within the agreed-upon range. Blockchain can even make it easy

for schools to publish diplomas and student records, vastly reducing the effort needed for employers to verify academic credentials—while also reducing the possibility of fraud.

Blockchain is real. It's here. And the possibilities are limited only by a company's imagination. □

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*Alan Zeichick is principal analyst at Camden Associates, a technology consultancy in Phoenix, Arizona, specializing in software development, artificial intelligence, enterprise networking, and cybersecurity. Follow him @zeichick.*

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ILLUSTRATION BY **PEDRO MURTEIRA**

## NEXT STEPS

**LEARN** more about blockchain.

**LEARN** more about blockchain at Oracle.

**EXPLORE** Oracle Blockchain Cloud Service.



"We're interested in getting to people early and getting to people with the right pathways of treatment," says Turning Point CIO Amarjit Dhillon (right), pictured with Turning Point Strategic Solutions Lead Johnny Barton.

## RX: CONTENT MANAGEMENT

Oracle Content and Experience Cloud helps Turning Point save lives. **BY LINDA CURREY POST**

**D**uring a drug overdose, every minute matters. And when first responders have immediate access to a patient's medical history and know the properties of the drug involved and the best treatment options, the outcome can be life instead of death. Up-to-the-minute information is particularly critical in saving a person who is overdosing on street drugs, which contain constantly changing combinations of deadly ingredients.

To stay a step ahead in the battle against drug addiction and mental illness, Turning Point, the United Kingdom's leading treatment and counseling agency, has adopted

#### Oracle Content and Experience

Cloud, part of Oracle Cloud Platform. The cloud service gives therapists and clinicians at Turning Point's 250 treatment centers across England instant updates on the changing composition of street drugs, as well as access to the most recent thinking about how to treat mental illness and drug and alcohol dependence.

"There has been a shift in focus in this country toward getting people the help they need before their problems become worse," says Amarjit Dhillon, Turning Point's chief information officer.

#### **Digital Tools Bring Better Health Outcomes**

To help with that effort, under Dhillon's leadership, Turning Point has embraced the latest digital technology, which now allows the agency to provide more-accurate diagnoses, deliver treatments faster, and improve health outcomes for the 30,000 people who use Turning Point's services every day. The agency's efforts, Dhillon

says, also help to improve public safety by swiftly identifying and helping people with mental health issues.

"We're interested in getting to people early and getting to people with the right pathways of treatment," he says.

That is where a carefully curated content management system can make all the difference.

Turning Point distributes its life-saving content across a wide

#### **TURNING POINT**

London, England

#### **INDUSTRY:**

Healthcare

#### **ORACLE PRODUCTS:**

Oracle Content and Experience Cloud  
Oracle Mobile Cloud  
Oracle Service Cloud  
Oracle Policy Automation

**“With Oracle Content and Experience Cloud, we’re developing world-class content that will help people self-assess their use of alcohol and drugs and think about making a change in that area of their life.”**

—Johnny Barton, Strategic Solutions Lead, Turning Point

variety of platforms to reach its existing and potential clients in the manner most convenient to them. Those methods of communication include traditional phone conversations with call center staffers, in-person consultations with doctors and therapists, smartphone interactions with a mobile app, and even text “conversations” with a computerized chatbot designed with [Oracle Mobile Cloud](#). Content management informs all those communications channels.

“When you are dealing with life-and-death situations, it’s so critical to have the right treatment information at hand,” says Tanu Sood, an Oracle senior principal marketing director. “Since the content resides in Oracle Content and Experience Cloud, you can create it once, and then publish it across any channel and any device. And you can update the information on

the fly, from anywhere at any time.”

The expansion of content management systems to work on a range of devices beyond websites is the biggest change during her 20-plus years in the field, says Mariam Tariq, a senior director in Oracle’s product management group focused on Oracle Content and Experience Cloud.

In the beginning, she recalls, “content was tied to the templates and the page layouts where the information was presented. Now, with the advent of mobile custom applications, voice-activated devices, and more, one of the most critical concepts for those of us in development is to build content management systems that are agnostic in presentation.” The agnostic approach to development, she explains, allows organizations to set up a



"The more appealing the content, the more likely people will turn to us for advice," says Turning Point Strategic Solutions Lead Johnny Barton (left), shown here with CIO Amarjit Dhillon.

content hub for which they can write content once and then distribute it automatically to web pages, smartphones, chatbots, and other communications channels.

Turning Point's digital strategy also includes Oracle Service Cloud, which the agency uses

to create patient histories that staff members can access from anywhere at any time to help with emergency care as well as to guide routine interactions and to schedule appointments for those who need immediate care.

Johnny Barton, Turning Point's strategic

**“With the advent of mobile custom applications, voice-activated devices, and more, one of the most critical concepts for those of us in development is to build content management systems that are agnostic in presentation.”**

—Mariam Tariq, Senior Director, Product Management, Oracle

solutions lead, is responsible for making sure all of the agency's communications channels work smoothly and offer consistent content that is designed to capture the interest of potential clients.

“The more appealing our content is, the more likely it is that people will turn to us for advice,” Barton notes.

#### **Interactive Tools Encourage Treatment**

Along with developing helpful content for all of Turning Point's platforms, Barton is overseeing a modernization of the Turning Point website, also built on Oracle Content and Experience Cloud, that will launch this spring. He envisions an interactive tool that will engage readers with quizzes about drug and alcohol use, informational videos about relaxation techniques,

and other content presented with a hopeful approach to encourage people to seek treatment. Toward that end, the site will feature a big button labelled “Get Help”—powered by an [Oracle Policy Automation](#) form embedded in Oracle Content and Experience Cloud—that will allow visitors to register to see a clinician.

“With Oracle Content and Experience Cloud, we're developing world-class content that will help people self-assess their use of alcohol and drugs and think about making a change in that area of their life,” Barton says. “I want them to be able to help themselves.”

People who click on that Get Help button will get a quick callback from a Turning Point staffer who will offer to set up an appointment. Total time elapsed from pushing the button to actual consultation with a professional will be dra-

matically less than the national average, Barton says. The website's rules-based "smart form" will present users only with questions germane to their request for treatment, instead of the endless general questions on standard patient information forms.

"The website will be an engagement tool for us," Barton says. "It's the opportunity for us to be in somebody's pocket, or in somebody's front room, to give them some helpful information—not just about what Turning Point does, but about what they can do to help themselves."

The traditional stigma associated with asking for help with addiction is gradually giving way. Dhillon applauds the recent high-profile efforts of the Royal Family to encourage citizens to seek help for depression and other mental health issues. And UK Prime Minister Theresa

May just appointed a Minister of Loneliness in recognition that people isolated by disease or old age and living on their own without friends and family nearby are particularly susceptible to depression and other mental illness.

Meanwhile, Barton, a long-time Turning Point employee who builds chatbots for fun in his free time, takes pride in what he and his colleagues accomplish every day.

"We're creating something new here that makes a difference in people's lives," he says. "If we were not here, some of these people would fall through the gaps. I'm proud I can tell my children that we're helping people who have issues turn their lives around." □

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*Linda Currey Post is a senior writer at Oracle covering science and technology advances.*

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PHOTOGRAPHY BY JOHN BLYTHE

## NEXT STEPS

**LEARN** more about Oracle Content and Experience Cloud.

**TRY** Oracle cloud services.

"For performance, you want the database to be really close to the application and middleware layers," says Claude Garalde, AT&T lead principal technical architect. Oracle Cloud at Customer connects directly to AT&T's data center network infrastructure.



## CALLING ON CLOUD

AT&T migrates massive mission-critical databases to Oracle Cloud in historic partnership. **BY MIKE FADEN**

**A**T&T, like other large companies, is moving to the cloud to ensure it can continue to innovate and stay ahead in a fast-moving industry. The world's largest communications company by revenue has led the telecom and pay-TV industries in virtualizing and software-controlling its global wide area network, providing a foundation for introducing new services and responding to customer needs more quickly.

The company operates a private cloud based on proprietary virtualization to support its software-defined network services. And it has moved thousands of its smaller Oracle databases to another virtualized private cloud designed for more general-purpose use.

Until recently, AT&T has lacked a cloud-based solution to run its roughly 2,000 largest mission-critical Oracle databases—those greater than 8 TB in size. Though AT&T's general-purpose private cloud

provides an agile, automated IT environment, it cannot provide the required performance for these very large, transaction-intensive databases, many of which contain customer data and must remain on premises for regulatory, privacy, and security reasons.

AT&T selected Oracle Cloud at Customer—which provides the same hardware and software platform that Oracle uses in its own cloud data centers and puts them into a “cloud machine” that lives in the customer's data center—to run its largest mission-critical Oracle databases. Under an agreement described as “historic” by Oracle CEO Mark Hurd, AT&T and Oracle announced a strategic five-year partnership in May that includes moving AT&T's large, high-performance databases to Oracle Cloud using Oracle Cloud at Customer. The agreement also includes global access to Oracle's cloud portfolio, including Oracle Field Service Cloud Service,

## AT&T

Dallas, Texas

**INDUSTRY:**  
Communications

### ORACLE PRODUCTS AND SERVICES:

Oracle Database  
Oracle Exadata Cloud machines  
Oracle platform-as-a-service products including Oracle Integration Cloud Service and Oracle Mobile Cloud Service  
Oracle Cloud at Customer  
Oracle Consulting

which AT&T will use to further optimize scheduling and dispatching for its more than 70,000 field technicians.

Oracle Cloud at Customer will enable AT&T to run mission-critical databases up to 100 TB in size in an Oracle-managed cloud that's as flexible and scalable as a public cloud—but is located in AT&T facilities. These databases will be run on Oracle Database Exadata Cloud at Customer, which provides the most-scalable and most-reliable platform for running Oracle Database. "What is very intriguing about Oracle Cloud at Customer is that it offers all the benefits of a public cloud with the security and performance of a private cloud," says Claude Garalde, AT&T lead principal technical architect. Application performance is also optimized because Oracle Cloud at Customer connects directly to AT&T's data center network infrastructure, he adds. "For performance, you want the database to be really close to the application and middleware layers—you don't necessarily want to be going out over a public internet link or even a VPN," he says.

Moving the databases to Oracle Cloud will significantly increase business agility and automation. AT&T expects to halve the time required

to implement big, complex databases, and it will be able to quickly increase capacity to meet demand peaks and reduce usage when demand recedes. "We want the solution to give us an elastic environment where we can scale up as the need arises and similarly scale down," says Venkat Tekkalur, director of technology development at AT&T.

### Dialing Up Databases

AT&T has more than 17,000 Oracle databases overall, storing a massive 19 PB of data. The company has been progressively migrating them to the cloud as part of a broad initiative that began more than five years ago; to date, it has moved about 5,000 of them to its general-purpose cloud. That cloud can support databases that are up to around 8 TB in size, Tekkalur says.

