ORACLE MAGAZINE

MAY/JUNE 2018

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Tom Haunert

The Self-Securing Cloud

Oracle Autonomous Data Warehouse Cloud is just the start of a self-securing cloud service vision.

At an Oracle launch event on March 27, 2018, Oracle Executive Chairman and CTO Larry Ellison announced the availability of Oracle Autonomous Data Warehouse Cloud, the first service based on the revolutionary new Oracle Autonomous Database. Oracle Autonomous Data Warehouse Cloud is the world's first self-securing, self-repairing, and self-managing database cloud service.

To get a better understanding of the characteristics of Oracle's new autonomous cloud service, I picked one of its descriptors—*self-securing*—and asked for some help from Vipin Samar, senior vice president of Oracle Database Security.

Samar and I focused on two self-securing features in Oracle Autonomous Data Warehouse Cloud: patching and encryption.

"Security patches are automatically applied every quarter or as needed," he explained. "This is full-stack patching, including the firmware, OS, clusterware, and database. And by applying patches in a rolling fashion across the nodes of a cluster, there is no application downtime. There are no steps required from the Oracle-customer side. Patching just happens!"

Samar's description of encryption in Oracle Autonomous Database was similar. "We encrypt the data everywhere—in traffic, in tablespaces, and in backups," he says. "The keys are managed automatically without requiring any intervention from the Oracle customer. Encryption cannot be turned off. Encryption just happens!"

Patching and encryption are part of higher-level security strategies and actions. "A big part of security is closing the known open gaps, securing assets by default, and using best security practices," Samar says. "And this is what we do, in addition to automation, for the autonomous databases on Oracle Cloud."

Samar also noted that the journey to self-securing is just starting. We signed off the conversation with a plan to run a detailed interview with Samar on Oracle Autonomous Database security, the self-securing vision, and more in the next issue of *Oracle Magazine*.

Tom Haunert,
Editor in Chief

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PHOTOGRAPH BY
BOB ADLER/THE VERBATIM AGENCY

NEXT STEPS

READ more about Oracle Autonomous Data Warehouse Cloud.

WATCH "Security for the Autonomous Warehouse Database Cloud."

LEARN more about Oracle Cloud Platform autonomous services.

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WATCH the Oracle Autonomous Data Warehouse Cloud launch replay.

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BY LESLIE STEERE

Get Charged, Stay Secure

Gadgets, apps, and info for road warriors

Cooking Light

Fire up a handful of twigs or sticks in the BioLite CampStove 2, and generate power for its USB outlet while your meal cooks. The CampStove 2's fan creates a smokeless fire that can cook meals in minutes while turning heat into electricity for charging your devices. Weighing in at only 2.06 pounds, the stove is light enough to add to your backpack load. US$129.95. BioLite Energy

Recharge Anywhere

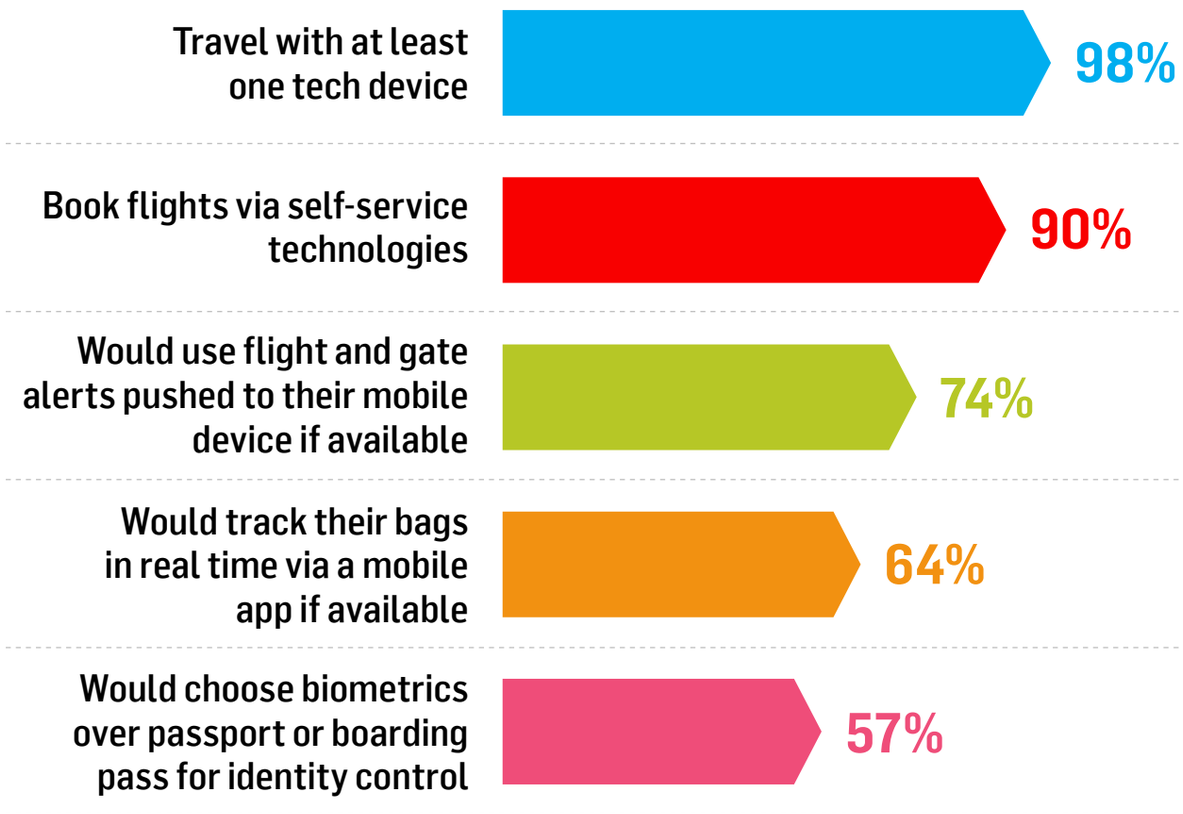
Planning a back-country adventure? Keep your devices charged with the rugged, high-capacity FosPower PowerActive 10200mAh power bank (2.1 A power output). Perfect for smartphones, tablets, and portable electronic devices, this power bank is designed to be not only water-proof but also snow-, dirt-, and drop-proof, and it sports built-in protection against short-circuiting, overcharging, and overheating. It comes with an LED flashlight, a compass, and a carabiner. US$25.99 FosPower

PHOTOGRAPHS COURTESY OF BIOLITE AND FOSPOWER

Travels with Tech

Surprise? Passengers prefer tech over human assistance.

From ticket purchase to baggage tags to security controls, travelers seem to prefer tech solutions over face-to-face interaction. A 2017 global survey found that passenger satisfaction not only tracked higher overall for tech users compared with those transacting with humans but that passengers increasingly are open to additional technology tools for travel. Among the findings:



Source: 2017 Air Transport Industry Insights: The Passenger IT Trends Survey

DO YOU SPEAK TECH? QUIZ YOURSELF!

1. In the context of security, COPE means

A. Compromised operation prevents execution

B. Corporate-owned, personally enabled

C. Cancel operation per executive

2. Which of the following refers to lighter, purpose-built protocols that allow the things in IoT to communicate and interchange?

A. Chirps

B. Thingiots

C. IoTics

3. A trust boundary is

A. The changeable security boundary between companies engaged in co-opetition

B. The separation of different application or system domains in which different levels of trust are required

C. An 8-foot-high cubicle wall between developers working on competing projects

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

APPS: SECURE DEVICES AND DATA—AND YOURSELF

Locate your missing devices, access websites securely, and keep your travels safe.

Prey

Locate your laptop, smartphone, or tablet with Prey, an app that not only uses GPS to track your device but also lets you watch what is happening on screen and remotely lock the missing device to prevent data theft. You can use your missing device's camera to take silent snaps and discover who is holding the item, set security zones to receive alerts when your device enters or leaves the zones, remotely wipe sensitive data, and more. Free (Android, iOS)

Hotspot Shield VPN Proxy

Access websites and apps securely and privately around the globe with the Hotspot Shield virtual private network (VPN) proxy. Hotspot Shield's wide coverage includes 17 countries, enabling you to access sites that some regions may have blocked, such as Facebook and Google. Your information is completely private, and connecting to a VPN requires only a single tap. The proxy allows users to stay anonymous and prevents anyone from tracking their IP address, identity, and location from websites and online trackers. Free (Android, iOS)

Geosure

Avoid travel troubles with Geosure, a location-sensitive personal security app that provides a safety score reflecting health risks, political uprisings, and environmental threats and gives crowd-sourced information about thefts and assaults that have occurred in your destination. Powered by an analytical engine that combines hundreds of information sources including those from the CDC, WHO, the United Nations, the US State Department, INTERPOL, and local authorities, the app lets you gauge your level of safety anywhere in the world. Free (Android, iOS)

INTERVIEW

Harish Gaur, Senior Director, Product Management, Internet of Things, at Oracle sees customers using IoT to improve operations, improve visibility, and enable new business models.

Building Business from Data

The data from IoT devices creates new business opportunities. **BY TOM HAUNERT**

IoT may still qualify as emerging technology, but enterprise IoT is now a part of many business strategies, plans, proof-of-concept projects, and more. *Oracle Magazine* caught up with Harish Gaur, senior director, product management, Internet of Things at Oracle, to talk about the state of enterprise IoT, business strategies and use cases, Oracle's latest IoT services, and more.

Oracle Magazine: What is the state of IoT in the enterprise?

Gaur: Most companies I speak to have some sort of an enterprise IoT initiative in their strategic roadmap, and we are starting to see a lot more IoT deployment.

We are starting to see patterns emerge, patterns of why companies are using IoT. The patterns I see bubble up in every use case focus on how to improve the existing way of doing business.

If I am servicing an asset, for example, how do I do improve those processes? We call that pattern *improving existing operations*.

The second pattern is about gaining visibility into what's going on in real time. Many businesses just want to understand where an asset is at the current point in time or what the health of a fleet is at the current point in time.

The third pattern is about businesses getting very creative and, as a result, enabling new models. They start with the goal of "Hey, I want to monitor my smart factory" or "I want to monitor my fleet," but then they realize they can do more with all the data they are getting from those enterprise assets.

Oracle Magazine: How do businesses get started with IoT projects? And what are some typical industrial or enterprise IoT use cases?

Gaur: We are telling customers *don't* start with your sensors and *don't* start with your devices. Instead, we tell them to start with the KPI [key performance indicator] that they want to monitor and improve. And from there, they can identify the *data* they would need in order to monitor that KPI, whether that data comes from an ERP [enterprise resource planning] system, a manufacturing plant, a maintenance system, or a type of asset or device. And once they identify the datasources, then they can start capturing all the data from those sources.

I talked about three IoT patterns we're starting to see: improving operations, improving visi-

bility, and enabling new business models. Let me give you some use case examples.

Improving the service operations could include monitoring the location of a pallet, the health of the HVAC system based on the temperature data, or the location and health of any other asset. Location- and health-based tracking are critical in manufacturing, shipping, workplace safety, plant safety, and more. With the tracking information, businesses can track and take actions to prevent accidents, make deliveries faster, save time, and more.

> "We are telling customers *don't* start with your sensors and *don't* start with your devices."

Improving visibility is especially important for smart factories. Factories have been able to get end-of-shift visibility into what just happened, but real-time visibility, during the shift, is ideal. With smart factories and IoT-based real-time visibility, management at smart factories can see that the production devices are not going to meet a production goal, look at the health and output of each and every device on the production line, and address it during the shift.

Enabling business models happens when companies gather, manage, and report on their IoT data and see opportunities to do more with what they've built for themselves. After reporting on the location and health of assets and improving visibility into their operations, they can offer those same services via dashboards companywide or as services to sell to other companies. Collected IoT data can show the location utilization of office space, conference facilities, factory floors, and more to show companies whether it's time to invest in more factory or office space, sublet, and so on.

Oracle Magazine: What are the Oracle solutions for IoT?

Gaur: For PaaS, there's Oracle Internet of Things Cloud Enterprise. It provides out-of-the-box integrations with Oracle Mobile Cloud Service, Oracle Integration Cloud Service, and Oracle Big Data Cloud Service, and we are adding more and more integrations. Oracle Internet of Things Cloud Enterprise also includes a REST-based

API interface, so companies that want to integrate with their own custom applications can do so by using the REST API.

Oracle Internet of Things Cloud Enterprise also provides and supports machine learning for things such as predictive analytics, for example, as well as the concept of a digital twin, which is a digital representation of a physical device. For example, the digital twin of a device can be used by a technician wearing VR [virtual reality] glasses to train for a repair procedure before repairing the physical device.

I believe chatbots and IoT are coming together, and Oracle Internet of Things Cloud Enterprise supports that. Chatbots are the conversation UI for IoT.

For SaaS, Oracle now offers five IoT SaaS applications, all built on Oracle Internet of Things Cloud Enterprise. Oracle Internet of Things

"Enabling business models happens when companies gather, manage, and report on their IoT data and see opportunities to do more with what they've built for themselves," says Harish Gaur, senior director, product management, Internet of Things, at Oracle.

Asset Monitoring Cloud Service delivers real-time insights from connected assets; Oracle Internet of Things Production Monitoring Cloud provides best-in-class production monitoring for factories, products, and machines; Oracle Internet of Things Fleet Monitoring Cloud delivers predictive analytics for connected vehicles to provide service and avoid downtime; Oracle Internet of Things Connected Worker Cloud Service ensures worker health and safety by providing real-time visibility into worker health, location, and work environments; and Oracle Internet of Things Service Monitoring for Connected Assets Cloud supports proactive customer service and a differentiated service experience.

PHOTOGRAPHY BY
BOB ADLER/THE VERBATIM AGENCY

NEXT STEPS

LEARN more about Oracle Internet of Things Cloud Enterprise.

LEARN more about Oracle Internet of Things applications.

TRY Oracle Internet of Things cloud services.

Multidirectional Security in a Multicloud World

Gain end-to-end visibility and control across diverse environments.

By John Maddison, Sr. VP of Products and Solutions, Fortinet, Inc.

John Maddison, Sr. VP of Products and Solutions, Fortinet, Inc.