But until now, larger and more performance-intensive databases have still required a bare metal configuration. Although that approach delivered the required performance, AT&T faced challenges that are typical of those experienced by many large enterprises, Tekkalur says.

Factors such as the additional time required to order, deliver, and install hardware and soft-

## **“What is very intriguing about Oracle Cloud at Customer is that it offers all the benefits of a public cloud with the security and performance of a private cloud.”**

—Claude Garalde, Lead Principal Technical Architect, AT&T

ware meant that it took roughly twice as long to implement a big database in a bare metal on-premises configuration compared to implementing databases in the cloud, he explains. The process was also more difficult to automate. As a result, it presented an obstacle to AT&T’s efforts to increase agility. “The mean time to implement was not aligned with the Agile methodology or the DevOps model,” Tekkalur says.

The approach also limited the ability to quickly scale to meet changes in business demand. “We often have to support major launches, such as new phones, with very little time to prepare,” Tekkalur adds.

In addition, the large databases and their supporting hardware were often dedicated to specific applications. That meant it was difficult to achieve savings by sharing infrastructure.

“Once we brought in that hardware, there was no way to use it for anything else,” he says.

With Oracle Cloud at Customer, AT&T plans to solve those challenges, slashing implementation times for databases up to 100 TB while greatly increasing flexibility, with an elastic shared environment that facilitates scaling and allows resources to be easily reallocated based on demand. Oracle Database Exadata Cloud at Customer will provide the performance required for the large transaction-intensive databases. And because those databases will run at AT&T facilities behind the company’s firewall, they will also meet regulatory, privacy, and security needs.

Furthermore, AT&T is integrating Oracle Cloud at Customer so that to users, it looks and behaves just like part of AT&T’s overall cloud environment; from a single AT&T portal, users



Claude Garalde, AT&T lead principal technical architect, says that over the long term, AT&T is also looking to further increase agility by replacing big, monolithic applications with multiple microservices.

will be able to provision databases in Oracle Cloud at Customer, in AT&T's general-purpose private cloud, or in public clouds. To achieve that integration, an abstraction layer below the portal will orchestrate a highly automated provisioning process across AT&T's clouds using Oracle's open cloud APIs to interface with Oracle Cloud.

### **Accelerating Migration**

To plan and implement the migration, AT&T is working closely with Oracle Consulting, which is providing a toolset to facilitate the migration process, including helping to size the required cloud database configuration and automate database provisioning. AT&T is also applying lessons gleaned from its private cloud experi-

**“We want the solution to give us an elastic environment where we can scale up as the need arises and similarly scale down.”**

—Venkat Tekkalur,  
Director of Technology Development, AT&T

ence to accelerate and automate the process, says Andy Ferretti, lead system engineer at AT&T. The net result is that AT&T expects to cut by 50 percent or even more the time it currently takes to complete the entire procurement and deployment process for big, complex databases. The time required to implement these large databases in Oracle Cloud at Customer will be similar to the time required to implement much smaller databases in AT&T’s private cloud today.

AT&T is also exploiting techniques learned in previous migrations to minimize downtime of these mission-critical databases as they move to Oracle Cloud at Customer, Ferretti says. After building a target database instance in Oracle Cloud, AT&T will take a snapshot of the source

on-premises data and begin moving it to its new home in the cloud. During the time it takes to move the multiterabyte databases, AT&T will continue to capture the changes to the live on-premises database. Once the snapshot has been copied to the cloud, a synchronization method such as Oracle Active Data Guard or Oracle GoldenGate will be used to bring the target database up to date with the latest changes, so AT&T can quickly cut over to Oracle Cloud at Customer to support the live application. A reverse synchronization method will be put in place just in case there’s a need to revert to the original database.

After testing by early adopters in late 2017, the first Oracle Cloud at Customer databases are set to go live in early 2018, Ferretti says. Following that, the databases will progressively move to Oracle Cloud in phases. Ultimately, the plan is to implement Oracle Cloud at Customer at roughly 19 AT&T locations.

### **Low on Risk, High on ROI**

Like AT&T, many other large enterprises are viewing Oracle Cloud at Customer as a way to solve data-protection as well as performance concerns as they migrate to the cloud, says

Andrew Mendelsohn, executive vice president for database server technologies at Oracle.

"For companies that have regulatory concerns or privacy concerns about customer data, this is a very low-risk way to go. Customers get all the agility and business model of the cloud, but they run in their own data center."

The fact that the databases are in the customer's data center and on the same network as the company's business applications "eliminates the performance latency that you would have between an on-premises application and a database in the public cloud," Mendelsohn adds. "And it is a stepping stone to a public cloud. If and when companies feel comfortable using the public cloud, it will be easy for them to move these databases."

Garalde says that over the long term, AT&T is also looking to further increase agility by replacing big, monolithic applications with multiple microservices, each potentially with its own database, linked together via open

APIs. This approach would allow AT&T to create and update new services more quickly by plugging together different combinations of microservices.

For AT&T, the cloud partnership with Oracle is a crucial step in its drive to deliver a seamless and intuitive experience for customers and to maintain industry leadership. "We believe that the future of the network is to be data-powered, to be software-centric, and to be fast and responsive," says John Donovan, CEO of AT&T Communications. "This collaboration with Oracle accelerates our network transformation and migration to the cloud to expand efficiency, [increase] performance, and reduce cost while improving overall customer service." □

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*Mike Faden is a principal at Content Marketing Partners. He has covered business, technology, and science for more than 30 years as a writer, editor, consultant, and analyst. Faden is based in Portland, Oregon.*

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## NEXT STEPS

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# World's First “Self-Driving” Database



**No Human Labor**  
Half the Cost

**No Human Error**  
100x More Reliable



**ORACLE MOBILE CLOUD ENTERPRISE, ORACLE INTELLIGENT BOTS**

# Build a Chatbot in Minutes

By Frank Nimphius



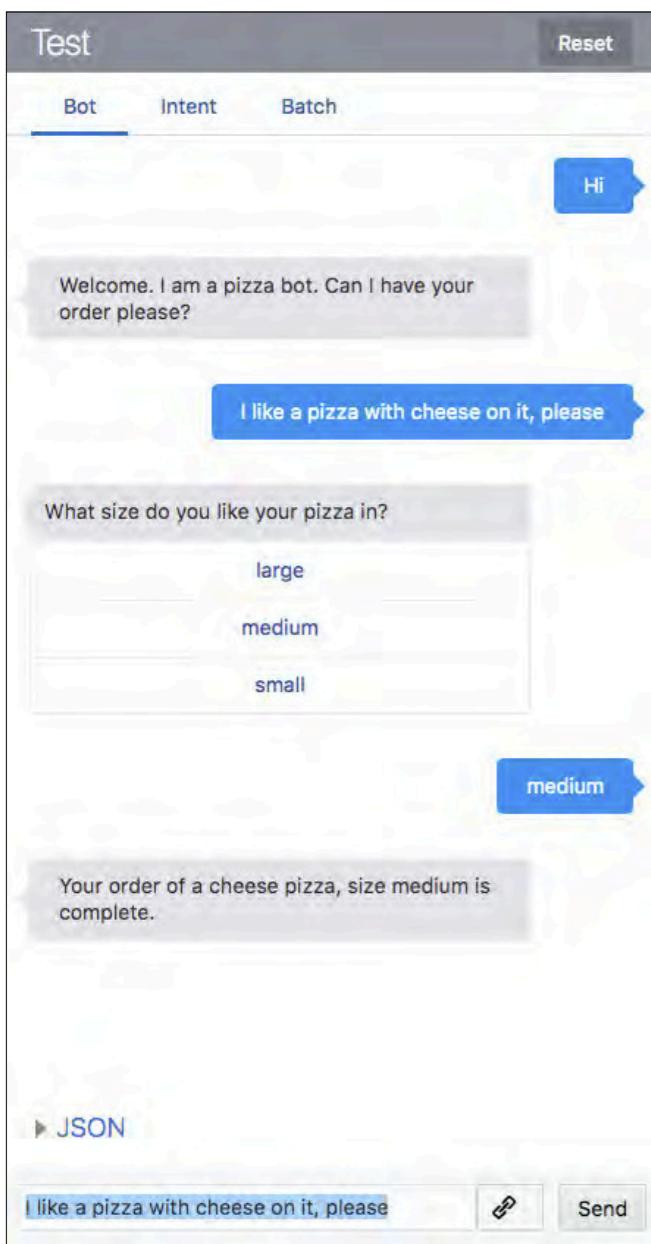
Get started with Oracle Intelligent Bots in Oracle Mobile Cloud Enterprise.

**2017 was a banner year for chatbots**, and 2018 is expected to be another one. Young people in particular refuse to download specific mobile applications just to get in touch with specific organizations. In the same way they communicate with friends and social media followers, young people like to use speech or messengers such as Facebook to book, buy, order, or complain about products and services.

Leveraging conversation as a channel for business has become a necessity for organizations to stay connected with this new generation of consumers. Many companies, especially those that focus on customer service, have already reacted to the trend and added chat capabilities to their websites.

But how scalable is customer service where each incoming customer message is answered by a human? If message volume exceeds the human capacity to handle it, customers would likely experience the same delays and frustrations users experience when waiting on traditional call centers for an agent to pick up and handle the

**Figure 1:** Pizza bot in the Oracle Intelligent Bots integrated tester



call. This is where chatbots can help, because their job is to automate conversation between users and services on the conversational channel.

So what is a chatbot? A chatbot is computer program that simulates a conversation with a human to serve users on the conversational channel. Often, chatbots are associated with artificial intelligence and machine learning. Though you could easily build bots *without* these technologies, the majority of chatbots are built based on artificial intelligence and machine learning in order to understand the intent of and extract information from user input, which in most cases is free text or speech.

Oracle Intelligent Bots is a feature of Oracle Mobile Cloud Enterprise—which is part of Oracle Cloud Platform—for building multichannel mobile back ends and bots. Using Oracle Intelligent Bots and following the instructions in this article, you are going to build a pizza bot that leverages artificial intelligence and machine learning to understand user intent and to extract values from user input. To access Oracle Intelligent Bots, [sign up for a free Oracle Mobile Cloud Enterprise trial](#).

## ABOUT THE SAMPLE BOT

Following the steps in this hands-on article, you will build a simple pizza bot. The process will familiarize you with the Oracle Intelligent Bots user interface and the terminology involved in building chatbots.

**Figure 1** shows a screenshot of a conversation that you, as the bot user, can have with the bot at the end of this tutorial. The screenshot is taken from the integrated tester in Oracle Intelligent Bots and shows the user input in bubbles with a blue background and the bot responses in bubbles with a gray background.

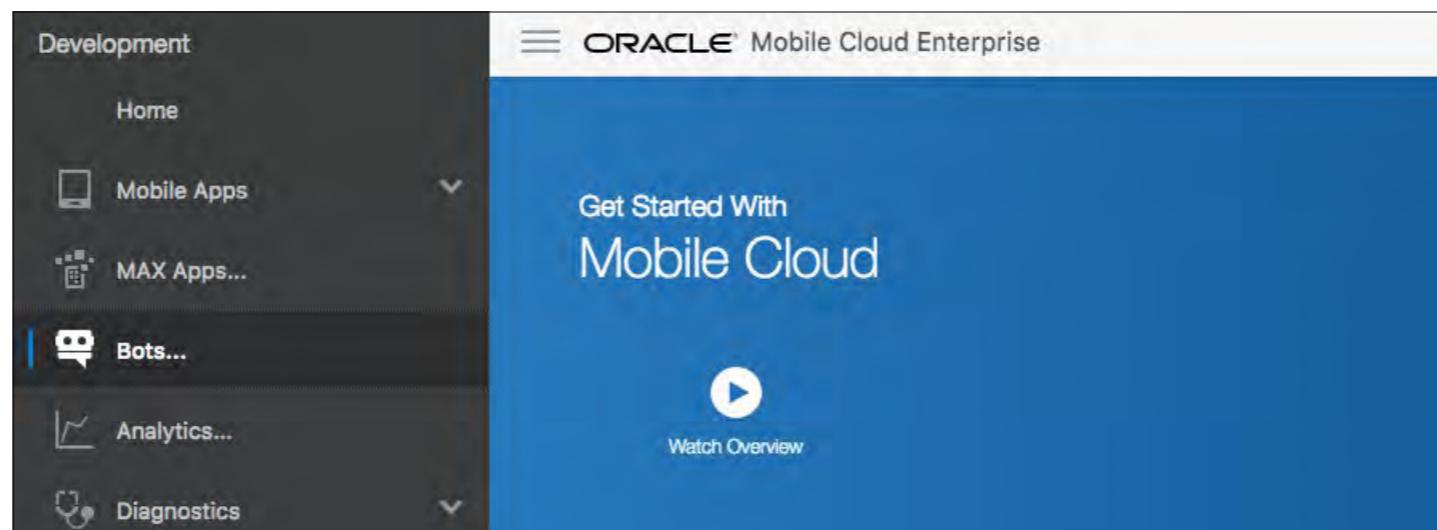
## CREATING THE PIZZA BOT

From here, the article's steps assume that you have access to Oracle Intelligent Bots through a trial or paid subscription to Oracle Mobile Cloud Enterprise.

Start creating your new bot by performing the following steps:

1. Open a browser and access the Oracle Mobile Cloud Enterprise home page. Authenticate with the user credentials you defined when you provisioned the cloud service.
2. Click the hamburger icon in the upper left to open the Oracle Mobile Cloud Enterprise menu.
3. Click the **Bots** menu item (shown in **Figure 2**), which opens the Oracle Intelligent Bots dashboard in a separate browser window or tab.
4. Click the **New Bot** icon to create a new bot project.
5. Enter **OracleMagazineOnlinePizza** in the **Name** field and, optionally, enter a description of your choice in the **Description** field.
6. Click **Create**.

**Figure 2:** Oracle Mobile Cloud Enterprise dashboard



The new bot opens in the development environment. **Figure 3** shows the bot development environment with annotations added to make it easy for you to see the menu options to use in these hands-on instructions.

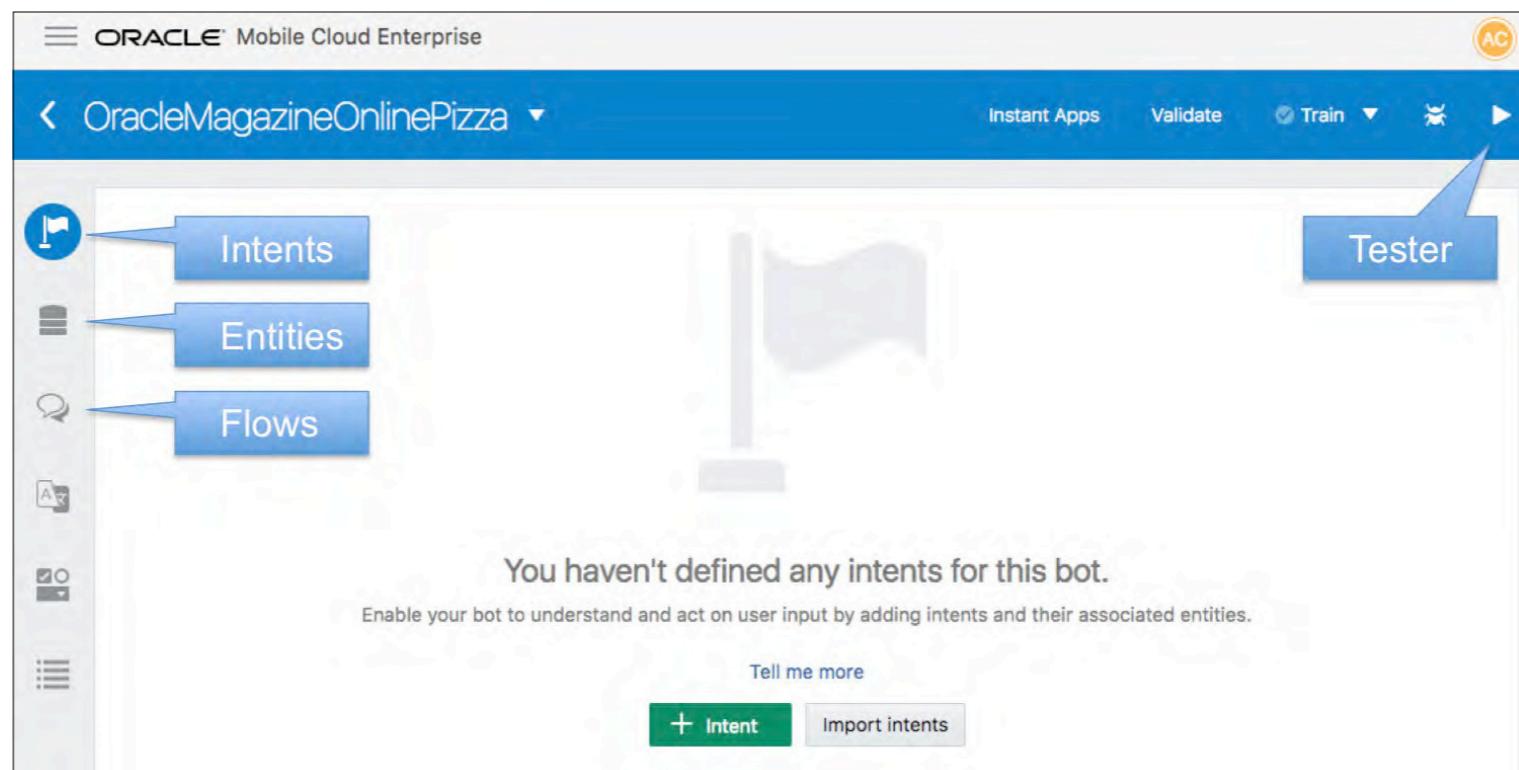
### DEFINING INTENTS AND TRAINING THE BOT

After you complete the previous steps, the Intents screen opens, as shown in **Figure 3**. If the Intents screen is not open, click the **Intents** icon.

Intents represent what a user wants to achieve within a conversation. For the sample pizza bot, you'll create two intents: Order Pizza and Cancel Pizza.

7. Click the green **+ Intent** button.
8. Enter **Order Pizza**, replacing any default text, in the **Name** field.

**Figure 3:** Oracle Intelligent Bots development environment with annotations



9. Enter **Order a Pizza** in the **Description** field.
10. Enter the following example sentences, one by one, to the **Examples** field, replacing the default **Enter your example utterances** text prompt, and then confirm each entry by pressing the Enter key.

I like to order a pizza.

Pizza please

Can I order pizza?

I want a large pizza

I fancy a pizza

11. Click the green **+ Intent** button (at the top left) and enter **Cancel Pizza** to create a new intent.
12. Repeat step 10 using the following values:

I don't want my pizza anymore

Forget my order please

Can you cancel my order?

I changed my mind, no pizza anymore

Please delete my pizza order

13. Click **Train** (at the top right of the screen).

**What you just did:** You created two intents and provided example sentences for each for the bot to learn what a user wants. Those example sentences are called *utterances* and they build the learning foundation for the bot to create a prediction

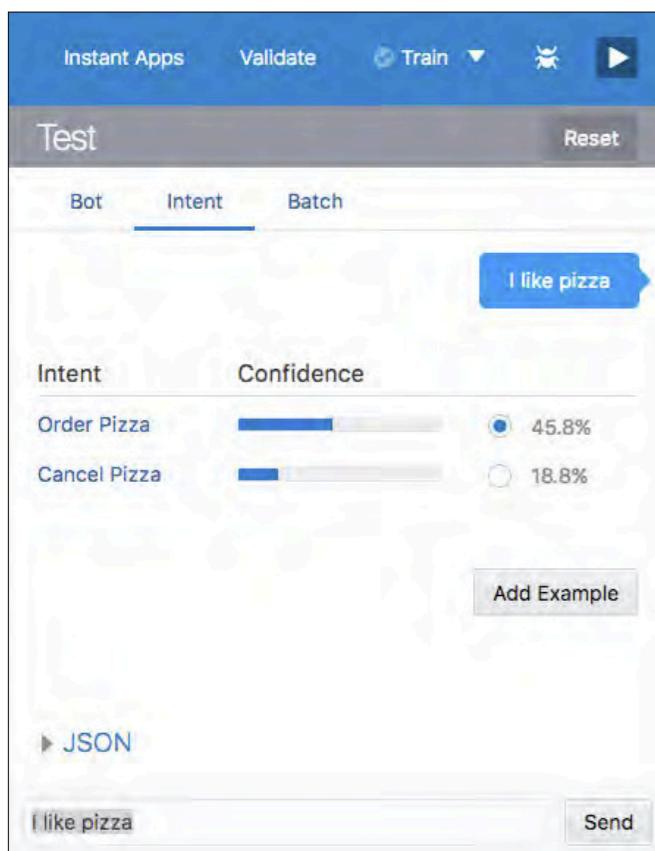
model that helps it to understand the user intent, even if the user uses different words when ordering or cancelling a pizza.

**Note:** Oracle Intelligent Bots displays green or red notifications to acknowledge the success or failure of an operation. Close a notification by clicking the X on the right.

## TESTING THE LANGUAGE UNDERSTANDING

Now is a good time to test how well the bot was trained and if it is ready to accept orders and cancellation requests.