Maintaining visibility into what's happening deep within the cloud isn't easy, and it's becoming more important than ever to protect critical data and defend a growing potential attack surface. According to Fortinet's Global Threat Landscape Report, enterprises use a median of 62 different cloud applications or services in their networks, with Infrastructure-as-a-Service (IaaS) reaching an all-time high. That's nearly a third of all applications and services used, spanning everything from data storage and file sharing to collaboration and on-demand infrastructure for data centers and computing needs.

To meet growing needs for on-demand network and compute resources, organizations are extending their infrastructures out to the public cloud. According to IDC, 75 percent are currently implementing or considering the implementation of public cloud resources, and they predict that 50 percent of enterprise workloads will migrate to the public cloud by 2018[1]. From a security perspective, cloud security solutions must be as elastic and dynamic as the cloud itself.

Q. As more enterprises migrate critical applications and workloads from their on-premises data centers and private clouds to the public cloud for its agility and scale benefits, how have security requirements evolved?

A. The days of simply securing the network perimeter are long gone. Today, resources can be consumed by different cloud-based solutions and applications, and data is often shared and migrated between these clouds. As organizations move to

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www.fortinet.com

[1] "Securing Dynamic Cloud Environments: Developing Your Solution Checklist in a Changing Paradigm," Fortinet, 2017

hybrid cloud environments, they're actually creating multidimensional cloud ecosystems. That creates new challenges when it comes to securing all these environments and the data traveling through them.

One of the top requirements for securing a hybrid cloud is delivering single pane-of-glass management across all the disparate cloud environments. Organizations need to maintain deep visibility, centralized policy orchestration, integrated event correlation, and consistent controls and response. That requires a high level of integration. You need tools that are either natively designed to operate together across different environments, or based on open standards and APIs, so you can build a central security operations solution.

Securing the connections themselves is also key. Hybrid solutions must support robust VPN functions for secure, temporary access to resources when it's needed—while protecting the rest of the network. In addition, migrating data, accessing large data sets, or using third-party, cloud-based analytics services requires secure connections to external networks.

When it comes to multicloud environments, security teams need to be sure that their solution is scalable and elastic, so it can keep pace with environments that are changing and growing fast. And they need to be able to easily and dynamically separate and segment systems, workloads, and applications, based on unique risk profiles.

"Fortinet and Oracle continue to expand their relationship to deliver virtualized security solutions across Oracle public and hybrid cloud environments."

—John Maddison, Sr. VP of Products and Solutions, Fortinet, Inc.

Q. How does Fortinet help organizations maintain consistent security visibility and control across multicloud networks, spanning private and public clouds to Software-as-a-Service (SaaS) applications?

A. The deluge of isolated, specialized security tools being deployed has created a blind spot in the overall security strategy of many organizations. A critical lapse in visibility, control, or coordination in any part of the distributed network, especially in the cloud, can spell disaster for a digital business.

To protect today's distributed business, organizations need to adopt an integrated security strategy that can collect, share, and correlate threat information; distribute mitigation instructions across all attack vectors; extend visibility and control across the networked ecosystem; and enable a synchronized attack response. One effective way to do this is to design a security fabric, or architectural approach, that enables you to tie your deployed security tools into a single, holistic solution. The Fortinet Security Fabric employs this approach to provide broad, powerful, automated security across physical, virtual, and cloud environments.

Q. Are cloud providers and managed security service providers (MSSPs) facing the same concerns when it comes to security as enterprise organizations? How does Fortinet address these concerns?

A. An especially important part of the business model for cloud providers and MSSPs is the need to accurately bill customers for the consumption of cloud resources. This can be tricky for security services because

many cloud-based security tools are simply virtual versions of their enterprise-based appliances. These tools don't meter and track security consumption.

Fortinet's VM On-Demand security platform provides a turnkey VM licensing and provisioning platform for cloud providers and MSSPs, as well as enterprises with large private cloud resources. Its metering capabilities enable them to deliver on-demand pricing and automation to end customers. The VM On-Demand security platform supports consumption-based, pay-as-you-grow billing, with hourly or volume-based metering options, as well as network functions virtualization (NFV) orchestration compatibility for MSSPs. When it's paired with FortiHypervisor, VM On-Demand offers cloud providers and enterprises the widest choice of physical, virtual, and hybrid customer-premises equipment (CPE) form factors to support managed security and software-defined wide area networking (SD-WAN) services.

Q. Many enterprises are embracing Oracle Cloud as their public cloud solution. How does the Fortinet Security Fabric improve security and compliance for Oracle Cloud customers?

A. We want businesses to be able to experience the same level of cybersecurity and threat intelligence in cloud environments as they do on their physical networks. That's why we've extended the core capabilities of Fortinet Security Fabric to the cloud. For example, we have enhanced our virtualized FortiGate to deliver cloud-scale performance for private and public clouds. Its VMs now deliver up to three times faster per-core throughput than before, with increased capacity options.

We are also improving public cloud security automation with on-demand and auto-scale capabilities. Fortinet Security Fabric virtual solutions deliver complete content and network protection, and they are available on demand or BYOL (Bring Your Own Licenses), helping to take advantage of elastic workloads and automated security that scales with their needs.

Fortinet has also introduced a new API-based FortiCASB service, which lets IT teams maintain security visibility for both on- and off-network user access to some of the most widely used SaaS applications, including Microsoft® Office 365™.

Q. What are some of the ways Oracle and Fortinet are working together to help organizations protect multidimensional cloud environments?

A. Fortinet and Oracle continue to expand their relationship to deliver virtualized security solutions across Oracle public and hybrid cloud environments. Available now as a BYOL offering in the Oracle Cloud Marketplace, FortiGate VMs give Oracle Cloud customers a combination of advanced threat intelligence from FortiGuard Labs, along with the industry-leading security operating system, FortiOS. Together, these solutions enable complete security feature control, workload visibility, and management across physical, virtual, and cloud environments.

Fortinet is an early adopter of Oracle Cloud Infrastructure, featuring its FortiGate VM. This close integration lets users securely move business-critical workloads from on-premises, private-to-public cloud deployments, without compromising policy visibility. As Oracle Cloud scales through multiple Availability Domains (ADs), FortiGate will complement the cloud services with highly available, multi-layered security to support our customers' most critical workloads across every environment. Together, Oracle and Fortinet will continue to deliver the on-demand, multiple layers of security that today's dynamic cloud networks need most.

Mark Rakhmilevich, blockchain product management director at Oracle, looks at high-level blockchain design patterns with applications in different industries.

Build Trust

Blockchain builds enterprise trust on secure business transactions. **BY TOM HAUNERT**

The newness of blockchain and its potential contributions to enterprise technology have a lot of people asking a lot of questions about when, why, and how to use it.

Oracle Magazine sat down with Mark Rakhmilevich, blockchain product management director at Oracle, to talk about blockchain technology, blockchain for the enterprise, blockchain challenges, and blockchain strategies from Oracle.

Oracle Magazine: What is blockchain?

Rakhmilevich: At a high level, blockchain is a distributed system for conducting transactions, including business-to-business transactions and business-to-consumer transactions, and for maintaining distributed ledgers across multiple organizations.

Blockchain helps multiple organizations conduct business securely without requiring an intermediary. It helps to enable trust because all the transactions in the blockchain can be easily tracked and provide an immutable trail of what happened, when, and how.

Oracle Magazine: What types of business and development challenges does blockchain address?

Rakhmilevich: Many organizations face the challenge of reconciling ERP [enterprise resource planning] discrepancies between multiple internal systems or across their partner ecosystems. When people extract data from systems of record—databases or ERP systems, for example—into batch files or spreadsheets, and send those around and then get updates back, the processes involve delays, potential for human error, and risk of fraud. And when an audit attempts to validate the accuracy and sourcing for all of the data, there are significant challenges to finding and proving data lineage.

Using blockchain instead to automate those kinds of processes and share data in real time is one area where many businesses can benefit. Fraud, settlement time, cost, and complexity can be reduced and businesses can get real-time visibility of information across the ecosystem.

There are a variety of uses for blockchain across a variety of industries. I'll highlight four high-level blockchain design patterns with applications in different industries. The first one is using blockchain to enable distributed autonomous marketplaces where people exchange things of value. Cryptocurrency is an example,

but there could be other things of value being traded, whether they're physical goods or digital goods of some sort.

> "When information is published in a blockchain, access to the information requires authorization."

The second design pattern is using blockchain to reduce friction in business transactions and to support reconciliation where you have complex multiparty ecosystems, such as a supply chain. Blockchain helps to automate processes and reduces transaction friction.

The third design pattern uses blockchain to help publish information securely, whether it's from government entities or other organizations. It could be business licenses, land titles, university diplomas, birth certificates, electronic health or vaccination records, or any other kind of information where people would benefit from being able to access it in real time in a secure manner. When information is published in a blockchain, access to the information requires authorization. And authorization to access a particular part of that information can be granted to a particular entity, and that grant itself can be securely recorded on the blockchain for nonrepudiation.

And the fourth design pattern is what's called *track and trace*, where the organization can track the provenance of products and materials and ingredients, whether it's a manufacturing environment or a retail supply chain.

Oracle Magazine: What are some specific business and industry use cases for blockchain?

Rakhmilevich: In financial services, for example, a lot of communication and work is required to handle different types of payments and remittances, such as interbank, cross-border remittances, B2B payments between companies, and national fund transfers between different financial institutions within a country. Blockchain-based systems can simplify many of these operations, bypass centralized intermediaries, and automate some of the manual processes.

Securitization processes, where you take a bunch of mortgages or other loans and create a security out of them, could benefit from blockchain. All of the loan information is often

collected in a spreadsheet that is floating back and forth in an unaudited manner between the participants until the value of the security gets finalized. Blockchain could automate that process and provide a lot more security and visibility around it. And it could even track the changing value of the security in real time as underlying loan payments are recorded.

In the retail space, there's a lot of interest in blockchain. Earlier, I mentioned track-and-trace capabilities. This could be, for example, a farm-to-table kind of a food provenance tracking, where you have information on the participants from the initial farm, as well as the processing steps, the ingredients used in the final product, the country of origin, and so on, and all of the information could be accessible to the final consumer. And in warranty management, where you have the retailer, the manufacturer, and the

Mark Rakhmilevich, blockchain product management director at Oracle, sees the value of blockchain to help automate processes and reduce transaction friction.

customer involved, blockchain could help provide and automate the processes in a trusted manner. Refunds management and multibrand loyalty points tracking could also leverage blockchain.

Multiple companies are involved in clinical drug trials and need to collect and secure a variety of information and flow it back to the original pharmaceutical companies in a trusted manner. Blockchain can be a valuable solution for these transactions and speed up the data collection process.

And there are significant problems with counterfeit pharmaceuticals, particularly in the developing world where up to 30 percent of drugs in a supply chain might be counterfeit. Using blockchain to track pharmaceuticals from manufacturing to distribution to patients can help there as well as in the broader healthcare industry.

Those are just some examples.

Oracle Magazine: How do companies looking to develop and deploy blockchain solutions get started? What do they look for in tools, platforms, technologies, and so on?

Rakhmilevich: First of all, businesses are looking for enterprise-grade platforms. They want to be able to tick off all of the difficult enterprise checkboxes in terms of requirements, resiliency, security, recoverability, and so on—once. They're going to use blockchain in business-critical processes, so the foundation platform has to provide those capabilities while at the same time supporting rapid experimentation with multiple use cases—through rapid provisioning, dynamic configuration, fast onboarding of members, and easy development of smart contracts.

> "Oracle Blockchain Cloud Service is built on the Linux Foundation's Hyperledger Fabric project."

And businesses look for integration requirements. Does a blockchain solution require the business to build one-off integrations, or are there tools, APIs, and capabilities available or built-in on-ramps in the applications to make it easier to include blockchain? Obviously, for broader adoption you can't afford to depend on one-off integrations.

As many as 2,500 patents have been filed for blockchain technology in the last two or three years, according to some reports. Many of those patents have been finding their way into implementation. Where there is a rapid evolution of the technology, such as with blockchain, as businesses adopt and update new solutions they are going to want backward compatibility and confidence that the work they have put into integration and deployment does not need to be redone. That work takes time and money.

IT monitoring, service-level monitoring, and lifecycle management tools are important in blockchain solutions. The ability to monitor the status and dynamically change the configuration as the requirements change is important as well.

Underlying all of that, people are looking at performance and scalability. Enterprise customers are looking for hundreds and maybe thousands of transactions per second. Security and confidentiality are big requirements as well. Businesses need to know that they can control the data that's going to be accessible to others and can determine who can see what.

Oracle Magazine: How does Oracle support blockchain?

Rakhmilevich: Oracle has built Oracle Blockchain Cloud Service as part of Oracle Cloud Platform. Oracle Blockchain Cloud Service is built on the Linux Foundation's Hyperledger Fabric project, and it includes a lot of enhancements that focus on the blockchain strategies and business requirements I mentioned earlier.

With Oracle Blockchain Cloud Service, you don't have to spend months building and integrating all of the key technologies, examining the enterprise requirements, and so on. You can get the service and all of its dependencies provisioned in less than 30 minutes and be up and running.

Learn more about the Oracle Blockchain Cloud Service.

PHOTOGRAPHY BY
BOB ADLER/THE VERBATIM AGENCY

NEXT STEPS

READ more about blockchain.

LEARN more about blockchain at Oracle.

EXPLORE Oracle Blockchain Cloud Service.

BY BLAIR CAMPBELL

The Right Questions

Translating customer needs, sharing on social media, and identifying vulnerabilities

Pam Koertshuis

Rotterdam, The Netherlands

ORACLE ACE Associate

Company/URL: Profource B.V.

Job title: Solution architect

Length of time using Oracle products: 23 years

How did you get started in IT? After earning my computer science degree, in 1995, I went to work for Oracle, building customizations in Oracle applications. During my time as a presales consultant, I developed a UI modeler tool to enable my colleagues to personalize their demos. In 2004, I received an Oracle Innovation Award for this tool, and it was incorporated into Oracle E-Business Suite for form personalization.

Which new features in Oracle Applications are you currently finding most valuable? As a custom developer and designer of form personalization, I love the personalization features the cloud offers such as Oracle Sales Cloud, which gives you enough freedom in making a standard application fit your specific purpose. The integrated pages and Oracle Application Builder Cloud Service are also tools that have potential in this area.