**Figure 4:** Oracle Intelligent Bots integrated tester for testing intent recognition



14. Click the test icon (the right arrow in the upper right of the screen).
  15. Click the **Intent** option (below the Test header text).
  16. In the **Message** field, type `I like pizza` and click the **Send** button (as shown in **Figure 4**).
  17. Ensure the **Order Pizza** option is selected and click the **Add Example** button.
  18. Click **Train**.
  19. With the `I like pizza` text in the message field, click the **Send** button again.
  20. Now replace the text in the **Message** field with `Gimme a pizza`.
  21. Click the **Send** button.
  22. Replace the text in the **Message** field with `Ignore my order`, and click the **Send** button. Note how this text resolves to the Cancel Pizza intent.
  23. Click the test icon to close the tester.
- What you just did:** With the small set of training sentences you added, the expectation is that the bot understands a basic pizza order, but that it is far from perfect. With 45.8% confidence, the bot identified the `I like pizza` input as a request to order pizza.

To fine-tune the bot's understanding for the Order Pizza intent, you added that sentence to the bot utterances, and a follow-up bot test showed a higher confidence that what the user wanted was to order pizza. Though "Gimme a pizza" was not among the training sentences, the bot identified it as an order request. If it didn't work, you would have added it as an example in the tester to refine the bot's understanding.

### CREATE ENTITIES FOR THE INFORMATION IN A SENTENCE

"I like to order a giant pizza with Salami and Cheese" contains more information than just the intent. For the bot to be able to extract the information that matters, you create *entities*.

24. Click the **Entities** menu item (on the left, below Intents).
25. Click the green **+ Entity** button.
26. Name the entity **PizzaType**.
27. For **Configuration -> Type**, select **Value list**.
28. Add the following values by clicking the **+Value** button, entering a name in **Value** field in the Create Value dialog box, and clicking the **Create** button after each new value is entered to close the dialog box.

Cheese

Veggie

Pepperoni

Supreme

Chicken

- 29.** Add one more value, `meat lover`, and add `meat` and `beef` to the **Synonyms** field in the Edit Value dialog box—pressing Enter between the synonym entries—and click **Update**.

**What you just did:** You created an entity for the pizza types sold by the bot. You selected **Value list** as the entity type, allowing you to define a finite list of values. For the meat-lover pizza, you defined synonyms, which also will be recognized by the bot in a pizza order and associated with the meat-lover pizza. Synonyms allow you to consider alternative names or slang for a value defined for an entity.

- 30.** Repeat steps 25–28 and create a **PizzaSize** entity with the following values and their synonyms (included in parentheses).

`large (big, lrg, lrge)`

`medium (med)`

`small`

- 31.** Select the **Intents** menu item (on the left).
- 32.** Select the **Order Pizza** intent.
- 33.** Click the green + **Entity** button (on the right).
- 34.** Scroll to and select **PizzaSize**.
- 35.** Scroll to and select **PizzaType**.
- 36.** Click the test icon (the right arrow in the upper right).
- 37.** Click the **Intent** option (below the Test header text).
- 38.** In the **Message** field, type `I like a big pizza supreme` and click the **Send** button.
- 39.** Notice the entity and entity values recognized in the request string.
- 40.** Click the test icon to close the tester.

**What you just did:** You created two entities for the type and size of a pizza. You then associated the entities with an intent (Order Pizza) so that Oracle Intelligent Bots extracts those entities if they're contained in the user input.

**Note:** If the entities don't show in step 39, ensure that you assigned the entities to the right intent.

## DESIGNING THE PIZZA ORDER FLOW

With the language model trained and the entities created, it's time to design the conversation the bot will have with users who want to order a pizza. For the sake of brevity, this article implements only the order pizza use case (and intent).

**41.** Click the **Flows** icon on the left.

**Note:** Oracle Intelligent Bots creates a sample conversation for every new bot you create. You can test this sample by clicking the test icon in the upper right corner. If you haven't already, select the **Bot** link in the test menu. Then, in the **Message** field, type **hi** and follow the instructions on the screen to receive a personal welcome message. When you're done, click the test icon again to close the tester window.

**42.** Before you can create your own conversation, you need to do some house-keeping. First, in the flow editor, delete all content in the states section: delete everything below **states**.

**43.** Also delete the **greeting** and **name** variables in the **variables** section.

**44.** Optionally, delete all comments starting with a **#** character for a cleaner look.

**45.** Create new variables as shown below. Ensure that the indenting of the new variables you create uses two initial blank spaces more than what is used for **variables**.

```
variables:  
    iResult: "nlpresult"  
    pizzaType: "PizzaType"  
    pizzaSize: "PizzaSize"
```

46. Place the cursor below `states`.
47. Click the green **+ Components** button and select **User Interface**.
48. Select **Output** in the left menu (you might need to scroll) and toggle the **Remove Comments** control so it is enabled.
49. Click the **Apply** button.
50. In the flow editor, change `output` to `welcome`. The `welcome` state should be indented two blanks further to the right compared to `states`.
51. Click the **Validate** link in the upper right. If this shows a green alert, your formatting is correct. If it shows red, then hover your mouse over the red overlay in the left margin of the flow editor to learn about the problem.
52. Place the cursor to the right of `text:` and type "`Welcome. I am a pizza bot. Can I have your order please?`" (including the surrounding quote marks).
53. Click the green **+ Components** button and select **Language**.
54. In the left menu, select **Intent**. Ensure the **Insert After** drop-down list shows `welcome` and click the **Apply** button.
55. Edit the `intent` component so it looks as shown below. Be sure you get the indenting right—each indent uses two blank spaces.

```
intent:  
    component: "System.Intent"  
    properties:
```

```
variable: "iResult"
confidenceThreshold: 0.7
transitions:
actions:
    Order Pizza: "startOrder"
    #Cancel Pizza:
    unresolvedIntent: "unresolved"
```

**What you just did:** The bot flow is defined as states associated with components. You created a welcome state to introduce the bot to the user. The intent state uses a `System.Intent` component to receive the user input and then it analyzes the input to determine what the user wants (to order a pizza) and glean the information about the pizza type and size contained in the user string. The `confidenceThreshold` property says that all user input that does not have a 70% confidence for the intent that the bot associated it with should be handled by the `unresolvedIntent` action. Note that the `Cancel Pizza` intent is commented out using the hash character (#) because this hands-on tutorial does not implement this use case.

Next, add a state to handle the unresolved intent. In the sample bot application, the unresolved intent simply prints a message for the user to try again.

**56. Click the green + Components button and select User Interface.**

**57. Select Output in the left menu, ensure the Insert After drop-down list shows intent, and click Apply.**

**58. Rename output to unresolved.**

**59. Edit the unresolved code in the flow editor to look as shown below:**

```
unresolved:
```

```
component: "System.Output"
properties:
  text: "Sorry, I did not understand the request. Please try again."
  keepTurn: false
transitions:
  next: "intent"
```

**What you just did:** The unresolved state prints a message to the user and directs the flow control to the intent state. Using this information, the user can rephrase the request.

Now add states to complete the order process.

60. Click the green **+ Components** button and select **User Interface**.
61. Select **List – set variable** in the left menu (you might need to scroll) and ensure the **Insert After** drop-down list shows **unresolved**.
62. Click **Apply**.
63. Rename **variableList** to **startOrder**.
64. Edit the **startOrder** state code so it looks as shown below (again, pay attention to the indenting).

```
startOrder:
  component: "System.List"
  properties:
    prompt: "Please select a pizza type"
    options: "${pizzaType.type.enumValues}"
    variable: "pizzaType"
    nlpResultVariable: "iResult"
```

**What you just did:** The `startOrder` state shows a list of pizza types if the user input does not contain this information. If the information is found in the user input, or if the user selects a pizza from the list, the pizza type value is stored in the `pizzaType` variable.

65. Click the **Validate** link (in the right upper right) to ensure your code formatting is correct. If it is not, correct it.
66. Repeat steps 60–62, but make sure the **Insert After** drop-down list shows `startOrder`.
67. Rename `variableList` to `askSize` and edit the state code so it looks as shown below:

```
askSize:  
  component: "System.List"  
  properties:  
    prompt: "What size pizza would you like?"  
    options: "${pizzaSize.type.enumValues}"  
    variable: "pizzaSize"  
    nlpResultVariable: "iResult"
```

**Note:** Whenever the code block defining a state does not contain a `transitions` property (such as with the `intent` state), the flow navigation goes to the next state below in the flow editor. You use the `transitions` property to break out of a sequential flow.

68. Click the green **+** **Components** button and select **User Interface**.
69. Select **Output** in the left menu, ensure the **Insert After** drop-down list shows `askSize`, and click **Apply**.

**70.** Rename `output` to `printOrder`.

**71.** Edit the `printOrder` state code to look as shown below:

```
printOrder:  
    component: "System.Output"  
    properties:  
        text: " Your order of a ${pizzaType.value} pizza, size ${pizzaSize.value}is  
complete."  
        keepTurn: false  
    transitions:  
        return: "done"
```

**What you just did:** The `printOrder` state acknowledges the order and prints the pizza type and pizza size as defined by the user. To add values to static text, Oracle Intelligent Bots uses expressions (as used in the `text` property). The `transitions` property directs the flow control to a `return` statement, which completes the bot conversation.

## TESTING YOUR PIZZA BOT

You tested the intent recognition and entity extraction earlier and know that they work. So now let's see if the conversation flow works as planned.

**72.** Click the test icon in the upper right.

**73.** Click the **Reset** button in the header of the tester to reset the test environment.

**74.** Ensure the **Bot** link is active in the header of the tester.

**75.** Type `Hi` into the **Message** field and click **Send**.

76. After the bot displays the welcome message, type **I like a pizza with cheese on it, please** into the **Message** field and click **Send**.
  77. Because you did not specify a size for the pizza, select one from the displayed list. In response, the pizza bot should display a message saying that your cheese pizza of the selected size is complete.
  78. Try another. Type **Hi** into the **Message** field and click **Send**.
  79. Now type **I like pizza** into the **Message** field and click **Send**.
  80. Select a pizza from the list and then select a size.
  81. Try a last order. Type **Hi** into the **Message** field and click **Send**.
  82. Type **I like a medium size pizza cheese** and click **Send**.
- What you just did:** You tested three use cases for the designed bot conversation. In the first, you ordered a pizza without mentioning the pizza size. As a result, the bot asks you for the size and displays your options. You then tested an order in which you did not mention the type and size of the pizza. The bot recognized the two missing pieces of information and asked for both. Lastly, you tested language understanding by providing all of the information in a single user input. And because the bot found all the required information, it did not ask for anything and immediately printed the pizza order.

## IMPORTING THE SOLUTION

This article also provides [the completed pizza bot as a downloadable zip file](#). After you download OracleMagazineOnlinePizza.zip, do the following:

83. Go to the Oracle Intelligent Bots dashboard.
84. Click the **Import Bot** button in the upper right of the dashboard.
85. In the opened dialog box, navigate to the location to which you saved the downloaded zip file and select it.

86. Click **Open**.
87. Close the upload confirmation dialog box by clicking the **X** at the right side.
88. If you already have existing bots defined in your environment, chances are good that you won't immediately spot the downloaded bot. To find the bot, type [OracleMagazine](#) into the **Filter** field above the green **New Bot +** icon.
89. Click the **OracleMagazineOnlinePizza** bot to open it.
90. Click the **Train** link in the top menu on the right side. The link should show an exclamation mark because the bot is not yet trained after the download and import.
91. Click the test icon to try the downloaded bot.

## CONCLUSION

In this article, you created a simple pizza bot that has a very simple conversation flow. Real bot use cases have more-complex flows and need to integrate with back-end systems. In follow-up articles, I will explain how you can enhance your pizza bot with additional features and more-complex conversation flows. ☺

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*Frank Nimphius is a senior principal product manager in the Oracle Mobility and Development Tools Product Management group, where he focuses on cloud and mobile products, including Oracle Mobile Application Framework, Oracle Mobile Cloud Service, and related products such as Oracle JavaScript Extension Toolkit.*

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## NEXT STEPS

**TRY** Oracle Mobile Cloud Enterprise and Oracle Intelligent Bots.

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**DOWNLOAD** the bot for this article.



By Dan McGhan



# It's Better with Two

Connect database and application services for a quick start to app development.

**Two of my favorite Oracle Cloud services** are [Oracle Database Exadata Express Cloud Service](#) (Exadata Express) and [Oracle Application Container Cloud](#). Exadata Express is a fully managed Oracle Database service at an entry-level price point for small-to-medium-sized data, and Oracle Application Container Cloud is a lightweight infrastructure that provides an easy way to deploy apps in Docker containers. In this article, I'll demonstrate how to connect these two at the most basic level.

What do I mean by "the most basic level"? The demo app will be minimalistic. Typically, I might use Oracle Developer Cloud Service to create a Git repository with an automated build process—but not here. This article will focus only on what's needed to get Exadata Express and Oracle Application Container Cloud connected. At a high-level, the steps are

- Create a test app
- Add Exadata Express client credentials

- Deploy the app to Oracle Application Container Cloud
- Add some environment variables to get everything working

## CREATE A TEST APP

The rest of this article assumes that you have an Oracle Cloud account with access to both Exadata Express and Oracle Application Container Cloud. (If you don't already have an Oracle Cloud account, you can sign up for a [free cloud trial](#).

To connect and use Exadata Express and Oracle Application Container Cloud, start by creating a new directory named connection-test-app on your local machine.

Now create two files in that directory.

1. Create a file named manifest.json with the following contents:

```
{  
  "runtime": {  
    "majorVersion": "8"  
  },  
  "command": "node index.js",  
  "release": {},  
  "notes": ""  
}
```

Oracle Application Container Cloud apps often include one or two metadata files. In this case, manifest.json specifies the version of Node.js to run and the command to use to start the application. Note that I've specified Node.js 8. This means the `async/await` constructs that I demonstrated in [the last part of the async series](#) can be used in the app.

**2.** Create a file named index.js with the following contents:

```
1 const http = require('http');
2 const oracledb = require('oracledb');
3 const dbConfig = {
4   user: process.env.EECS_USER,
5   password: process.env.EECS_PASSWORD,
6   connectString: 'dbaccess'
7 };
8 let error;
9 let user;
10
11 async function runConnectionTest() {
12   let conn;
13
14   try {
15     conn = await oracledb.getConnection(dbConfig);
16     const result = await conn.execute('select user from dual');
17
18     user = result.rows[0][0];
19     error = null;
20   } catch (err) {
21     error = err;
22   } finally {
23     if (conn) {
24       try {
```

```
25      await conn.close();
26  } catch (err) {
27      console.log(err);
28  }
29 }
30 }
31 }
32
33 runConnectionTest();
34
35 http.createServer(function(request, response) {
36     response.writeHead(200, {'Content-Type': 'text/plain'});
37
38     if (error === null) {
39         response.end('Connection test succeeded. You connected to Exadata Express as ' +
40 user + '!');
41     } else if (error instanceof Error) {
42         response.write('Connection test failed. Check the settings and redeploy app!\n');
43         response.end(error.message);
44     } else {
45         response.end('Connection test pending. Refresh after a few seconds... ');
46     }
47 }).listen(process.env.PORT);
```

The index.js file contains logic that runs a connection test (lines 11–33) and uses a simple web server to deliver the results of the test (lines 35–46). Note that three

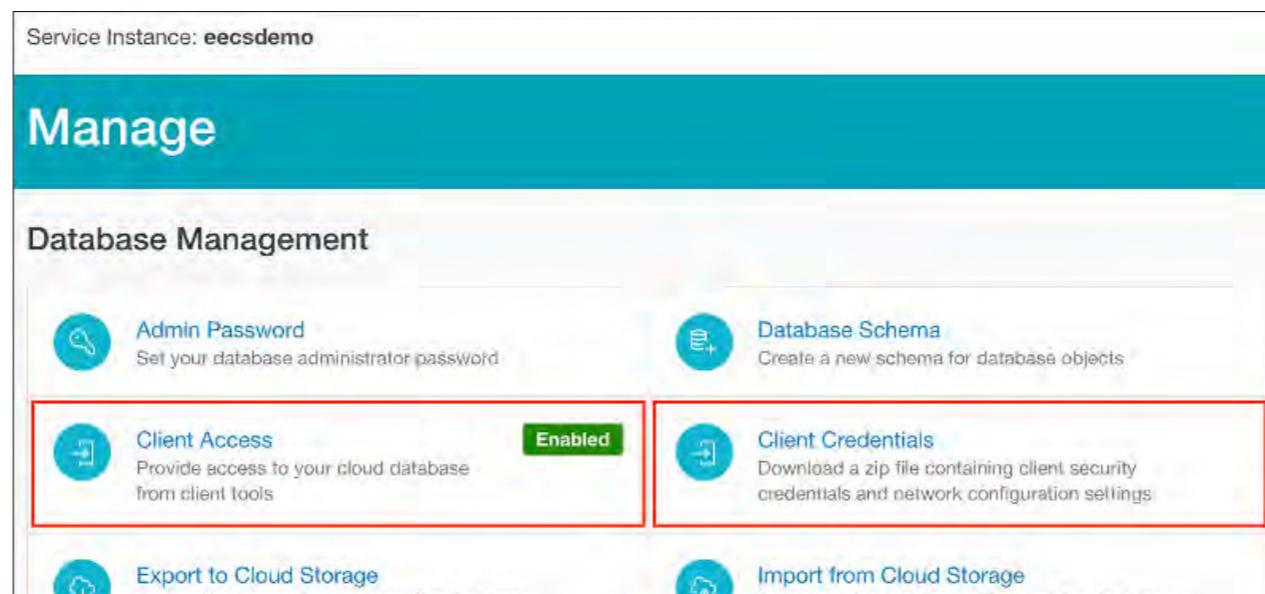
environment variables are referenced via process.env. PORT is [defined by Oracle Application Container Cloud](#), but the other environment variables will be created in the last step of this tutorial.

## ADD EXADATA EXPRESS CLIENT CREDENTIALS

To connect to Exadata Express, you must first enable client access and then download the client credentials. The client credentials are needed to encrypt communication between the client (Node.js, in this case) and the database—something that Exadata Express enforces.

1. Open a browser and sign in to your Oracle Cloud account. Navigate to the Exadata Express console, select the service instance that you'd like to connect to, and then click **Manage**.
2. **Figure 1** shows the console's Manage screen. Click the **Client Access** link and enable access (if this has not already been done). Then click **Client Credentials** to download the zip file containing client security credentials and network configuration settings.

**Figure 1:** Exadata Express console's Manage screen (with annotations)

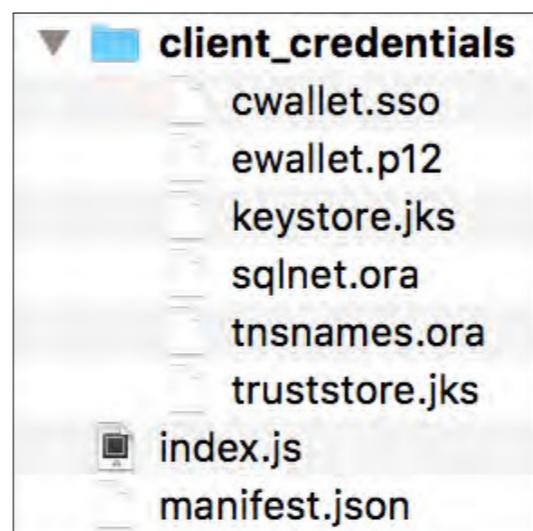


to download the files needed to make the connection. Before downloading the client credentials, you will be prompted to enter a password. You'll need the password when you connect to Exadata Express using a Java keystore (such as with Oracle SQL Developer), but not when you connect to the database with Oracle Call Interface (such as with Node.js via node-oracledb).

Enter and confirm the password, and then click **Download**. A file named `client_credentials.zip` will be downloaded to your machine. Treat the downloaded files securely to prevent unauthorized database access.

3. Extract the contents of the `client_credentials.zip` file to a new directory named `client_credentials` inside the `connection-test-app` directory created earlier. The contents of `connection-test-app` should look like the files shown in **Figure 2**.
4. Change to the `client_credentials` directory and open the `sqlnet.ora` file in a text editor. Change the value of `DIRECTORY` from `?/network/admin` to `/u01/app/client_credentials`. Note that when you deploy an app to Oracle Application Container Cloud, the app's files are copied to the `/u01/app` directory of the con-

**Figure 2:** Contents of the connection-test-app directory



tainer. The sqlnet.ora file must point to the location of the client credentials, which can differ depending on the environment.

## DEPLOY THE APP

At this point, you can deploy the app to Oracle Application Container Cloud.