Name one unique use of Oracle Applications at your company. For one client, we are currently using Oracle Policy Automation Cloud integrated with Oracle E-Business Suite on premises to streamline sourcing requests in a very advanced manner. The rules provide you with the right method for engaging the suppliers and make sure you add the correct information and documentation to be able to approve requests and send them to an external sourcing application.

Clarisa Maman Orfali
Irvine, California

ORACLE ACE Director

Company/URL:
ClarTech Solutions
Job title: Founder and director
Length of time using Oracle products: 9 years

How are you using social media in your work these days? I love teaching, and social networks not only help me share my experiences and knowledge in the classroom; they also let me reach the world by sharing my articles, posts, videos, webinars, and everything else that I periodically publish. The more we share, the more we learn—it opens a world of possibilities. On one hand, sharing allows me to connect and collaborate with other people and receive different opinions, which helps to increase my knowledge. On the other hand, helping people motivates me to continue learning—which in turn leads me to continue sharing, thus creating a cycle.

What would you like to see Oracle, as a company, do more of? I would like Oracle to increase its efforts in making Oracle Application Express known in Latin America as well as having the option to offer Oracle Application Express courses in Spanish at Oracle Academy. Despite my efforts to evangelize Oracle Application Express in the Hispanic world, I feel there is still a long way to go for Latin American companies to opt for Oracle Application Express for their web application development using Oracle Database.

What's your go-to Oracle reference book? I have the entire collection of books on Oracle Application Express in my library. My main reference books are both editions of *Expert Oracle Application Express* [Apress, 2011 and 2015], which are very special books for me because each of them has a dedication from my friends Dan McGhan and Jorge Rimblas—both coauthors.

Kamil Stawiarski

Warsaw, Poland

ORACLE ACE

Company/URL: Database Whisperers

Job title: Co-owner

Oracle credentials: Oracle Database Certified Master

Length of time using Oracle products: 12 years

What's your favorite technique on the job? I love to dig into traces and hex dumps to find a solution to complex problems. I also enjoy checking security for my customers and trying to find an escalation path for privileges. I use my own set of scripts and tools, plus official ones, such as Oracle Database Security Assessment Tool, and open source ones, such as John the Ripper and Metasploit. I usually try to find a way of escalating from a database application account to gain access to the operating system.

What advice do you have about getting into database development? The amount of knowledge on the internet is amazing. Take advantage of that by identifying Java Champions, Oracle ACEs, and well-known bloggers, and build your personal list of favorites. Learn from them. Start to write something that is useful for you—a tool that will help with something simple. And challenge yourself each week with something new. Don't get into the trap of DBA versus developer. There's no such thing as developer knowledge or DBA knowledge—there's only knowledge about the product.

What's the most common cause you see when IT projects go wrong? People who don't understand that nine women can't give birth to a child in a month—or who want things to be done quickly without proper testing and without thinking about security and scaling performance. It's also important to remember that if you hire developers and DBAs who lack experience, they need to be supported with appropriate education and guided by a manager who can help them learn quickly.

Tired of the “What Is DevOps?” Question?

Oracle Developer Champion Michael Hüttermann answered the question by writing a book about it.

By **Bob Rhubart**

DevOps consultant Michael Hüttermann grew so tired of answering the question “What is DevOps?” that he wrote a book. Five years later, he still gets the question on a daily basis, but now he can refer people to *DevOps for Developers* (Apress, 2012).

Hüttermann, an Oracle Developer Champion and Java Champion, describes his interest in DevOps as having evolved logically. “I recognized that languages are just the means for achieving a goal. I’m focusing on big projects and supporting big companies and big enterprises, and they often use a heterogeneous ecosystem involving many different languages and many different people,” he explains.

“DevOps is neither one single tool, nor is it a team,” says Oracle Developer Champion Michael Hüttermann.

“If you have the wrong expectations, the project or initiative can be very successful, but what is successful?”

—Michael Hüttermann, Oracle Developer Champion

“To make an IT initiative a success, it’s important to include all the different stakeholders and decision-makers and colleagues. From a more technical perspective, it’s important to include all different languages and platforms and artifact types to make a technically and functionally consistent release. That’s a DevOps background. All those different platforms and languages should be included in your efforts.”

That’s the plan. But getting there isn’t without challenges. “It’s still often the case that companies have a mismatch in their understanding of the value of processes and peopleware,” Hüttermann observes. Tools are a part of the formula. “It’s important to have very good tools and to integrate those tools with other tools to form great DevOps toolchains.”

What goes into those toolchains? “The major backbones are still the same,” Hüttermann says. “One example is Jenkins, which is often the foundation of many DevOps automation activities.” Farther down the toolchain, “It’s also important to have very powerful platforms to rely on, including cloud computing and microservices—all those neat things that help developers make their work even more productive and successful,” Hüttermann says.

But although the right tools are important, Hüttermann often sees too much focus on tools. “DevOps is neither one single tool, nor is it a team. Although there are good success stories, typically it’s not really one team; it’s a shared effort across different teams.

That’s indicative of one of the major DevOps challenges. “It’s all about expectations,” Hüttermann says. “In my daily work, I talk to prospects and customers and try to set the stage, to shape the expectations.” The wrong expectations can result in disappointment or, even worse, a false sense of success.

“If you have the wrong expectations, the project or initiative can be very successful, but what is successful? That’s often measured in terms of the expectations,” Hüttermann explains.

Of course, to have realistic DevOps expectations, organizations must accept and appreciate that DevOps matters. In his role as a consultant, Hüttermann devotes a lot of time and effort to that goal. "I support big companies on their DevOps path, helping them find the best approach and to utilize the best tools to achieve their goals," he explains. Across his considerable set of customers, "The problem and the solution remain the same. It's all about getting people and customers and companies to recognize that DevOps is important and not just an academic discussion. DevOps is really about values and improving the cycle time, and that's very important."

Hüttermann's interest and expertise in DevOps continues to evolve, as does the IT world he inhabits. "After so many decades in IT, there are always waves and evolutionary steps," he observes. "We do not invent anything from scratch nowadays. Everything is based on experience and lessons learned in the past. This includes languages and trends. Looking into the future, I'm optimistic."

That optimism, his ever-evolving expertise, and his willingness to share both are traits that helped Hüttermann earn his status as an Oracle Developer Champion.

Oracle Architect Community Manager Bob Rhubart 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.

PHOTOGRAPHY BY **MAREEN FISCHINGER/ THE VERBATIM AGENCY**

NEXT STEPS

LEARN more about Oracle Developer Champions.

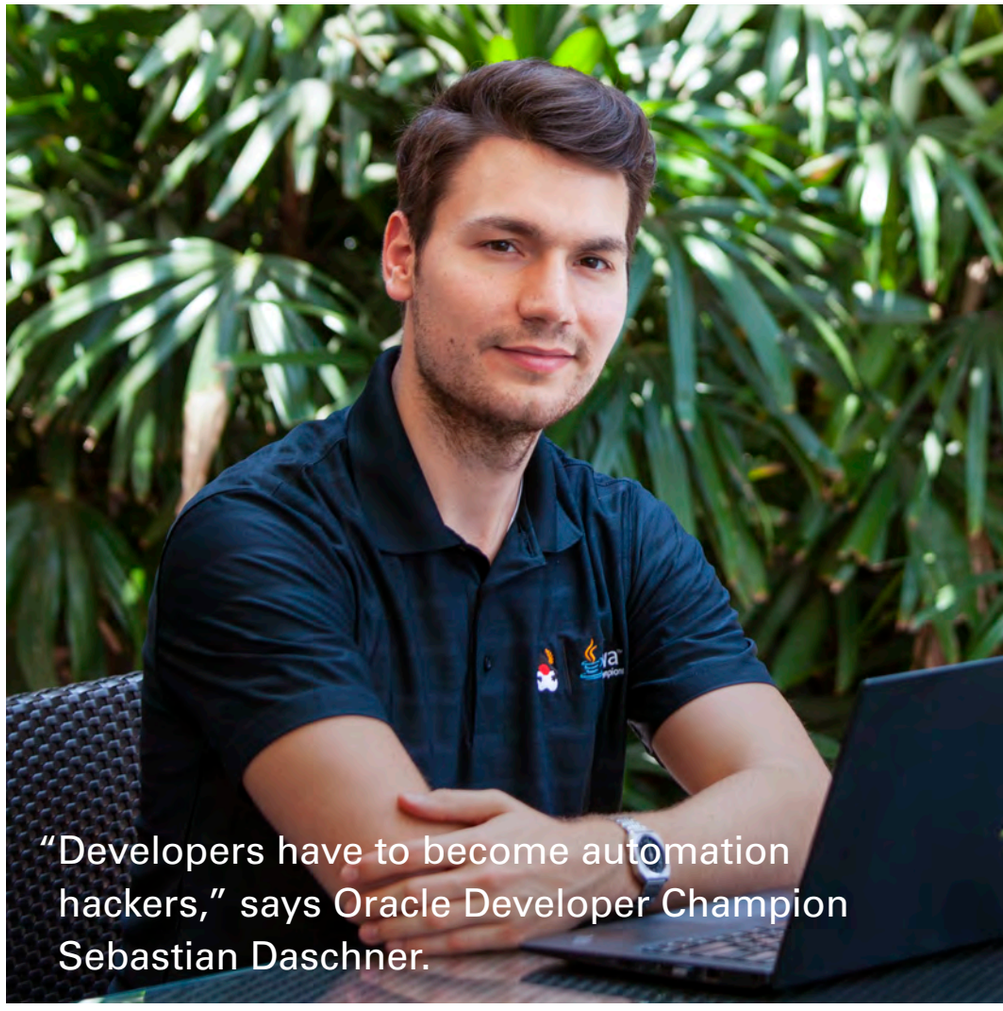
By **Alexandra Weber Morales**

Finding Flow

Ditch the GUI, script everything, plus more productivity tips from Oracle Developer Champion Sebastian Daschner.

It's a distinctive feeling every software developer knows: that moment when you're sucked into the vortex, blissfully impervious to distractions as your brain and fingers fly in concert and hours of productive coding pass by without struggle.

As psychologist Mihaly Csikszentmihalyi wrote in his seminal book *Flow: The Psychology of Optimal Experience* (Harper & Row, 1990), this feeling of being happily absorbed by a challenging task sans self-conscious rumination can be found among practitioners of any complex endeavor. One theory is that the temporary inactivation of the prefrontal cortex that neuroscientists observe during states of flow could be why we feel time distort and



"Developers have to become automation hackers," says Oracle Developer Champion Sebastian Daschner.

why our chattering inner critic dozes off.

Of course, we can't depend on being "in the zone" all the time, but we can set up triggers to get ourselves there faster—and stay there longer. Welcome to my new column for *Oracle Magazine* on developer productivity, where I'll focus on how developers in the increasingly fragmented and fast-moving world of technology can find flow. This first iteration focuses on insights from Sebastian Daschner, a Munich-based Java consultant and Oracle Developer Champion who is scheduled to present tips for developer productivity at multiple Oracle Code 2018 events.

LET COMPUTERS DO THE STUPID THINGS

"Developers have to become automation hackers," says Daschner. "They should reflect on what they are doing whenever they open up this window or change that function, and instead trigger a script or use keyboard shortcuts rather than the mouse. Use the fact that the computer can do stupid things really well."

Among computer programmers, those who automate their most mundane chores can become hallway legends. Daschner mentions the guy who wrote scripts to brew coffee at exactly the right time, based on how long it took to walk from his cubicle to the break room and to send a random excuse home to his spouse if he was logged in late at work. Indeed, many of the automation aspects of DevOps come from the same motivation to hand the mundane to computers. The process of checking in code, running a suite of tests, and integrating the new elements into the existing build, not to mention continuously deploying and maintaining code in production, were inspired because the process is dull and repeatable—especially for developers. And with Oracle's latest self-driving, self-securing, self-repairing cloud capabilities, the options for automating such work will only grow.

"Use the fact that the computer can do stupid things really well."

—Sebastian Daschner, Oracle Developer Champion

SCRIPT THE TOOLS YOU USE OFTEN

But before looking to optimize entire processes, have you optimized where the rubber meets the road: your own personal environment? There's no one-size-fits-all solution. Daschner's first recommendation is to start scripting or writing shortcuts for anything you find yourself typing frequently.

"I'm a heavy user of shell scripts. Also, the Linux environment I'm using is really supportive in scripting almost every-thing—even the UI. Besides that, I try to embrace every possible IntelliJ action I can."

For example, Daschner has set up his IntelliJ IDE so that typing "ijt" followed by Tab injects the correct import statement, which is something he otherwise would have to type out often when writing applications in Java Enterprise Edition.

GET RID OF THE GUI

The computer user experience has evolved to be highly visual, but visual is often not optimal for developers writing code—and using the mouse is anything but efficient. Instead, turn to the command line as much as possible, Daschner recommends.

One popular tool among developers is Vim (a clone of Bill Joy's vi text editor program for UNIX), which is packed with actions and macros. Vim encourages the touch-typing concept of keeping the hands on the home row (index fingers positioned on the ridges of the letters F and J) of the keyboard as much as possible.

CONSIDER A NEW KEYBOARD

Also, don't forget how your keyboard physically feels. Since 2008 or so, there's been a niche developer interest in mechanical keyboards, which use physical switches for each key—in fact, there's a forum dedicated to these devices. Daschner got into mechanical keyboards in "2012 or so, I think. I got more and more aware that I spend a considerable amount of every day

typing and wanted to have a better keyboard than what was available at my former employer."

Although they can be louder (clackier), heavier, and much more costly than standard keyboards, mechanical or capacitive switch keyboards such as Cherry Brown and Topre "may sound like expensive toys, but as developers we use these things for a lot of hours per day—carpenters wouldn't buy the cheapest tools in the hardware store, would they?" Daschner says.

HACK YOURSELF

Because he is writing about the topic, creating a web series, and giving talks at events such as Oracle Code, Daschner knows that it resonates among developers: "I've gotten very positive feedback, especially on the little tips and tricks, such as for better IDE or command line usage."