1. Change back to the connection-test-app directory and compress the contents (but not the top-level directory itself) in a new zip file named archive.zip. Use a command such as the following, which should work on Linux and macOS:

```
zip -r archive.zip .
```

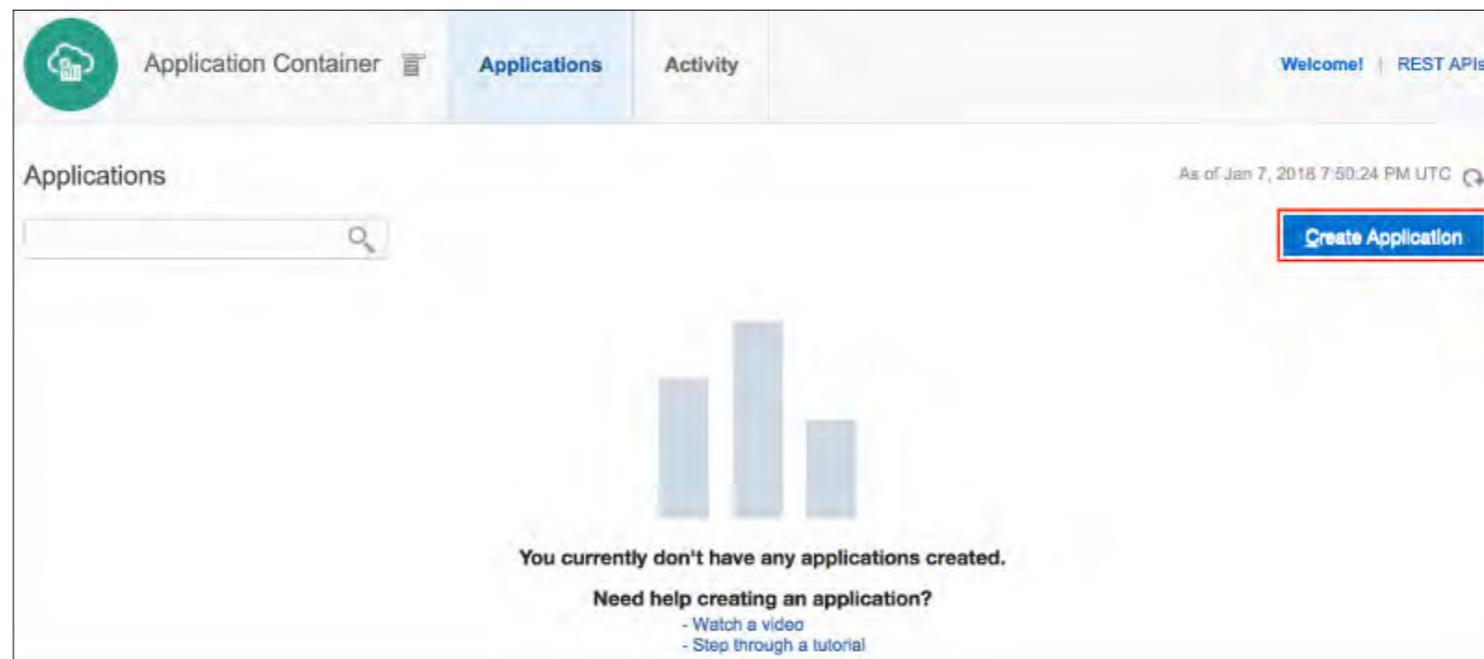
The resulting archive.zip file, shown in **Figure 3**, will be deployed to Oracle Application Container Cloud.

2. Return to the browser and navigate to the Oracle Application Container Cloud console (you might need to log in to a different identity domain). Click the **Create Application** button, as shown in **Figure 4**.
3. Select **Node** as the application platform, as shown in **Figure 5**.
4. Enter `eecstest` as the **Name** of the application, use the **Upload Archive** file picker to select the application archive created in the previous step, and then set the

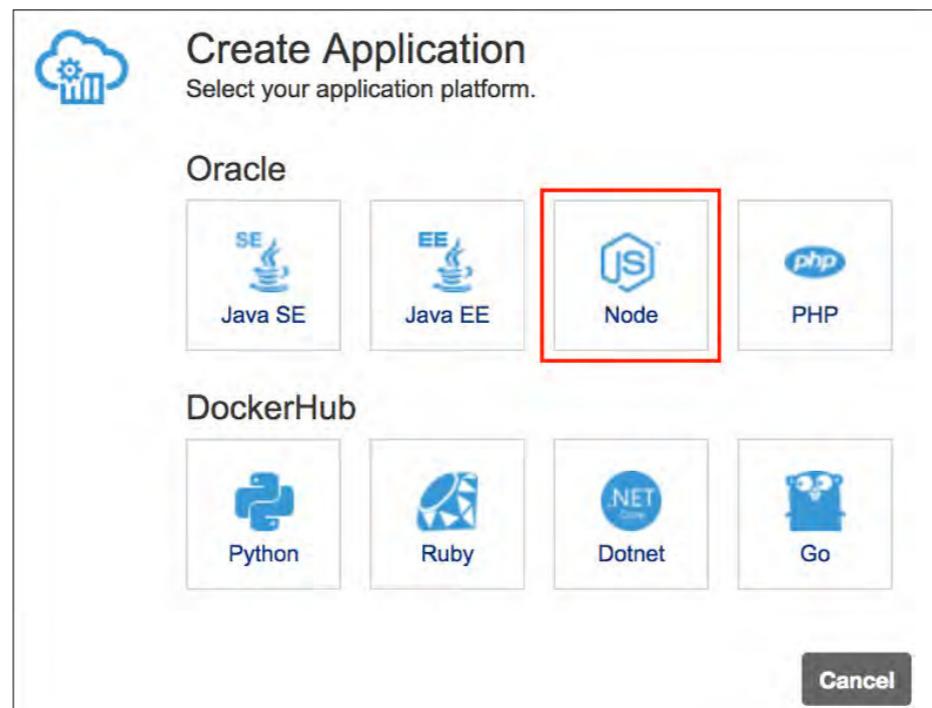
**Figure 3:** Contents of connection-test-app directory, including the archive.zip file



**Figure 4:** Oracle Application Container Cloud console



**Figure 5:** Oracle Application Container Cloud application platform choices



**Instances** and **Memory** options to 1, as shown in **Figure 6**. Click **Create** to start the deployment process.

The app will appear in the list of Oracle Application Container Cloud applications, where you can obtain its URL, as shown in **Figure 7**.

**Figure 6:** Creating the application

Create Application

Application

\* Name: eecstest

\* Application: Upload Archive Choose File archive.zip

Deploy Sample

Instances: 1

Memory (GB): 1

More Options

Create Cancel

**Figure 7:** List of Oracle Application Container Cloud applications

Applications		As of Jan 7, 2018 8:06:59 PM UTC		
		Create Application		
	eebstest	Version: 1.0	Last Deployed On: Jan 7, 2018 8:07:29 PM UTC	Memory: 1 GB
		Runtime: Node 8.1.4	Created On: Jan 7, 2018 8:07:29 PM UTC	Instances: 1
		URL: <a href="https://eecstest-gse00002176.apaas.emr2.oraclecloud.com">https://eecstest-gse00002176.apaas.emr2.oraclecloud.com</a>		

If you navigate to that URL in a browser, as shown in **Figure 8**, you'll see that the test has failed; this is expected.

Just one last task is required to get everything working: adding environment variables.

5. Return to the Oracle Application Container Cloud console and drill into the eecstest app. Select the **Deployments** option on the left and click the **Add** button in the Environment Variables section, as shown in **Figure 9**.

**Figure 8:** Application test fails



**Figure 9:** Adding environment variables

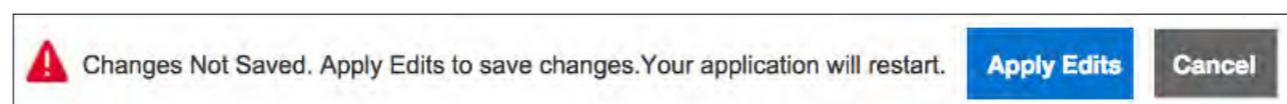
A screenshot of the Oracle Application Container Cloud Deployments page for the eecstest application. On the left, there is a sidebar with options: Deployments (highlighted with a red box), Service Bindings (0), User-defined Variables (0). The main content area shows deployment details: Launch Command: node index.js, Node Version: 8, Topology (Instances: 1, Memory (GB): 1), and Service Bindings (No Service Bindings). In the bottom right corner of the main content area, there is an "Add" button. Below the main content, there is an "Environment Variables" section with a table. The table has columns: Name, Value, and Actions. It contains one row: (x) APP\_HOME. There is also a "Hide System Variables" checkbox and another "Add" button at the bottom right of the table.

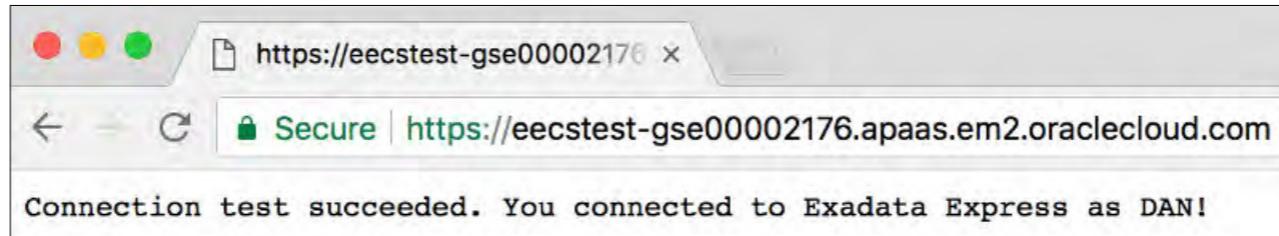
6. Enter `TNS_ADMIN` for the **Name** and enter `$APP_HOME/client_credentials` for the **Value**, as shown in **Figure 10**, and then click **Save**.
7. Repeat the previous two steps to create two more environment variables. For the second variable, enter `EECS_USER` as the **Name** and for the **Value**, enter the username of the Exadata Express database user you want to connect with. For the third variable, enter `EECS_PASSWORD` for the **Name** and for the **Value**, enter the password of the database user specified in `EECS_USER`.
8. After creating the three environment variables, scroll to the top and click the **Apply Edits** button, as shown in **Figure 11**. This will redeploy the application with the new settings.
9. After the app is deployed, navigate to its URL, where you should see that the connection test has succeeded, as shown in **Figure 12**.

**Figure 10:** Adding the TNS\_ADMIN variable

The screenshot shows a modal dialog titled "Add Environment Variable". It contains two input fields: one for "Name" with the value "TNS\_ADMIN" and another for "Value" with the value "\$APP\_HOME/client\_credentials". At the bottom of the dialog are two buttons: "Save" and "Cancel".

**Figure 11:** Apply edits after adding the environment variables



**Figure 12:** Connection test succeeded

As you can see, connecting Exadata Express and Oracle Application Container Cloud isn't that difficult once you understand what's involved. When you work with a real app, I recommend keeping the client credentials separate from the application files and any software configuration management tools, such as Git.