But more than the specific hacks, it's the mindset he wants to communicate: "I believe that the concepts behind these tricks that I try to get across in the presentation are even more important." Bottom line? Observe yourself; note what annoys, bores, distracts, or detains you; and program it out of your life.

Alexandra Weber Morales is Oracle director of developer content.

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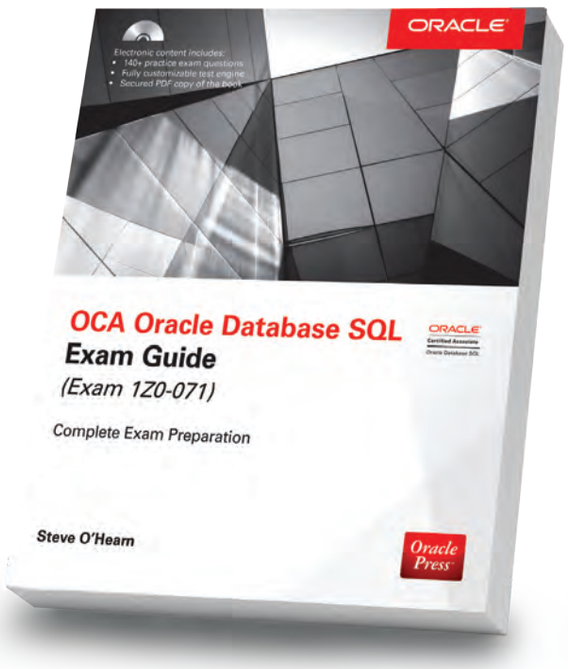

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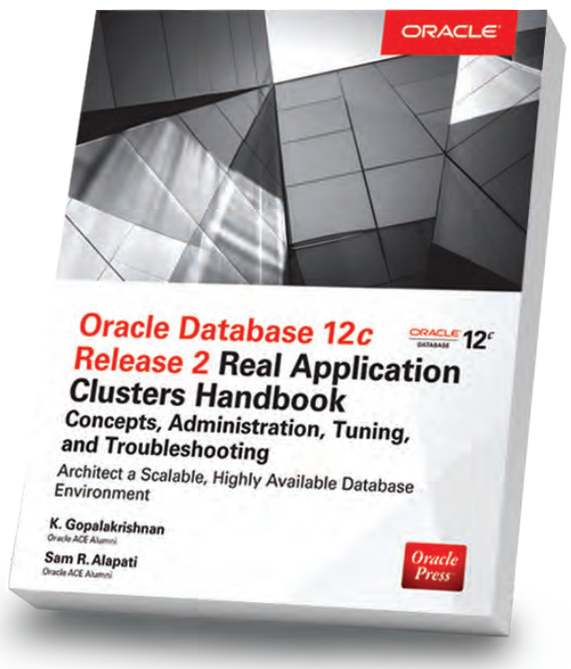

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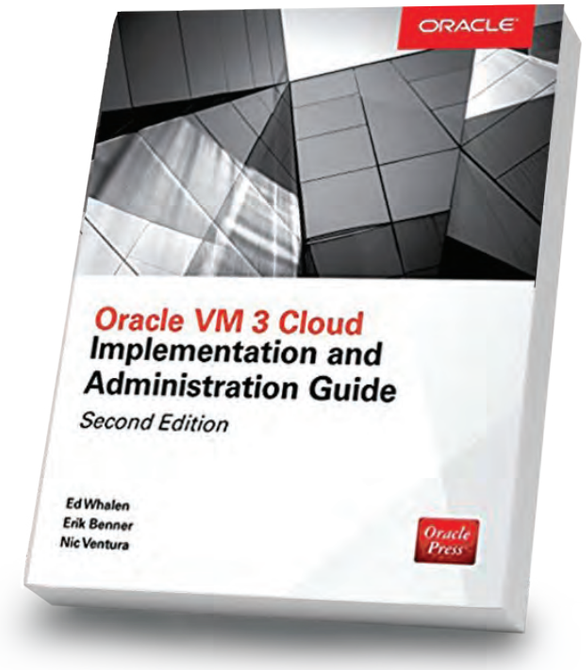

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INTERNET OF THINGS

The Business of Everywhere

How data from myriad IoT devices is driving unprecedented innovation

BY MIKE FADEN

Companies are transitioning from exploring the potential of the Internet of Things (IoT) to deploying production applications that deliver real business value. They're harnessing the flood of data from connected devices to achieve specific business goals, whether that means monitoring assets to improve business operations or using real-time production-line visibility to increase manufacturing efficiency.

"Compared to last year, we are starting to see a lot more IoT deployment," says Harish Gaur, senior director, product management, Internet of Things at Oracle. "Almost every company I talk to has an enterprise IoT initiative in its strategic roadmap."

To build those production IoT systems, companies are often integrating IoT platforms such as Oracle Internet of Things Cloud Enterprise (Oracle IoT Cloud Enterprise) with existing enterprise applications, enabling them to take advantage of IoT data throughout the business.

Concentrix
Fremont, California

INDUSTRY:
Business services

ORACLE PRODUCTS:
Oracle Internet of Things Cloud Enterprise
Oracle Service Cloud
Oracle Marketing Cloud
Oracle Social Cloud
Oracle CPQ Cloud Service
Oracle Integration Cloud
Oracle Monetization Cloud

Furthermore, Gaur says, some companies are using IoT data to develop new services that drive revenue and strengthen customer relationships.

An example is Concentrix, the global provider of strategy, technology, analytics, and high-value white-label customer interactions for some of the world's top brands, which is building new services for connected cars—widely seen as one of the first IoT markets to really take off.

Headquartered in Fremont, California, Concentrix has more than 120,000 employees in 125 locations; if you call tech support for a major household brand, the odds are you'll be talking to a Concentrix agent. The company uses Oracle Service Cloud to support those interactions and Oracle Marketing Cloud for marketing functions, including email campaigns.

Concentrix customers include 19 of the world's major automakers. For several of those manufacturers, Concentrix is developing connected-car appli-

Initially Concentrix developed connected-car applications focused on safety and other basic capabilities, according to David Cook, vice president of Connected Car Solutions at Concentrix. But the company realized there was the potential for additional services that enable automakers to generate additional revenue.

cations that generate revenue and provide a natural extension of its core customer-interaction business, according to David Cook, vice president of Connected Car Solutions at Concentrix.

These connected-car applications funnel information from the hundreds of sensors in today's high-tech vehicles into Oracle IoT Cloud Enterprise, which provides built-in capabilities to connect different devices, analyze data, and

> **“With the IoT data, automakers have the opportunity for greater engagement with the owners of the vehicles, and they’re able to educate them on the vehicle features.”**
>
> —**David Cook**, Vice President, Connected Car Solutions, Concentrix

integrate with other cloud-based and on-premises applications. Concentrix uses those integration capabilities to make the IoT data available within other Oracle Cloud services such as Oracle Service Cloud, so it can be used to help agents interact with customers and offer targeted services.

Initially Concentrix developed connected-car applications focused on safety and other basic capabilities, Cook says. If a car flips over or is in a collision, for example, sensors detect the accident and generate alerts that are relayed via Oracle IoT Cloud Enterprise to a call center agent, who can quickly see the location and condition of the car, start a voice conversation with the driver, and coordinate with roadside service or 911 emergency services if necessary.

Another application provides remote services such as enabling drivers to find and remotely lock and unlock their car from as much as a mile away by speaking into an app on their phone or smart watch—thus eliminating the age-old problem of locking the keys in the car. A third application lets drivers look up directions on their smartphones and then download the directions to the car’s dashboard navigation system.

But Concentrix realized there was the potential for additional services that enable automakers to generate additional revenue from their investment in connected-car technology while increasing car buyers’ satisfaction and strengthening the relationships between driver, manufacturer, and dealer.

For example, Concentrix now summarizes and analyzes each car’s IoT data to produce a monthly vehicle health report (VHR), which is emailed to customers, using Oracle Marketing Cloud. The personalized report gives drivers a

clear picture of the health of their vehicle based on real sensor data, including actual mileage and other dashboard information.

The report describes any maintenance and repairs that are needed, combined with relevant dealer service offers, warranty offers, and recall notices based on information from the sensors. That empowers car owners with a list of items that they can take to a dealer's service shop—thus avoiding potential uncertainty or haggling over the work that actually needs to be done. The report includes links to the dealer's service appointment system as well as service discount offers, which have helped to increase dealers' service business, Cook says. The email also includes links to videos that let users explore the vehicle's connected-car features. More than 56% of recipients open the VHRs, compared with the 10% or less open rate for traditional email coupon campaigns, and click-through rates are also high, according to Concentrix.

With services such as these, automakers have realized that the IoT data from connected cars can be used to deliver a much broader range of benefits, Cook says. "With the IoT data, automakers have the opportunity for greater engagement with the owners of the vehicles, and they're able to educate them on the vehicle features," he says.

Accordingly, Concentrix is building advanced applications that will further take advantage of connected-car data to provide other new services and enhance Concentrix' overall customer interaction business. For example, the company has created an agent screen in Oracle Service Cloud that includes an easy-to-understand visual representation of the vehicle, with icons representing the sensors. If the pressure in one tire becomes dangerously low, an icon turns red. The application can alert the car's owner and, if necessary, organize a visit by a service technician to fix the problem. Because the problem is automatically flagged by the sensor and transmitted via Oracle IoT Cloud Enterprise, the problem can be diagnosed and fixed even if the car is parked and the owner is away.

"The prebuilt integrations between Oracle IoT Cloud Enterprise and other enterprise applications was a game-changer for us," says Cook, "enabling us to quickly interconnect services to demonstrate how vehicle data can influence the entire omnichannel customer experience—

agent, chat, email, and social."

With Oracle's cloud-based software, Cook adds, Concentrix is able to rapidly develop services for new auto-manufacturer customers, typically being able to set up a new service for prelaunch acceptance by an automaker within 90 days. Notably, the cloud has eliminated the time-consuming tasks of building and configuring servers, which previously accounted for much of the time needed to create a new system. "And if we want to spin up new environments to conduct analysis or for a demonstration, it's easy to create them, use them for several months, and then drop them," Cook says.

Making Space Better

Whereas connected cars are one of the first IoT use cases, companies in other industries are also now starting to use IoT to drive business value. One of those companies is VINCI Facilities, a major facilities management provider for office buildings and other facilities across Europe. Based in Puteaux, France, VINCI Facilities has 8,000 employees supporting customers in more than 15 countries.

Today, a customer in one of those facilities can report a problem, such as a chilly conference room, via a smartphone or other device using a self-service portal that VINCI created using Oracle Service Cloud. The request generates a ticket that VINCI Facilities uses to track and respond to the problem, dispatching a field technician if necessary.

Now, VINCI Facilities is starting to install IoT devices with the goal of enabling the company to proactively detect, fix, and prevent problems—before users even notice and report them. The data generated by the devices may also generate other business benefits for VINCI Facilities customers, such as reduced energy costs and improved building utilization, says Julien Delbecchi, information system director at VINCI Facilities.

At several customer sites, VINCI Facilities is installing Rubik's Cube–like devices that sense environmental factors

VINCI Facilities
Puteaux, France

INDUSTRY:
Facilities management and building solutions

ORACLE PRODUCTS:
Oracle Internet of Things
Asset Monitoring Cloud Service
Oracle Service Cloud

"With the IoT sensors, we have a way to improve our business today. We will be able to detect a trend and improve the issue before customers say they are too hot or too cold," says Julien Delbecchi, information system director at VINCI Facilities.

such as temperature, humidity, light level, and noise. Designed to be placed unobtrusively on desks and in other locations, the devices are connected via a low-power wide-area wireless network. Every few minutes, the cubes send updated sensor data to Oracle Internet of Things Asset Monitoring Cloud Service (Oracle IoT Asset Monitoring Cloud Service).

In the initial implementation, Oracle IoT Asset Monitoring Cloud Service monitors the incoming data from the cubes and, based on rules created by VINCI Facilities, automatically generates a ticket if it detects a problem—for example, if a conference room's temperature drops below a predetermined threshold. VINCI Facilities can then send

a technician to fix the problem. “With the IoT sensors, we have a way to improve our business today,” Delbecchi says. “We will be able to detect a trend and improve the issue before customers say they’re too hot or too cold.”

But once more devices are installed and generating data, VINCI Facilities also plans more-advanced services that will analyze trends in the data to deliver a broader range of business benefits, such as optimizing energy consumption.

For example, the system could determine whether a change to the building’s HVAC temperature programming produces the right temperature in meeting rooms during the following week and make adjustments accordingly. By linking to the meeting-room reservation operations, the system might determine that nobody is expected to use the rooms on one side of a building on Friday afternoon, allowing the company to reduce energy consumption by shutting off the heat to those rooms.

Grow Your Data; Grow Your Business

Like Concentrix and VINCI Facilities, a growing number of companies are progressing beyond the IoT proof-of-concept stage and embarking on enterprise deployment. As they do, they’re integrating the information from IoT sensors with other enterprise applications to deliver business value. And increasingly, they’re using IoT to build new business models that provide a competitive advantage. As Oracle’s Gaur puts it, “Companies are getting very creative with the data that they get from their assets—and they are using this data to create new services.”

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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Building Complex Bot Responses with Ease

Learn to love the common response component and render complex and composite responses.

By Frank Nimphius

The Oracle Intelligent Bots feature of Oracle Mobile Cloud Enterprise uses built-in components to render bot responses in a dialogue flow. Being component-based is an advantage Oracle Intelligent Bots has over its competitors, because it enables bot designers to easily build bot conversations with no code.

The common response (CR) component is a relatively new component in Oracle Intelligent Bots that can render arbitrary complex and composite responses, thus making it even less likely that you'll need to write code.

ABOUT THE COMMON RESPONSE COMPONENT

With the rise of chatbots, messaging channels such as Facebook Messenger, Slack, and WeChat have become the equivalent of operating systems in client/server com-

puting. Also like operating systems, whereas all messaging channels do the same things, they differ in the UI they can render, the functionality they support, and the message structure—the payload—they require.

The CR component, like the Oracle Intelligent Bots list and text components, is built on top of a new channel-agnostic message model in Oracle Intelligent Bots that abstracts the channel specifics from component developers. For component developers, this new message model means that they can worry less and be more productive.

For more concept and reference information on the CR component, refer to the documentation.

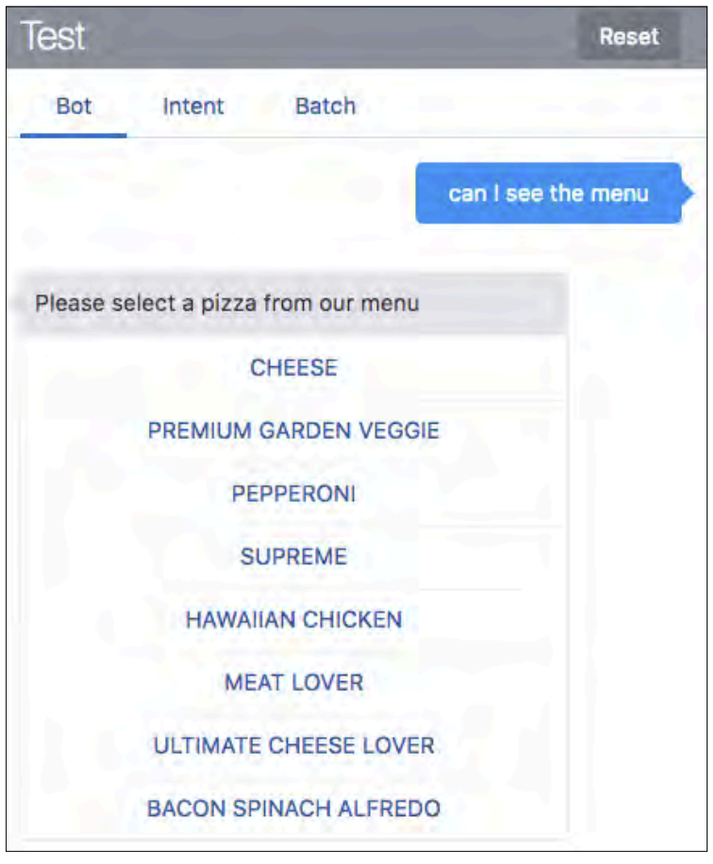


Figure 1: Pizza menu

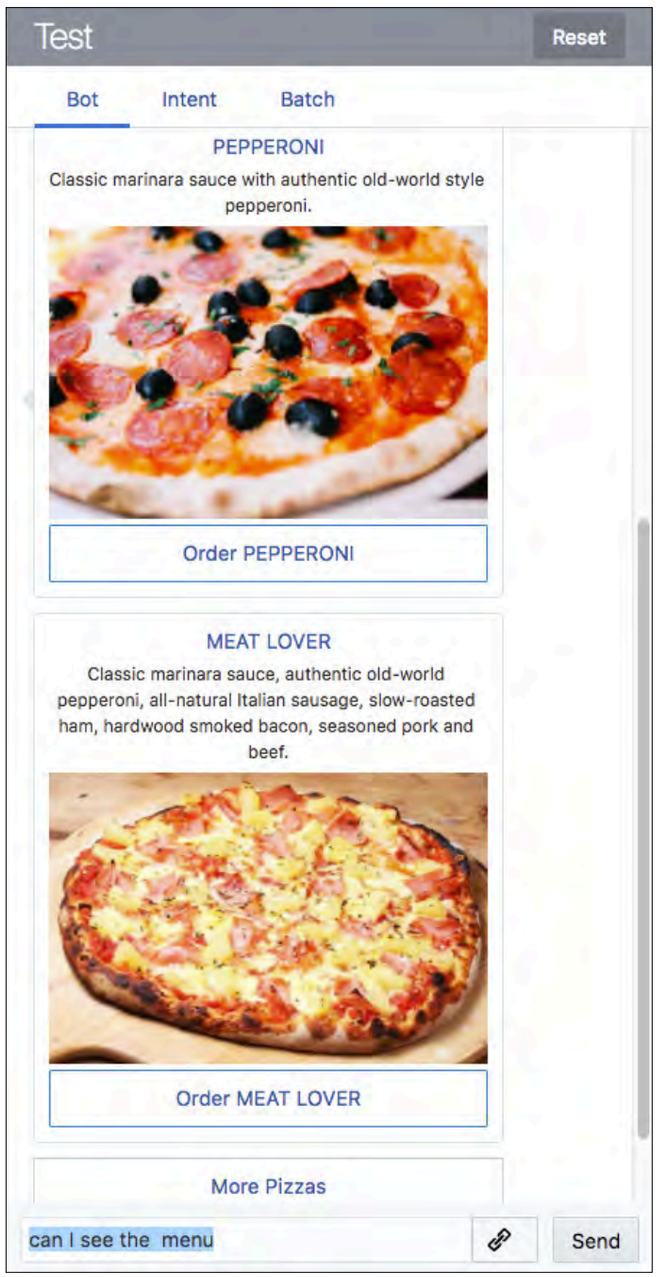
ABOUT THE HANDS-ON INSTRUCTIONS

Following the hands-on instructions in this article, you will learn how to use the CR component to build a visually rich select list. To follow the hands-on instructions, you need access to Oracle Mobile Cloud Enterprise, which is available as a free trial.

The starter bot for this article simulates a pizza ordering service. Users can order pizzas by typing, "I like to order a pizza" or "I like to order a pizza supreme." In the latter case, because the type of pizza is included in the user sentence already, no pizza menu from which the user can select a pizza type is displayed. Similarly, a user may type, "can I see the menu?" for the bot to display a list of pizzas the user can order (as shown in **Figure 1**).

For many use cases, the list-style menu displayed by the starter bot may work just fine. For *ordering pizza*, however, it certainly will *not* work.

Figure 2: CR component displaying the pizza menu



Users expect a richer UI that displays not only the name of a pizza but also a description and an image. In addition, instead of seeing all the pizzas on a single list, users may expect to be able to flip through the menu so they don't need to scroll (as shown in **Figure 2**).

In the hands-on steps for this article, you are going to

- Import the starter bot from the download for this article
- Test the functionality of the starter bot to ensure that the importation and training of the bot were successful
- Define the data for a richer pizza menu locally in a new context variable you create
- Define a variable used for pagination and initialize it to 0
- Add the CR component to replace the current list component
- Run and test the changes

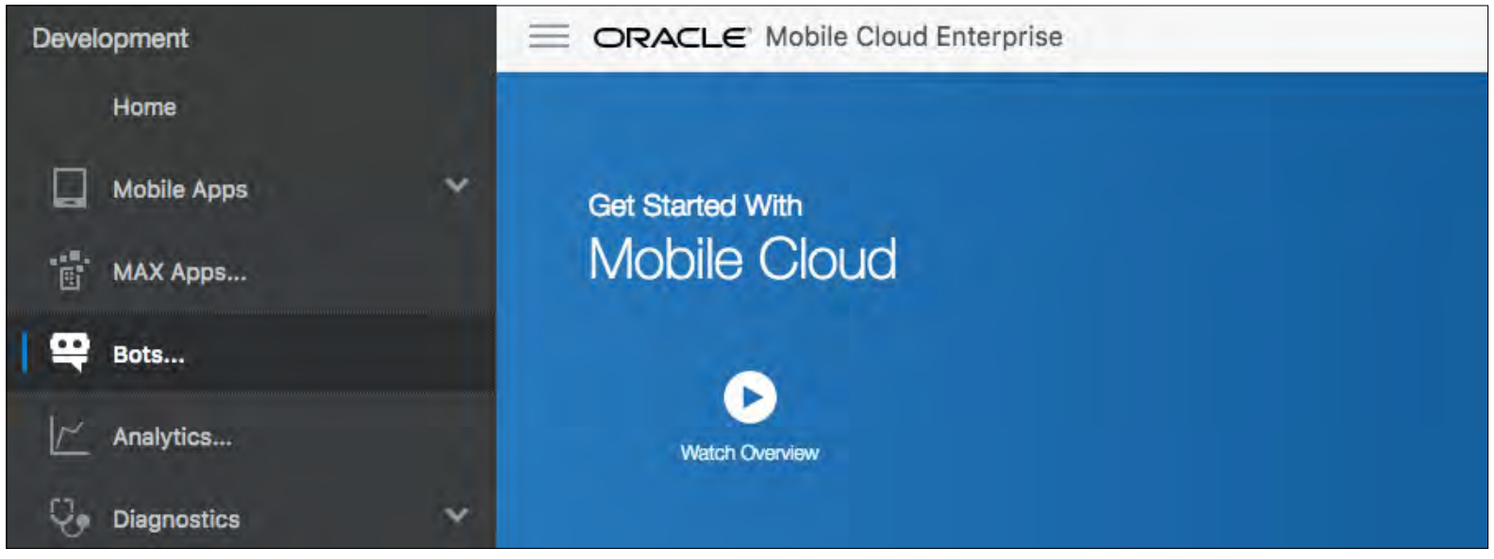
IMPORTING THE STARTER BOT

The download for this article contains a bot in the starter folder that you need to import to your Oracle Intelligent Bots instance to complete the hands-on steps for this article. To import the bot, download the zip file containing the starter bot and then do the following:

1. Open a browser, and access the Oracle Mobile Cloud Enterprise home page.
2. Authenticate with the user credentials you defined when you provisioned the cloud service.
3. Click the hamburger icon in the upper left to open the Oracle Mobile Cloud Enterprise menu.

4. Click the **Bots** menu item (shown in **Figure 3**), which opens the Oracle Intelligent Bots dashboard in a separate browser window or tab.
5. Click the **Import Bot** button in the upper right of the dashboard.
6. In the opened dialog box, navigate to the location to which you extracted the downloaded zip file and open the **starter** folder.
7. Select the **OracleMagazineOnlinePizzaBot2.zip** import file, and click **Open**.
8. Close the upload confirmation dialog box, by clicking the **X** at the right side.
9. 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.
10. Click the **OracleMagazineOnlinePizzaBot2** bot to open it.
11. Click **Train** (in the upper right of the screen). Before you click it, **Train** should show an exclamation point, because the bot is not yet trained after the down-

Figure 3: Oracle Mobile Cloud Enterprise with Oracle Intelligent Bots selected



load and import. After you click **Train**, a dialog box appears that confirms that the bot has been trained. Training the model is required for the bot to understand free text input.

Note: You cannot import two bots with the same name. If you need to import the starter bot more than once or if you share an Oracle Intelligent Bots instance, rename any previous imports of the starter bot before importing the new bot. You can rename a bot by opening it, clicking the **Settings** icon, renaming the bot, and exiting the bot.

TESTING THE STARTER BOT

Now that you have imported the bot and trained it, review the starter bot's functionality.

12. To run the embedded bot tester, click the test icon (▶—the right arrow in the upper right of the screen).
13. In the **Message** field, type `Hi`, and press the Enter key.
14. After the pizza bot welcomes you, type `I like to order a pizza` and press the Enter key.
15. Select a pizza from the displayed list.
16. Choose a size to complete the order.
17. Click the **Reset** button in the upper right corner of the tester to start over.
18. Type `I like to order a pizza supreme` and press the Enter key. This time the pizza menu is skipped, and you are asked for the size of the pizza you want.
19. Choose a size to complete the order.
20. Click the **Reset** button for one last test.
21. Type `Can I see the menu?`, and press the Enter key.

22. Don't choose an item from the menu, but instead type `I like a pizza pepperoni`.
23. Select a size to finish the order.
24. Click the test icon again to close the tester.

DEFINING THE NEW PIZZA MENU

The current implementation of the pizza menu reads the pizza types from values saved in the PizzaType custom entity. This, however, doesn't allow images and additional descriptions as required in this article. So, instead, you will create a context variable to hold the pizza menu definition.

25. Open the flow editing environment, by clicking the Flows icon ( ) on the left.
26. Create a new context variable—`pizzaMenu: "string"`—in the context | variables section of the dialogue flow, right below the `cancelOrderYesNo` variable. This variable will hold the menu content.

```
pizzaMenu: "string"
```

27. Next, click the **+ Components** button to add a new component to the flow.
28. In the opened dialog box, select the **Variables** category and then select **Set variable**.
29. Toggle the **Remove Comments** switch, and click the **Apply** button.
30. The previous step created a `setVariable:` state at the bottom of the editor. Rename the state `initializeMenu:`.
31. The `initializeMenu:` state needs to be moved to the top of the dialogue flow, so copy the `initializeMenu:` state and its content to the clipboard (Ctrl + C) and then delete it from the dialogue flow.

32. Navigate to the top of the dialogue flow, and paste the content of the clipboard right *below* the `states:` label.
33. Click the **Validate** link in the upper right. If validation succeeds, you should see an alert with a green icon. If the icon is red, chances are that the indenting of the pasted content is not correct. In this case, ensure that the `initializeMenu:` state is indented with two blank spaces, as in the `states:` label (see **Figure 4)**.

Figure 4: System.SetVariable with value property alignment

```
states:
  InitializeMenu:
    component: "System.SetVariable"
    properties:
      variable: "pizzaMenu"
      value:
      - name: "CHEESE"
        description: "Classic marinara sauce topp
        image: "https://cdn.pixabay.com/photo/201
      - name: "PEPPERONI"
        description: "Classic marinara sauce with
        image: "https://cdn.pixabay.com/photo/201
      - name: "MEAT LOVER"
```

34. Set the variable property of the `System.SetVariable` component to reference the "`pizzaMenu`" context variable. The `initializeMenu:` state should look like it does below.

```
initializeMenu:
        component: "System.SetVariable"
         properties:
```

```
variable: "pizzaMenu"
value:
```

35. To set the `System.SetVariable` value property, open the **menu.txt** file in the starter folder of the extracted download for this article in a text editor.
36. Copy all the content to the clipboard, and make sure you don't miss any leading blank characters.
37. In the flow editor, highlight the `System.SetVariable` value property and paste the content from the clipboard so it replaces the value string.
38. Ensure that the `value:` string pasted from the clipboard aligns with the variable property as shown in **Figure 4**.
39. Click the **Validate** link in the upper right to ensure proper indenting. Again, if you don't see an alert with a green icon, you need to adjust the formatting of the added content.

What you just did: You defined a new context variable and added the pizza menu definition to it. When defining the pizza menu items, you used Apache FreeMarker expressions. In a later article, you will learn how to dynamically query the pizza menu from a back-end system by using a custom component service in Oracle Intelligent Bots.