If you are developing apps locally, you can point the TNS\_ADMIN environment variable to a local copy of the client credentials used for development. When you deploy apps to another environment in Oracle Application Container Cloud, you can use an Oracle Developer Cloud Service build process to download the correct client credentials from a storage service and add them to the app files before deploying them to Oracle Application Container Cloud. □

---

*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.*

---

PHOTOGRAPHY BY  
CAREY KIRKELLA/THE VERBATIM AGENCY

## NEXT STEPS

[LEARN](#) more about  
Oracle Database Exadata  
Express Cloud Service.

[LEARN](#) more about  
Oracle Application  
Container Cloud.  
[TRY](#) Oracle Cloud.



By Steven Feuerstein



ORACLE DATABASE 12c

## JSON and PL/SQL: A Match Made in Database

PL/SQL object types for JSON construct and manipulate in-memory JSON data.

**Oracle Database 12c Release 1 ushered in a new age of JSON** inside Oracle Database through wide-ranging and smart support of JSON documents in SQL. You can use SQL to join JSON data with relational data. You can “project” JSON data relationally, extracting content from within the JSON document, thereby making it available for relational processes and tools. You can even query, right from within the database, JSON data that is stored *outside* Oracle Database in an external table.

Oracle Database 12c Release 2 added several predefined object types to PL/SQL to allow fine-grained programmatic construction and manipulation of in-memory JSON data. You can introspect it, modify it, and serialize it back to textual JSON data.

## WHY USE PL/SQL WITH JSON DATA?

If you can query and manipulate JSON data in Oracle Database tables with SQL, why do you also need PL/SQL object types? You can use the object types to programmatically manipulate JSON data in memory, to do things such as the following:

- Check the structure, types, or values of existing JSON data. For example, check whether the value of a given object field satisfies certain conditions.
- Transform existing JSON data. Suppose, for example, your users have decided they want phone numbers to be stored in a different format.
- Create JSON data using complex rules that reflect the kind of per-row variation you can find in document-oriented applications. For example, suppose your table holds items for sale, and the type of item determines the type of data to be stored (for instance, a flammable product must also have safety information).

## OVERVIEW

The primary PL/SQL JSON object types you will use are `JSON_ELEMENT_T`, `JSON_OBJECT_T`, `JSON_ARRAY_T`, and `JSON_SCALAR_T`.

Instances of these types are not persistent. Instead, you first read data from a table into the appropriate instances of the object types or construct the instances through parsing and other operations directly in your PL/SQL code. Next, you manipulate the instances as needed, modifying, removing, or adding values. Finally, you convert or *serialize* them to `VARCHAR2` or large object (LOB) data. Then you store that serialized data back into the database table—or pass it along to a consumer of this data, such as a JavaScript-based web application.

As with so many other data structures manipulated in PL/SQL, you don't have to worry about freeing up the memory associated with these instances. The database will automatically perform garbage collection tasks. Thanks, Oracle Database!

Let's explore the new PL/SQL JSON functionality in Oracle Database 12.2 through a series of simple examples.

## EXTRACT JSON VALUES

I first create and populate my species table with very simple JSON data:

```
CREATE TABLE json_species
(
    id      NUMBER NOT NULL PRIMARY KEY,
    info    CLOB CONSTRAINT is_json CHECK (info IS JSON ) )
/
BEGIN
    INSERT INTO json_species
        VALUES (1, '{"name":"Spider"}');

    INSERT INTO json_species
        VALUES (2, '{"name":"Elephant", "trunk_length":"10"}');

    INSERT INTO json_species
        VALUES (3, '{"name":"Shark", "fin_count":"4"}');

    COMMIT;
END;
/
```

I can use SQL to query the values of specific items within the JSON documents, as follows:

```
SELECT sp.info.name  
  FROM json_species sp
```

But I can also use the PL/SQL API:

```
DECLARE  
    CURSOR species_cur  
    IS  
        SELECT id, sp.info  
          FROM json_species sp;  
  
    l_info          json_element_t;  
    l_document_object  json_object_t;  
    l_name          json_element_t;  
  
BEGIN  
    FOR rec IN species_cur  
    LOOP  
        l_info := json_element_t.parse (rec.info);  
        l_document_object := TREAT (l_info AS json_object_t);  
        l_name := l_document_object.get ('name');  
  
        dbms_output.put_line (l_name.to_string);  
    end loop;
```

```
END;
/
```

The JSON\_ELEMENT\_T.parse method converts the JSON text into a hierarchical structure that can be traversed using methods in the object types.

I then use TREAT to cast the JSON element instance to a JSON object. Next, I use the `get` method of JSON\_OBJECT\_T to get the value for the `name` attribute. Then I use the `to_string` method to convert that value into a string.

For this very simple requirement of displaying the names, in which I am *not* going to iterate through the parsed structure, I could also do this:

```
BEGIN
    FOR rec IN (SELECT sp.info FROM json_species sp
                 ORDER BY sp.info.name)
    LOOP
        dbms_output.put_line (
            json_object_t (rec.info).get ('name').to_string);
    END LOOP;
END;
```

## ORACLE'S LIVE SQL

Oracle's Live SQL provides developers a free and easy online way to test and share SQL and PL/SQL application development concepts.

In this block, I take advantage of the object-oriented ability to string together multiple invocations of methods. First, I call the constructor function for JSON\_OBJECT\_T, passing it the JSON character large object (CLOB) data. That returns an instance of JSON\_OBJECT\_T. Then I call its `get` method, passing it the name of the attribute (`name`), and then I invoke the `to_string` method.

Now what if I want to change the names?

## UPDATE JSON VALUES

The first and most important thing to remember about changing the contents of a JSON document stored in a table is that you must *replace the entire document*. You cannot, through a SQL UPDATE statement, change the values of individual attributes in the document.

Instead, you retrieve the document from the table, make changes to the document's contents using the PL/SQL API in Oracle Database 12.2 or 12.1 string operations on the JSON text, and then use a SQL UPDATE to replace the entire document.

Let's go through the steps needed to implement the following requirement for my species table: all names need to be in uppercase. The code for the requirement is in **Listing 1**.

**Listing 1:** Use PL/SQL object types for JSON to change all names to uppercase.

```
1 DECLARE
2   CURSOR species_cur
3   IS
4     SELECT sp.id, sp.info
5       FROM json_species sp
6     FOR UPDATE;
7
8   l_species          json_object_t;
9   l_species_for_update json_species.info%TYPE;
10  l_current_name    VARCHAR2 (1000);
11  l_new_name        VARCHAR2 (1000);
12 BEGIN
13   FOR rec IN species_cur
```

```
14    LOOP
15        l_species := json_object_t (rec.info);
16
17        l_current_name := l_species.get ('name').to_string;
18
19        l_new_name := TRIM (BOTH '''' FROM UPPER (l_current_name));
20
21        l_species.put ('name', l_new_name);
22
23        l_species_for_update := l_species.stringify;
24
25        UPDATE json_species
26            SET info = l_species_for_update
27            WHERE CURRENT OF species_cur;
28    END LOOP;
29 END;
```

And here is an explanation of that code, line by line:

Line(s)	Explanation
2–6	Declare a cursor to iterate through all the species in the table.
8	Declare a JSON object instance to hold the value returned from the query.
9	Declare a CLOB variable that will be used to update the table after the name has been converted to uppercase.
10	Declare a local variable to hold the current, lowercase name.

- 
- 11 Declare a local variable to hold the new, uppercase name.
- 15 Get the CLOB containing the JSON text from the table and convert it to a JSON object.
- 17 Call the `get` method to obtain the current value of the name.
- 19 Use the TRIM function to remove both the leading and trailing double quote mark around the string. Without this, the `put` method on line 21 will convert each quote mark to `\"` in order to “escape” it. You don’t want that.
- 21 Call the `put` method to change the value of the name in the JSON object.
- 23 Convert the JSON object into a CLOB.
- 25–27 Update the entire JSON column value with the uppercase name.

As you get more comfortable with these PL/SQL object types for JSON and their methods, you will look at that code and say “We don’t need to do all that, Steven!” And you will be right. You can replace lines 17 though 21 with a single statement:

```
l_species.put (
    'name',
    TRIM (BOTH '"' FROM
        UPPER (l_species.get ('name').to_string)));
```

But when you are first working with these types, you will likely want to trace each step of the transformation to make sure you get it right. Local variables help with that.

As you might expect, there’s more than one method for modifying the contents of a JSON document. PL/SQL object types for JSON also offer the following methods.

- **PUT\_NULL**. This method sets the value of the specified key to NULL. If the key does not exist, a new one is added to the JSON document with the value set to NULL. The following statement sets the value of `name` to NULL:

```
l_species.put_null ('name');
```

- **RENAME\_KEY**. This method renames the specified key with the new value. I could, for example, change the key value from `name` to `species_name`, as follows:

```
l_species.rename_key ('name', 'species_name');
```

- **REMOVE**. This method removes a name-value pair from the document. Suppose I no longer need to keep track of the length of elephant trunks. I can then execute this statement before updating the row in the table:

```
l_species.remove ('trunk_length');
```

You can also use `PUT`, `PUT_NULL`, and `REMOVE` to modify arrays, which I cover in the next section.

## WORKING WITH JSON ARRAYS

Most JSON documents aren't nearly so simple as the values inserted earlier into the `JSON_SPECIES.INFO` column. For example, they often contain arrays, indicated by square brackets, as in the following:

```
BEGIN  
    INSERT INTO json_species  
        VALUES (10, '{"name":"Ostrich",  
                    "favorite_eats":  
                        ["Stirfry", "Yogurt", "Mosquitos"]}]');  
END;
```

The very first thing you should accept—and remember—about JSON arrays is that the first index value is 0, not 1 (as is the case for PL/SQL nested tables and varrays).

With that out of the way, let's look at how to use JSON\_ARRAY\_T to work with JSON arrays.

Here are some of the methods you will find helpful for array manipulation:

- [GET\\_SIZE](#) returns the number of elements in the array.
- [IS\\_ARRAY](#) returns TRUE if the instance is an array.
- [APPEND](#) appends a new item at the end of the array.
- [APPEND\\_NULL](#) appends a NULL at the end of the array.
- [PUT](#) adds or modifies an element at the specified position in the array.
- [PUT\\_NULL](#) sets the value of an element at the specified position in the array to NULL.
- [REMOVE](#) removes an element from an array at a specified position. Note: positions are automatically rearranged after a remove operation.

Here are a number of examples using these methods. In each example, assume that the block is executed from within an outer block that declared and populated a JSON object instance as follows:

```
DECLARE  
    l_ostrich    json_object_t;
```

```
l_eats      json_array_t;
BEGIN
    l_ostrich := 
        json_object_t (
            '{"name":"Ostrich",
                "favorite_eats":
                    ["Stirfry", "Yogurt", "Mosquitos"]}');
    ...example block here...
END;
```

1. Get the number of elements in the array.

```
DECLARE
    l_eats      json_array_t;
BEGIN
    l_eats := TREAT (l_ostrich.get ('favorite_eats') AS json_array_t);

    DBMS_OUTPUT.put_line ('# of eats = ' || l_eats.get_size);
END;
```

I get the value for favorite\_eats from l\_ostrich and cast it to an instance of the JSON\_ARRAY\_T type. I then call the `get_size` method to get the number of elements in the array.