SETTING UP FOR PAGINATION

Pagination is a feature of the CR component that enables you to specify the start index and the range size for content rendered from an iterator. To prepare for pagination, create a context variable of type `"int"` to hold the index and initialize it with its first value, `0`.

40. Create a new variable, `cardsRangeStart`, in the context | variables section at the top of the dialogue flow:

```
cardsRangeStart: "int"
```

41. Next, click the **+ Components** button to add a new component to the flow.
42. In the opened dialog box, select the **Variables** category and **Set variable**.
43. From the **Insert After** select list, choose **initializeMenu**, so that the new component is created below.
44. Click **Apply**.
45. Change the name of the new state from `setVariable:` to `setCardsRangeStart:`.
46. Set the variable property value to `"cardsRangeStart"` and the value property value to `0`:

```
setCardsRangeStart:
        component: "System.SetVariable"
        properties:
          variable: "cardsRangeStart"
          value: 0
```

47. Click **Validate** to ensure proper indenting. Again, if you don't see an alert with a green icon, you need to adjust the formatting of the added content.

ADDING THE CR COMPONENT

In this section, you are going to replace the existing pizza menu list, which uses the `System.List` built-in component, with the `System.CommonResponse` component.

48. Scroll down to the `startOrder:` state.
49. Before you delete the `startOrder:` state, notice the `pizzaType` variable that is updated by the list component and also take note of the `iResult` variable. Both settings make it possible to *not* display the pizza menu list when user input strings contain the pizza type for an order. You will implement the same functionality with the CR component.
50. Delete the `startOrder:` state and all of its content.
51. Click **+ Components** at the top of the flow editor, and select the **User Interface** category in the opened dialog box.
52. Select the **Common response – card** entry, and ensure that the **Remove Comments** toggle is enabled so no component comments get added.
53. From the **Insert After** list, choose **unresolved** as the value. This adds the new CR component into the same spot in the flow editor that the `startOrder:` state was in.
54. Click **Apply**.
55. Change the generated state name `cardResponse:` to `startOrder:` to ensure that the bot conversation flow works as before.

What you just did: You replaced the list component with the CR component. The new card layout enables you to define a title, a description, and an image for each item on the menu. Next you are going to configure the card layout to read its values from the menu variable you defined earlier.

CONFIGURING THE CR COMPONENT

As you can see from the many properties that got added to the new `startOrder:` component definition, the common response component is very powerful.

Instead of setting up each property manually, the approach in the following steps loads the configuration from a text file and copies it into the dialogue flow.

The "Explaining the CR Component BotML Settings" section below explains what each property is, so you'll know how to reproduce the bot response in your own bot projects.

56. Open the **startOrder.txt** file you find in the starter folder of the extracted download for this article in a text editor.
57. Copy the whole content to the clipboard, and make sure you don't miss any leading blank characters.
58. In the flow editor, delete the `startOrder:` state and all of its content.
59. Place the cursor at the beginning of the line that previously held the `startOrder:` state.
60. Paste the content from the clipboard. The `startOrder:` state label should be aligned with the `unresolved:` state label above.
61. Click **Validate** to ensure proper indenting. Again, if you don't see an alert with a green icon, you need to work on the formatting of the added content.

What you just did: You configured the CR component to display a list of pizzas defined in the `pizzaMenu` variable. The start index for the cards is set to reference the `cardsRangeStart` variable so only three pizzas are displayed at a time. Note that the CR component properties that are not used in this sample were removed from the BotML definition.

TESTING THE BOT

At this point, the bot response has been changed from a simple list menu to one that responds with a rich card layout that users can flip through to select a pizza. Let's see what it looks like.

62. Click the tester icon (▶) at the right side of the top menu.

63. Click the **Reset** button to ensure a fresh session.
64. Type `Can I see the menu?` into the **Message** field, and press the Enter key.
65. Click the **More Pizzas** button to flip to the next three pizzas.
66. Select a pizza and then a size.
67. Click the **Reset** button.
68. Type `I like to order a pizza`, and press the Enter key.
69. Type `I want a pepperoni one`, and then choose a size to complete the process.
70. Click the **Reset** button again.
71. Now type `I want to order a large pepperoni pizza`. You should see the order printed immediately.
72. Close the tester by clicking the tester icon (▶) again.

What you just proved: With the first test, you ensured that the pagination feature worked when you displayed the menu with three pizzas per iteration. In the second test, you showed that you could select a pizza not only by clicking its **Order** button but also by typing the selection. Finally, in the last test, you showed that both menus are skipped if the user string contains all the information needed for the order.

EXPLAINING THE CR COMPONENT BOTML SETTINGS

Configuring the CR component in the hands-on application steps was done by copy-and-paste, which means that you didn't learn how the component works.

In this section, you will see all the component properties that were set to achieve the response you just saw in the tester.

To follow this component properties list in the sample application, navigate to the `startOrder:` state in the flow. The properties are explained from top to bottom.

CR component property	Description
`variable`	This references a context of type entity to validate user input. If you, for example, type `"salami"` when the pizza menu is displayed, the menu will appear again, because the value is not valid for the `PizzaType` entity.
`nlpResultVariable`	This property references the `iResult` variable (of type `nlpresult`). If this property is set, the component—before rendering the menu response—checks whether the user input string contains a valid pizza type. If it does, the menu will *not* appear.
`metadata`	The metadata section is where you can define the component response, using the various response types, such as card, text, and attachment. This is also where you define the action possible for the cards.
`cardLayout`	The `cardLayout` property defines whether cards are printed vertically or for horizontal scrolling. Valid values are `"vertical"` and `"horizontal"`.
`actions`	This property defines actions that are global for all cards. In the example, this setting is used to define the More Pizzas iterator button.
`rendered`	This property defines whether an element is shown in the response. For the More Pizzas button, it uses an Apache FreeMarker expression to hide the button when the last page in the list of pizzas is reached.
`payload`	The `payload` property of the `postback` action defines the action string that determines the next transition in the dialogue flow when the button is clicked as well as the variables and values that will be updated. In this case, the `cardsRangeStart` variable is updated with the next start index.

CR component property	Description
`cards`	The `cards` property defines the configuration of a single card. Multiple cards can be configured in BotML or, as in this example, generated from content in an iterator.
`title`	This property is the title of a card. `${pizzaMenu.name}` references the current item in an iterator and reads the name attribute from it.
`iteratorVariable`	This property references the `pizzaMenu` variable, which is an array of objects. For each entry in the array, the `cards` section prints a card.
`rangeStart`	This property references the `cardsRangestart` variable to indicate to the CR component where in the iterator it should start printing the cards.
`rangeSize`	This property defines how many cards should be printed, starting from the `rangeStart` index.
`actions`	This property defines an action for each individual card. In this example, the action is a postback that sets the `pizzaType` variable's value to the name of the selected pizza. In addition, it returns `"order"` as an action to prompt the dialogue flow to navigate to the `"askSize:"` state.
`processUserMessage`	If set to true, this property ensures that the component will wait for and handle user input.
`transitions`	This section defines where in a conversation the dialogue flow engine transitions to, based on the user interaction in the component. As you see, an action of `"order"` issued when the **Order** button is clicked leads the navigation to the `askSize:` state.

IMPORTING THE SOLUTION

This article also provides the completed pizza bot as a download. After you download and extract the completed pizza bot, do the following:

1. Go to the Oracle Intelligent Bots dashboard.
2. Click the **Import Bot** button in the upper right of the dashboard.
3. In the opened dialog box, navigate to the folder to which you extracted the downloaded zip file. Open the **final** folder, and select the **OracleMagazineOnlinePizzaBot2-final.zip** file.
4. Click **Open**.
5. Close the upload confirmation dialog box, by clicking the **X** at the right side.
6. 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.
7. Click the **OracleMagazineOnlinePizzaBot2** bot to open it.
8. Click **Train** (in the upper right of the screen). Before you click it, **Train** should show an exclamation point, because the bot has not yet been trained after the download and import. After you click **Train**, a dialog box appears that confirms that the bot has been trained.
9. Click the test icon to try the downloaded bot.

CONCLUSION

Both the component-based approach in which you build chatbot conversations in Oracle Intelligent Bots and the CR component deliver big productivity gains to chatbot developers using the Oracle platform. The CR component in particular saves bot designers a lot of programming time they otherwise would have to spend on

developing complex and composite responses for each of the channels they support.

In addition to learning how the CR component works, you also learned how to create mockup data in BotML by defining the pizza menu as the content of a context variable. Mockup data is useful when bot design and back-end data system integration are handled by different teams or at different times in a bot development project.

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NEXT STEPS

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OracleMagazine-OnlinePizzaBot2 (final).

By Steven Feuerstein

ORACLE DATABASE

Working with JSON Arrays in PL/SQL

Use the PL/SQL JSON_ARRAY_T object type to construct and manipulate in-memory JSON arrays.

As explored in my last Oracle Magazine article, Oracle Database 12c Release 2 adds several predefined object types to PL/SQL to enable 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.

You can use the new PL/SQL 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
- Transform existing JSON data
- Create JSON data by using complex rules that reflect the kind of per-row variation you can find in document-oriented applications

The PL/SQL JSON object types available for use are JSON_ELEMENT_T, JSON_OBJECT_T, JSON_ARRAY_T, and JSON_SCALAR_T. This article explores the JSON_ARRAY_T type in more detail.

JSON ARRAY BASICS

An array is a comma-delimited list of elements inside square brackets, as in

```
["SQL", "PL/SQL"]
```

The index for a JSON array starts at 0, which is different from the norm for PL/SQL collections, where nested tables and varrays start at index value 1. So the above array has elements defined at index values 0 and 1, not 1 and 2. The ordering of elements in an array is also significant.

A JSON array can contain scalars, objects, and arrays within it. The following are all valid JSON arrays:

- An array containing a single scalar value

```
[1]
```

- An array containing three scalar values

```
[1,2,"three"]
```

- An array containing three JSON objects

```
[{"object":1},{"inside":2},{"array":3}]
```

- An array containing a Boolean literal, an array of scalars, and an object

```
[true,
 [1,2,3],
 {"name":"steven"},
]
```

HOW BIG IS MY ARRAY?

The JSON_ARRAY_T object type offers a `get_size` method that returns the number of elements in the array. This method can iterate through *all* the elements of an array.

In the following block, I get the number of elements in the array and then use a loop to determine how many elements are in *each* array *within* that array.

```
DECLARE
   l_stuff        json_array_t;
BEGIN
   l_stuff :=
      json_array_t ('[
        ["Stirfry", "Yogurt", "Apple"],
        ["carpet", "rug", "tiles", "dirt", "concrete"],
        ["smile", "frown", "grimace", "puzzled"]
       ]');

   DBMS_OUTPUT.put_line (
      'Number of elements in array: ' || l_stuff.get_size ());

   FOR indx IN 0 .. l_stuff.get_size - 1
   LOOP
```

```
      DBMS_OUTPUT.put_line (l_stuff.get (indx).get_size ());
   END LOOP;
END;
```

Here's the output:

```
Number of elements in array: 3
3
5
4
```

If you've been working with PL/SQL as your primary language, you will be in the habit of writing a FOR loop on a nested table as follows:

```
FOR indx IN 1 .. l_stuff.COUNT
```

If you write the same thing for a JSON array, your code will raise an error. This is the one I've seen most—and it took me a little while and some tracing, the first time, to realize that that's what this error meant.

```
ORA-30625: method dispatch on NULL SELF argument is disallowed
```

BUILD YOUR OWN ARRAY

Sometimes an array is provided to you and you need to go exploring (see Recursive Looping Through an Array). Sometimes you need to construct an array from data in a table or your program.

The JSON_ARRAY_T object type offers several member procedures to BYOA (*build your own array*):

- **APPEND.** Appends a new item on the end of the array
- **APPEND_NULL.** Appends a null on the end of the array
- **PUT.** Adds or modifies an element at a specified position in the array
- **PUT_NULL.** Sets the value of an element at a specified position in the array to NULL

To demonstrate APPEND, I created a to_JSON package that converts a string-indexed associative array to a JSON array. (It also contains other to_JSON functions; check out the Live SQL script at the end of this article for the full implementation.)

In the to_JSON package, each element in the JSON array returned is a *JSON object* in the form

```
{"index-value":"item-value"}
```

where `index-value` is the string index value in the associative array and `item-value` is the value of the item at that location in the array.

Here's the to_JSON package specification; note that the associative array is indexed by a subtype, INDEX_T, which is defined as VARCHAR2 (50).

```
PACKAGE to_json AUTHID DEFINER
IS
   SUBTYPE index_t IS VARCHAR2 (50);

   TYPE assoc_array_t IS TABLE OF VARCHAR2 (100)
      INDEX BY index_t;
```

```
   FUNCTION to_object (key_in IN VARCHAR2, value_in IN VARCHAR2)
      RETURN json_object_t;

   FUNCTION to_array (assoc_array_in IN assoc_array_t)
      RETURN json_array_t;
END;
```

And here's the package body:

```
PACKAGE BODY to_json
IS
   FUNCTION to_object (key_in IN VARCHAR2, value_in IN VARCHAR2)
      RETURN json_object_t
   IS
   BEGIN
      RETURN json_object_t ('{"' || key_in || '":"' || value_in || '"}');
   END;

   FUNCTION to_array (assoc_array_in IN assoc_array_t)
      RETURN json_array_t
   IS
      l_index        index_t := assoc_array_in.FIRST;
      l_json_array   json_array_t := json_array_t ();
   BEGIN
      WHILE l_index IS NOT NULL
      LOOP
```

```
18          DBMS_OUTPUT.put_line (
19             'Appending ' || l_index || ':' || assoc_array_in (l_index));
20
21          l_json_array.append (to_object (l_index, assoc_array_in (l_index)));
22
23          DBMS_OUTPUT.put_line ('Watch it grow! ' || l_json_array.get_size ());
24
25          l_index := assoc_array_in.NEXT (l_index);
26       END LOOP;
27
28       RETURN l_json_array;
29    END;
30    END;
```

The `to_object` function hides all the details of constructing a valid JSON object from the key and the value. The following table explains the `to_array` function, line by line:

Line	Description
10–11	Accept an associative array and return a JSON array object type instance.
16	Because this is a string-indexed collection, I cannot use a `FOR indx IN 1 .. array.COUNT` approach. Instead, I start with the lowest-defined index value (retrieved on line 13 with a call to the FIRST function) and use a WHILE LOOP.
21	Call the JSON_OBJECT_T append member method to add an element to the end of the JSON array. What am I adding? I'm adding a JSON object constructed from the associative array index and item, using the `to_json.to_object` function.

25	Find the next defined index value (remember: strings!). The NEXT function returns NULL when going past the last index value, and that will stop the WHILE LOOP.
28	Finally, return the JSON array.

Let's run this conversion function through its paces. In the following block, I take advantage of the new-in-Oracle Database 18c qualified expression feature, enabling me to initialize the contents of a string-indexed array with a single expression. I then convert it to a JSON array and display the results, all in a single call to DBMS_OUTPUT.put_line:

```
DECLARE
   l_array to_json.assoc_array_t :=
      to_json.assoc_array_t (
         'yes' => 'you', 'can'=>'in', 'oracledatabase'=>'18c',
         'fullstop'=>NULL, 'and then'=>'some');
BEGIN
   DBMS_OUTPUT.put_line (to_json.to_array (l_array).to_string ());
END;
/
```

Here are the results:

```
Appending and then:some
Watch it grow! 1
Appending can:in
```

```
Watch it grow! 2
Appending fullstop:
Watch it grow! 3
Appending oracledatabase:18c
Watch it grow! 4
Appending yes:you
Watch it grow! 5
[{"andthen":"some"},{"can":"in"},{"fullstop":""},{"oracledatabase":"18c"},
{"yes":"you"}]
```

Note that the items in the JSON array are *not* in the same order in which they appeared in the qualified expression that populated the associative array. That's due to the automatic ordering by character set when values are put into a string-indexed collection.

REMOVE ELEMENTS FROM AN ARRAY

When it comes to JSON arrays, what PL/SQL giveth, PL/SQL can also taketh away. You can use the `remove` method to remove an element from an array at a specific location.

In the following block, I remove any element from the array of strings if it cannot be converted to a number.

```
DECLARE
   l_nums   json_array_t := json_array_t ('["123","123.456","abc","19e10"]');
BEGIN
   FOR indx IN REVERSE 0 .. l_nums.get_size - 1
```

```
   LOOP
      IF l_nums.get_number (indx) IS NULL
      THEN
         l_nums.remove (indx);
      END IF;
   END LOOP;
   DBMS_OUTPUT.put_line (l_nums.stringify ());
END;
/
```

After execution, I see this text displayed:

```
["123","123.456","19e10"]
```

This block takes advantage of the fact that the default mode for error handling with PL/SQL JSON object type methods is to return NULL if there is an error. So I just check to see if the result of `get_number` is NULL.

If I "escalate" error handling in this same block by putting this line

```
l_nums.on_error (1);
```

right after the BEGIN, it will fail with this unhandled exception when I run the block:

```
ORA-40566: JSON path expression selected a value of different data type.
```

RECURSIVE LOOPING THROUGH AN ARRAY

Some JSON arrays are simple lists of scalars or even objects. But many arrays have other arrays within them. And with these arrays-with-nested-arrays, you might want to iterate through all the *leaves* in that hierarchical structure. The easiest way to do that is with recursion. Let's build a procedure to do just that.

First I create a `put_line` helper procedure to display the string, indented to show its place in the JSON array hierarchy:

```
CREATE OR REPLACE PROCEDURE put_line (
   string_in   IN VARCHAR2,
   pad_in      IN INTEGER DEFAULT 0)
IS
BEGIN
   DBMS_OUTPUT.put_line (LPAD (' ', pad_in * 3) || string_in);
END;
/
```

My version of DBMS_OUTPUT.put_line is used in several places in the following `json_array_traversal` procedure.

```
1 CREATE OR REPLACE PROCEDURE json_array_traversal (
2    json_document_in   IN CLOB,
3    leaf_action_in     IN VARCHAR2,
4    level_in           IN INTEGER DEFAULT 0)
5 IS
6    l_array     json_array_t;
```

```
   l_object    json_object_t;
   l_keys      json_key_list;
   l_element   json_element_t;
BEGIN
   l_array := json_array_t.parse (json_document_in);

   put_line ('Traverse: ' || l_array.stringify (), level_in);

   FOR indx IN 0 .. l_array.get_size - 1
   LOOP
      put_line ('Index: ' || indx, level_in);

   CASE
      WHEN l_array.get (indx).is_string
      THEN
         EXECUTE IMMEDIATE leaf_action_in
            USING l_array.get_string (indx), level_in;
      WHEN l_array.get (indx).is_object
      THEN
         l_object := TREAT (l_array.get (indx) AS json_object_t);

         l_keys := l_object.get_keys;

         FOR k_index IN 1 .. l_keys.COUNT
         LOOP
            EXECUTE IMMEDIATE leaf_action_in
```

```
33                  USING l_keys (k_index), level_in;
34            END LOOP;
35         WHEN l_array.get (indx).is_array
36         THEN
37            json_array_traversal (
38               TREAT (l_array.get (indx) AS json_array_t).stringify (),
39               leaf_action_in,
40               level_in + 1);
41         ELSE
42            DBMS_OUTPUT.put_line (
43               '*** No match for type on array index ' || indx);
44      END CASE;
45      END LOOP;
46   END;
```

The following table explains the points of interest in the `json_array_traversal` procedure, line by line.

Line	Description
2–4	Pass in a CLOB containing a JSON document, which, for this procedure, should be an array. The actual value for the "leaf action" parameter (`leaf_action_in`) is a dynamic PL/SQL block to be executed when a leaf is encountered. It is unlikely that you would use anything this generic in production code, but it could be very handy as a utility.
6–9	Define a number of instances of JSON object types: an array, object, key list, and element.

11 Parse the document (text) into a hierarchical in-memory representation. At this point, if `json_document_in` is *not* a valid array, the following error will be raised:

```
ORA-40587: invalid JSON type
```

You can verify this with the following block:

```
DECLARE
   l_doc   CLOB := '{"name":"Spider"}';
BEGIN
   json_array_traversal (
      l_doc,
      q'[BEGIN NULL; END;]');
END;
```

13 Display the document passed in, taking advantage of the `stringify` method.

15 Iterate through each element in the array. The `get_size` method returns the number of elements in the array. Remember that JSON array indexes start with zero (0). So this works:

```
FOR indx IN 0 .. l_array.get_size - 1
```

But a formulation consistent with iteration through a PL/SQL nested table, such as

```
FOR indx IN 1 .. l_array.get_size
```

is likely to result in this error:

```
ORA-30625: method dispatch on NULL SELF argument is disallowed
```

19 Because an element in an array can be a scalar, object, or another array, provide a WHEN clause for each possibility. Well, not *each and every possibility*. There are more types of scalars than string, but I leave the expansion of the CASE statement to cover all scalar types.

20–23	If the element is a scalar string, use native dynamic SQL to execute the provided PL/SQL block. I pass the string value (by calling the `get_string` method for that index value) and the level (so that the entry is properly indented in the output).
24	Handle the element, which is a JSON object.
26	Cast the array element into a JSON object type instance.
28	Get the names of all the keys in the object.
30–34	Call the leaf action for each of the key values. Note: This is the action I chose to perform for an object. In a more complete implementation, you would iterate through the values of the object and take specific action, depending on the value's type. For example, an object could have an array within it, as in `{"chicken_noises":["click","clack","cluck"]`
35	If the element in this index of the array is itself an array, call the `json_array_traversal` procedure recursively, passing 1. This element, cast to an array and then converted back to string format 2. The same leaf action dynamic block 3. The level, raised by 1

When I call this traversal procedure as follows:

```
DECLARE
   l_doc   CLOB :=
      '["Stirfry",
        {"name":"Spider"},
        "Mosquitos",
        ["finger","toe","nose"]
       ]';
```

```
BEGIN
   json_array_traversal (
      l_doc,
      q'[BEGIN put_line ('Leaf: '|| :val, :tlevel);  END;]');
END;
/
```

I see this output:

```
Traverse: ["Stirfry",{"name":"Spider"},"Mosquitos",["finger","toe","nose"]]
Index: 0
Leaf: Stirfry
Index: 1
Leaf: name
Index: 2
Leaf: Mosquitos
Index: 3
   Traverse: ["finger","toe","nose"]
   Index: 0
   Leaf: finger
   Index: 1
   Leaf: toe
   Index: 2
   Leaf: nose
```

And with the following invocation:

```
DECLARE
   l_doc   CLOB := '["Stirfry",
        {"name":"Spider"},
        "Mosquitos",
        ["finger",
         "toe",
         [{"object":1},{"inside":2},{"array":3}]
        ],
        {"elbow":"tennis"}
       ]';
BEGIN
   json_array_traversal (
      l_doc,
      q'[BEGIN put_line ('Leaf: '|| :val, :tlevel);  END;]');
END;
/
```

I see this:

```
Traverse: ["Stirfry",{"name":"Spider"},"Mosquitos",["finger","toe",[{"object":1},
{"inside":2},{"array":3}]],{"elbow":"tennis"}]
Index: 0
Leaf: Stirfry
Index: 1
```

```
Leaf: name
Index: 2
Leaf: Mosquitos
Index: 3
   Traverse: ["finger","toe",[{"object":1},{"inside":2},{"array":3}]]
   Index: 0
   Leaf: finger
   Index: 1
   Leaf: toe
   Index: 2
      Traverse: [{"object":1},{"inside":2},{"array":3}]
      Index: 0
      Leaf: object
      Index: 1
      Leaf: inside
      Index: 2
      Leaf: array
Index: 4
Leaf: elbow
```

A RAY OF SUNSHINE WITH JSON ARRAYS

JSON arrays are widely and heavily used. They are also extremely flexible, because they can contain scalars, objects, and other arrays. The more complex and nested the structure of your JSON array, the more challenging it can be to work with.

The JSON_ARRAY_T object type offers a clean, fast API for interrogating and constructing JSON arrays. Once you are able to correlate PL/SQL arrays with JSON

arrays (correcting for differences in indexing, for example), you will find it easy to productively write code to work with JSON arrays in your PL/SQL code.

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) provide in-depth resources for Oracle Database developers.*

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.

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

- JSON array traversal
- The to_json package

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

ORACLE DATABASE

Perform Basic CRUD Operations with cx_Oracle, Part 2

Here's how to use Python for CRUD operations in Oracle Database.

By Blaine Carter

Python is a powerful open source language, and the cx_Oracle driver gives your Python application access to the full power of Oracle Database.

In this article series, I'm going to take a look at how to perform CRUD (create, retrieve, update, and delete) operations in Python with the cx_Oracle driver. Part 1 of this series included setup information and examples for *create*: the *C* in *CRUD*. This article, part 2, continues with information and examples on how to perform operations for the *R* in *CRUD—retrieve*. For setup information for the complete article series—including links and instructions for downloading the cx_Oracle driver and setting up the sample data—refer to "Perform Basic CRUD Operations Using CX_ORACLE, Part 1."

RUN A SIMPLE QUERY

With the cx_Oracle driver installed and the setup complete, you will perform a simple query that pulls all the records in no particular order.

First, create a select.py file that includes the following code:

```
import cx_Oracle
import os
connectString = os.getenv('DB_CONNECT')
# The environment variable for the connect string:
DB_CONNECT=user/password@database
con = cx_Oracle.connect(connectString)

# Your code here
```

For the different examples in this article, replace

```
# Your code here
```

with the specified code. To run this first simple query, replace

```
# Your code here
```

with the following:

```
# Query all rows
cur = con.cursor()
```

```
statement = 'select id, name, age, notes from cx_people'
cur.execute(statement)
res = cur.fetchall()
print (res)
```

When I run select.py in my Python session, I see

```
[(1, 'Bob', 35, 'I like dogs'), (2, 'Kim', 27, 'I like birds')]
```

Here's what the code does:

1. Gets a cursor object from your connection. You will use this cursor to perform your database operations.
2. Prepares a SQL SELECT statement specifying the columns wanted from the table.
3. Executes the statement.
4. Fetches the results into a variable.
5. Prints the results.

DEEPER DIVE

Now modify the SELECT statement to order the results by age. When you're done, the results should be

```
[(2, 'Kim', 27, 'I like birds'), (1, 'Bob', 35, 'I like dogs')]
```

What does the successful code look like? Here's the answer:

```
cur = con.cursor()
statement = 'select id, name, age, notes from cx_people order by age'
cur.execute(statement)
res = cur.fetchall()
print (res)
```

SELECT SPECIFIC ROWS

Now I want to see only the data for Kim. I want, therefore, to restrict the rows returned by SELECT. This is done with a WHERE clause, and there are several ways to do it.

I could put the WHERE clause in the `statement`, and it would work:

```
statement = "select id, name, age, notes from cx_people where name = 'Kim'"
```

However, I want to choose the name at runtime and store it in a variable called `person_name`. I could accept the value as an argument or pass it into a function, but I'll just set a variable to keep it simple.

It *is* possible to simply concatenate the value into the statement, but *this is very dangerous* and opens the code to a SQL injection attack. I won't be going into detail on SQL injection in this series, but you should, generally, not allow end user input to be fed directly into a dynamic SQL statement.

A much safer way to pass external values into a SQL statement is by using bind variables with prepared statements. You have a couple of different options:

Positional. You can use a positional statement to pass in the values:

```
cur.execute('select id, name, age, notes
from cx_people where name=:1 and age=:2', ('Bob', 35))
```

```
cur.execute('select id, name, age, notes
from cx_people where name = :2 and age = :1', ('Bob', 35))
```

Note that the `:1` and the `:2` are switched in the two examples. With a positional statement, the labels do not matter; it could just as well have been `:1` and `:something`. What matters is that the first variable in the statement will be assigned the first of the provided values (`'Bob'`) and the second variable in the statement will be assigned the second value (`35`).

Named. You can use a statement that passes in the values by name:

```
cur.execute('select id, name, age, notes
from cx_people where name = :name and age = :age', {'name':'Bob', 'age':35})
```

```
cur.execute('select id, name, age, notes
from cx_people where name = :name and age = :age', {'age':35, 'name':'Bob'})
```

With this method, the `:name` variable will be assigned the value of `'name'` in the provided key value set.