2. Determine whether the name-value pair is an array.

```
DECLARE
    l_eats    json_array_t;
BEGIN
    IF l_ostrich.get ('favorite_eats').is_array ()
    THEN
        DBMS_OUTPUT.put_line ('favorite eats is an array');
    END IF;

    IF NOT l_ostrich.get ('name').is_array ()
    THEN
        DBMS_OUTPUT.put_line ('name is NOT an array');
    END IF;
END;
```

Here's the output from this block:

```
favorite eats is an array
name is NOT an array
```

### 3. Add to the end of the array.

Append a non-null value, and then use the `stringify` method to convert the array to a string.

```
BEGIN
    l_eats.APPEND ('Truffles');
    DBMS_OUTPUT.put_line (l_eats.stringify());
```

```
END;  
/
```

```
["Stirfry", "Yogurt", "Mosquitos", "Truffles"]
```

Append a null value and display the string value.

```
BEGIN  
    l_eats.APPEND_NULL;  
    DBMS_OUTPUT.put_line (l_eats.stringify());  
END;  
/
```

```
["Stirfry", "Yogurt", "Mosquitos", null]
```

#### 4. Change the value of an element in the array.

The following block combines several `put`-related actions.

```
BEGIN  
    /* Add Ice Cream before Yogurt.  
       Remember: arrays start at 0 */  
    l_eats.put (1, 'Ice Cream');  
    DBMS_OUTPUT.put_line (l_eats.stringify());  
  
    /* Add a null value before Ice Cream */  
    l_eats.put_null (1);
```

```
DBMS_OUTPUT.put_line (l_eats.stringify());

/* Replace that null with Broccoli */
l_eats.REMOVE (1);
l_eats.put (1, 'Broccoli');
DBMS_OUTPUT.put_line (l_eats.stringify());
END;
/
```

Here's the output from this block:

```
["Stirfry","Ice Cream","Yogurt","Mosquitos"]
["Stirfry",null,"Ice Cream","Yogurt","Mosquitos"]
["Stirfry","Broccoli","Ice Cream","Yogurt","Mosquitos"]
```

Notice that to change a value in an array, I had to first remove it, and then I put a new value in its place.

### ERROR HANDLING WITH JSON TYPES

When it comes to handling errors, the behavior of the JSON types is a bit different from the default behavior in PL/SQL. Generally, if an operation in SQL or PL/SQL results in an error, an exception is raised, halting execution of the block.

You have more flexibility when it comes to the JSON types. First of all, the default behavior is that if an error occurs when an operation calls a *member* function (a function called for the instance of a type versus a *static* function, which is invoked on the type itself), that function returns a NULL value.

You can change this behavior by calling the `on_error` method and passing it one of the following values:

Value	Action Performed
0	Reset to the default behavior, which is to return NULL instead of raising an error.
1	Raise all errors.
2	Raise an error if no value is detected.
3	Raise an error if the data types do not match.
4	Raise an error if the input is invalid. Example: an array reference is out of bounds.

In the following block, I rely on the default behavior. As a result, `Number =` is displayed, and no error is raised.

```
DECLARE
    l_fav    json_object_t;
    l_num    NUMBER;
BEGIN
    l_fav := json_object_t ('{"favorite_flavor":"chocolate"}');

    /* The default */
    l_fav.on_error (0);

    l_num := l_fav.get_number ('favorite_flavor');
```

```
    DBMS_OUTPUT.put_line ('Number = ' || l_num);
END;
```

Now I set the error handling value to 1 in the `on_error` method to raise all errors. When I execute this block:

```
DECLARE
    l_fav    json_object_t;
    l_num    NUMBER;
BEGIN
    l_fav := json_object_t ('{"favorite_flavor":"chocolate"}');

    /* Raise all errors */
    l_fav.on_error (1);

    l_num := l_fav.get_number ('favorite_flavor');
END;
```

I see the following error:

```
ORA-40566: JSON path expression selected a value of different data type.
ORA-06512: at "SYS.JDOM_T", line 418
ORA-06512: at "SYS.JSON_OBJECT_T", line 256
ORA-06512: at line 10
```

Now, what if I try to access an array position that is out of bounds?

```
DECLARE
    l_eats      json_array_t;
BEGIN
    l_eats := JSON_ARRAY_T ('[ "Stirfry", "Yogurt", "Mosquitos" ]');

    /* Raise all errors */
    l_eats.on_error (4);

    l_eats.put (-1, 'Ice Cream');

    DBMS_OUTPUT.PUT_LINE (l_eats.get_size());
END;
```

I see the following error:

```
ORA-40578: invalid or non-existent array position
ORA-06512: at "SYS.JDOM_T", line 255
ORA-06512: at "SYS.JSON_ARRAY_T", line 192
ORA-06512: at line 9
```

### CHASING JSON TO A CONCLUSION

Almost every new application being built today, even those constructed in Oracle Application Express, rely heavily on JavaScript and JSON. It's easy for front-end developers to think that Oracle Database is good only for "relational data" and that if they want data in a JSON format, they need to look elsewhere, perhaps in a document or NoSQL database.

This is definitely and demonstrably not the case, especially with Oracle Database 12.2.

Database developers should learn about JSON in Oracle Database and get really good at building APIs with PL/SQL packages and Oracle REST Data Services. That way, they can provide all the JSON their front-end developers need while ensuring a high level of performance and security for application data.

This article gives you a starting point for manipulating JSON in PL/SQL. Future articles will explore the topic in greater detail. 

---

*Steven Feuerstein is a developer advocate for Oracle, specializing in PL/SQL. Feuerstein's books, including Oracle PL/SQL Programming, videos, and over 1,500 quizzes at the Oracle Dev Gym ([devgym.oracle.com](http://devgym.oracle.com)) provide in-depth resources for Oracle Database developers.*

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PHOTOGRAPHY BY **ANDREA MANDEL**

### NEXT STEPS

**READ** more about Oracle Database support for JSON (documentation).

**READ** Steven Feuerstein's blog post on getting started with JSON in Oracle Database.

**LEARN** more about Oracle Database support for JSON (tutorial).

**EXPLORE** code used in this article at Oracle's Live SQL.

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# Beyond ERP: The Way Forward, Part 1

OAUG president sees mission expanding as user group members delve into emerging technologies. **BY LESLIE STEERE**

**As Christine Hipp begins her tenure** as Oracle Applications User Group (OAUG) president this year, she brings 14 years of Oracle technology experience and several years of OAUG service to the role. Along with a commitment to continue advocating for OAUG's on-premises members, she also has a deep interest in helping the membership navigate their paths toward emerging technologies—from cloud computing to blockchain to artificial intelligence. Hipp recently took a few minutes from her day job as IT manager at Los Alamos



Christine Hipp, president of Oracle Applications User Group, describes COLLABORATE as a place to develop skills, understand job options, and get ready for new technologies.

National Laboratory to discuss OAUG's ever-expanding mission.

**Oracle Magazine:** How do you see the mission of OAUG changing as members begin to look at the cloud and emerging technologies?

**“While we’re still providing the education our members running Oracle E-Business Suite on premises need, we’re expanding into topics such as security, emerging technologies, system architecture considerations, and SaaS.”**

—*Christine Hipp, President, Oracle Applications User Group*

**Hipp:** When you use technology to improve your business, every time there is a technology change, it energizes you. You say, “What is this? What do I need to know? How is this going to be an advantage for me?” I think this is happening now with cloud technology. It’s obvious that there are advantages to the cloud, but which of those advantages are right

for you right now? Is it moving your workloads and your disaster recovery to PaaS? Is it considering a SaaS solution as a bolt-on or an extension of your business capability?

These are the questions for OAUG members who have long been core Oracle E-Business Suite users. But there’s a whole other group of people who are implementing for the first time in the cloud. And they’re also hungry for information.

OAUG was founded in 1990 to serve a real need. At that time, in order to maximize their IT investments users were dealing with questions such as “How do I install this?” “How do I patch it and when?” and “What are these applications capable of doing?” And they turned to OAUG, because OAUG put them together with other members that allowed them to get real answers to those questions.

That doesn’t change with cloud technology, because whether you’re implementing something on premises or in

the cloud, you still want to understand how to use it, how to optimize it for your business, and what the options are.

The cloud delivers new challenges and opportunities, but it isn't changing that core need for information.

So while we're still providing the education our members running Oracle E-Business Suite on premises need, we're expanding into topics such as security, emerging technologies, system architecture considerations, and SaaS.

**Oracle Magazine:** How will those changes be reflected at the [COLLABORATE user group conference](#) this year?

**Hipp:** Honestly, most of what we're hearing is that people with big on-premises installs can't lift and shift quickly. But that doesn't mean they're not looking to see how they can take advantage of new technologies in a planned uptake. They want to hear specific stories in the context of their current state that help them in their own strategic planning. They are hungry for stories of companies with

an on-premises install that are adding SaaS; they're hungry for the stories of somebody who's picked up and moved development workloads.

So for cloud in particular, at COLLABORATE this year we have more than 500 sessions that explore various aspects of cloud solutions—up from around 140 last year. It's clear that the appetite for information on the cloud is out there. The OAUG also will have a new special interest group specifically focused on emerging technologies, and at COLLABORATE that group's conversation will be focused on blockchain. We've got about eight additional sessions covering blockchain as well.

**Oracle Magazine:** Have you noticed membership job roles changing as the technology changes?

**Hipp:** I do think traditional IT and business roles are changing and will continue to change with the new wave of technologies we're working with in IT. There's cloud; there's agile implementation; and there are low-code/no-code conversa-

tions I have every day at work, where you look at what people have been doing in their role, and how that changes.

So we've got a renewed focus on the individual at this year's **COLLABORATE**. The conference is about Oracle products, but it's also about developing your skills as an employee, helping you understand what the various job options look like, and making sure you are ready to move with the new technologies. And it also helps employers when OAUG provides content about what they need to be looking for in employees. Let's say I turn into an entire cloud shop in 10

years: what kind of employees do I need to have? It's likely a different mix of skills from the employees I have had running my on-premises applications.

*Editor's note: Our conversation with Hipp continues in the next issue of Oracle Magazine, where she discusses the importance of diversity in the workforce, mentorships, networking, and more. □*

*Leslie Steere is editor at large for Oracle Content Central. She has more than 30 years of journalism and marketing content experience.*

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**THE VERBATIM AGENCY**

### NEXT STEPS

[LEARN](#) more about **COLLABORATE**. [JOIN](#) OAUG.