Note, in both examples, that you do not wrap the bind variable for `:name` with quotes. This is handled automatically when the statement is prepared for execution. Here's an example that passes in values by name:

```
# Query for Kim
cur = con.cursor()
person_name = 'Kim'
statement = 'select id, name, age, notes from cx_people where name = :name'
```

```
cur.execute(statement, {'name':person_name})
res = cur.fetchall()
print (res)
```

This will return only the data for Kim:

```
[(2, 'Kim', 27, 'I like birds')]
```

Here's what the code does:

1. Gets a cursor object from the connection. You will use this cursor to perform your database operations.
2. Assigns `'Kim'` to `person_name`.
3. Prepares a SQL statement, using a bind variable.
4. With the cursor, executes the query by using the prepared statement.
5. Fetches the results from the cursor into a variable.
6. Prints the results.

ANOTHER DEEPER DIVE

Now modify the previous statement and variable to retrieve people older than 30. When you're done, the results should be

```
[(1, 'Bob', 35, 'I like dogs')]
```

What does the successful code look like? Here's the answer:

```
cur = con.cursor()
person_age = 30
statement = 'select id, name, age, notes from cx_people where age &gt; :age'
cur.execute(statement, {'age':person_age})
res = cur.fetchall()
print (res)
```

SOME OTHER THINGS YOU COULD TRY

Here are some other things to try for retrieving the sample data:

- Join the cx_people and cx_pets tables to retrieve people and their pets.
- Retrieve only a person's name and age.
- Change the result order to display the results in descending order.

Hint: If you have trouble getting a query to run in your code, try running it in SQL *Plus or another database console tool. This will help you determine whether the problem is with the query or the code.

The next article in this series will cover the *U* in *CRUD*: *update*.

Blaine Carter is the Oracle developer advocate for open source. He applies his exploratory eye and tinkering inclinations to the intersection of open source software and Oracle Database.

NEXT STEPS

DOWNLOAD cx_Oracle.

GET this article's code examples from GitHub.

READ Part 1 of this article series.

By Dan McGhan

Build REST APIs for Node.js, Part 1

Start by learning about web server basics.

Node.js and REST APIs go hand in hand. In fact, Ryan Dahl (the creator of Node.js) once described the focus of Node.js as "doing networking correctly." But where should you start when building a REST API for Node.js? What components should be used, and how should things be organized? These are surprisingly difficult questions to answer—especially when you're new to the Node.js ecosystem.

You could choose to use low-level packages and lots of custom code to build an API that's highly optimized for a specific workload. Or you could use an all-in-one framework such as Sails, where many of the decisions have been made for you. There is no right or wrong answer—the best option will depend on the type of project you're working on and where you want to invest your time.

In this article series, I'll assume you're new to Node.js and show you how to build a REST API that attempts to balance granular control and magical black boxes. The goal will be to create an API that supports basic create, read, update, and delete

(CRUD) functionality on the EMPLOYEES table in the HR sample schema. By the end of this series, you should be able to make decisions about what's best for your own projects.

This first article focuses on web server basics. Future articles will cover topics such as database basics (including connection pooling), handling various types of HTTP requests, and more.

TARGET ENVIRONMENT

For consistency, the instructions I use throughout the series will assume that you're working with the Oracle Database developer VM and that Node.js version 8 or higher is installed in the VM. See this post for instructions on setting up this type of environment.

I generally prefer to run Node.js in my host OS and communicate with the database in the guest VM. You can adapt the instructions to do this if you want; just be aware that doing so will require additional installation steps to get the driver working on your platform.

HIGH-LEVEL COMPONENTS

I like to organize my REST APIs into four core components or layers. Incoming HTTP requests will usually touch each of these layers in turn. There may be a lot more going on, depending on the features an API supports, but the following components are required:

- **Web server.** The role of the web server is to accept incoming HTTP requests and send responses. There are many options for web servers in Node.js. At the lowest level, you could use the built-in modules, such as http, https, and http2. For most

folks, those modules will be too low-level. I like to use Express for the web server, because it's very popular, flexible, and easy to use. There are many other web server options, including restify, kracken, and hapi. You might consider some of these options as you experiment more with APIs over time.

- **Router.** Routing logic is used to define the URL endpoints and HTTP methods the API will support. At runtime this layer will map incoming requests to the appropriate controller logic. The implementation of the routing logic is almost always tied to the choice of web server, because most include a means to define routes. I'll use the Router class that comes with Express in this series.
- **Controllers.** The controller layer includes one JavaScript function for each URL path/HTTP method combination. The function will inspect and pull data from the incoming request (URL, body, and HTTP headers) as needed, interact with appropriate database APIs to fetch or persist data, and then generate the HTTP response.
- **Database APIs.** The database APIs will handle the interactions with the database. This layer will be isolated from the HTTP request and response. Some developers will prefer to use an object-relational mapper (ORM), such as Sequelize, to abstract away the database as much as possible. For those folks, this layer is often called the model layer, because ORMs work by defining models in the middle tier. I'm going to stay lower-level and work directly with the Oracle Database driver for Node.js (node-oracledb).

STARTING UP AND SAYING HELLO

The code in this project will be organized with a generic directory structure that can be adjusted and built out over time as needed.

With your setup—the Oracle Database developer VM and Node.js version 8 or higher installed in it—complete, open a new terminal by going to **Applications** -> **Favorites** -> **Terminal** and then run the following commands:

```
cd ~
mkdir hr_app
cd hr_app/
touch index.js
mkdir config
touch config/web-server.js
mkdir controllers
mkdir db_apis
mkdir services
touch services/web-server.js
```

The project will be contained in the hr_app directory. The directories within hr_app should be easy to understand, based on their names and the "High-Level Components" overview above. The index.js file can be thought of as the main file in a Java app—it will be the entry point of the application. You will be adding code to that file and the web-server.js files in the config and services directories in this article.

Go to **Applications** -> **Favorites** -> **Files** to open the file browser, and navigate to **Home** -> **hr_app** -> **config**. Double-click **web-server.js** to open it in the gedit text editor. Copy and paste the following code into the file, and save your changes.

```
module.exports = {
```

```
  port: process.env.HTTP_PORT || 3000
};
```

This is a simple JavaScript module that exposes a single property named `port`. In Node.js, the `process` object has an `env` property that contains the user environment. I'm using that to set the value of `port` to the value of the environment variable `HTTP_PORT`. If that environment variable isn't defined, the default value will be 3000. It's common to derive port values from environment variables, because they may vary in different environments or be randomly assigned at runtime.

With the configuration file ready, you can turn your attention to the web server module. Open the **services/web-server.js file** in gedit. Copy and paste the following code into the file, and save your changes.

```
1  const http = require('http');
2  const express = require('express');
3  const webServerConfig = require('../config/web-server.js');
4
5  let httpServer;
6
7  function initialize() {
8    return new Promise((resolve, reject) => {
9      const app = express();
10     httpServer = http.createServer(app);
11
12     app.get('/', (req, res) => {
13       res.end('Hello World!');
```

```
14    });
15
16    httpServer.listen(webServerConfig.port, err => {
17      if (err) {
18        reject(err);
19        return;
20      }
21
22      console.log('Web server listening on localhost:${webServerConfig.port}');
23
24      resolve();
25    });
26  });
27  }
28
29  module.exports.initialize = initialize;
```

Here's a line-by-line breakdown of the web server module so far:

Lines	Description
1–3	Several modules are required. The http module is included with Node.js, but the express module will need to be installed via npm.
7–27	A function named `initialize` is declared. The function immediately returns a promise, which is resolved or rejected, depending on whether the web server is started successfully.

9–10	A new Express application is created (which is really just a function) and then used to create an HTTP server via the http module.
12–14	The app's `get` method is used to add a handler for GET requests that come in on the root (/) path. The callback function (also called a middleware function) will be invoked when such a request is received, and it will use the "response" parameter (`res`) to send a "Hello World!" response to the client.
16–25	The server's `listen` method is used to bind to the specified port and start listening for incoming requests.
29	The `initialize` function is exported from the module so it can be invoked externally.

With the web server module defined, you can put it to use in the main module. Open **index.js**, copy and paste the following code into it, and save your changes.

```
const webServer = require('./services/web-server.js');

async function startup() {
  console.log('Starting application');

  try {
    console.log('Initializing web server module');

    await webServer.initialize();
  } catch (err) {
    console.error(err);
```

```
    process.exit(1); // Non-zero failure code
  }
}

startup();
```

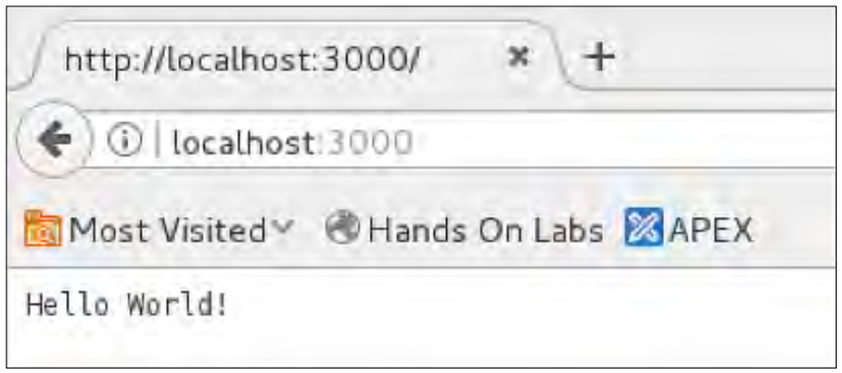
The main module brings in the web server module, and then it defines and invokes an async function named `startup`. Because the web server module's `initialize` function returns a promise, you can use it with async/await and wrap it in a `try-catch` block (follow this link to learn more about async/await). If the `initialize` function finishes successfully, the web server will be running; otherwise, any exceptions will be caught and handled.

All you need to do now is initialize `npm` and install Express—then you can run the app. Run the following commands in the terminal from the hr_app directory:

```
npm init -y
npm install express -s
node .
```

The `npm init` command creates the package.json file, which `npm` uses as a manifest file (the -y flag accepts the default options). The `npm install` command is used to install Express (the -s flag adds Express to the list of dependencies in package.json). `npm` stores the modules you install in the node_modules directory and also creates a file named package.lock.json to ensure that module trees are identical across a team of developers.

Figure 1: Accessing the web server and the application



Do you see a message telling you that the web server is listening on localhost:3000? Congratulations, you've created an Express-based web server! Open Firefox, and navigate to http://localhost:3000, as shown in **Figure 1**.

There it is, yet another "Hello World!" Although not particularly exciting, it's an important first step for your API. When you're ready, you can shut down the server by returning to the terminal and pressing Ctrl + c.

CONTROLLING THE SHUTDOWN

Although shutting down by pressing Ctrl + c works, you didn't have much control over how it happened. To control the shutdown process, you will need to explicitly close the web server and exit the Node.js process.

Append the following code to the bottom of the web server module.

```
// *** previous code above this line ***

function close() {
  return new Promise((resolve, reject) => {
```

```
    httpServer.close((err) => {
      if (err) {
        reject(err);
        return;
      }

      resolve();
    });
  });
}

module.exports.close = close;
```

The `close` function returns a promise that is resolved when the web server is successfully closed. The `httpServer.close` method stops new connections from being established, but it will not force already opened connections closed. Depending on how many connections are open and what they are doing, you might have to wait a bit for the callback to fire. Although you will not do it in this application, it is possible to use custom code or `npm` modules, such as http-shutdown, to force open connections to close.

With the `close` function in place, the main module can be updated to invoke it at the right times. Append the following code to the end of index.js:

```
// *** previous code above this line ***

async function shutdown(e) {
```

```
    let err = e;

    console.log('Shutting down');

    try {
      console.log('Closing web server module');

      await webServer.close();
    } catch (e) {
      console.log('Encountered error', e);

      err = err || e;
    }

    console.log('Exiting process');

    if (err) {
      process.exit(1); // Non-zero failure code
    } else {
      process.exit(0);
    }
  }

  process.on('SIGTERM', () => {
    console.log('Received SIGTERM');
```

```
  shutdown();
});

process.on('SIGINT', () => {
  console.log('Received SIGINT');

  shutdown();
});

process.on('uncaughtException', err => {
  console.log('Uncaught exception');
  console.error(err);

  shutdown(err);
});
```

`SIGINT` and `SIGTERM` events are related to signals that can be sent to the process to shut it down, such as when Ctrl + c is pressed. The uncaught exception event will occur when JavaScript code throws an error but doesn't handle it.

Try running and shutting down the application again. You'll know that everything is working correctly when you see the "shutting down" messages in the terminal.

ADDING WEB SERVER LOGGING

There's just one last thing to round out your web server module: HTTP logging. There are various modules you could use for this type of logging, but `morgan` is

known to be one of the best (and simplest). Let's install `morgan` with `npm`.

```
npm install morgan -s
```

Next, add the following line to services/web-server.js under the line that requires Express (line 2).

```
const morgan = require('morgan');
```

Now you can incorporate `morgan` as a middleware function that all requests will go through with `app.use`. Add this line before the `app.get` call that produces the "Hello World!" message.

```
// Combines logging info from request and response
app.use(morgan('combined'));

// *** app.get call below this line ***
```

Note that `app.use` is creating a pipeline of middleware functions that can interact with HTTP requests and responses. The middleware functions will execute in the order in which they are included.

Restart the app, and position the terminal so you can see it and Firefox at the same time. Each time you reload the page in Firefox, you should see a new log entry appear in the terminal. By default, `morgan` streams log info to STDOUT (which is displayed in the terminal).

This is as far as I'll go with logging in this series. However, in a production application, you might want to stream morgan's output to an HTTP access log file. As an alternative to the `console` object, you might also consider a logging utility such as Winston for debugging and tracing.

The next article in this series focuses on database basics—including connection pooling—that will help you understand and build REST APIs for Node.js.

Dan McGhan is the Oracle developer advocate for JavaScript and Oracle Database. He enjoys sharing what he's learned about these technologies and helping others be successful with them.

NEXT STEPS

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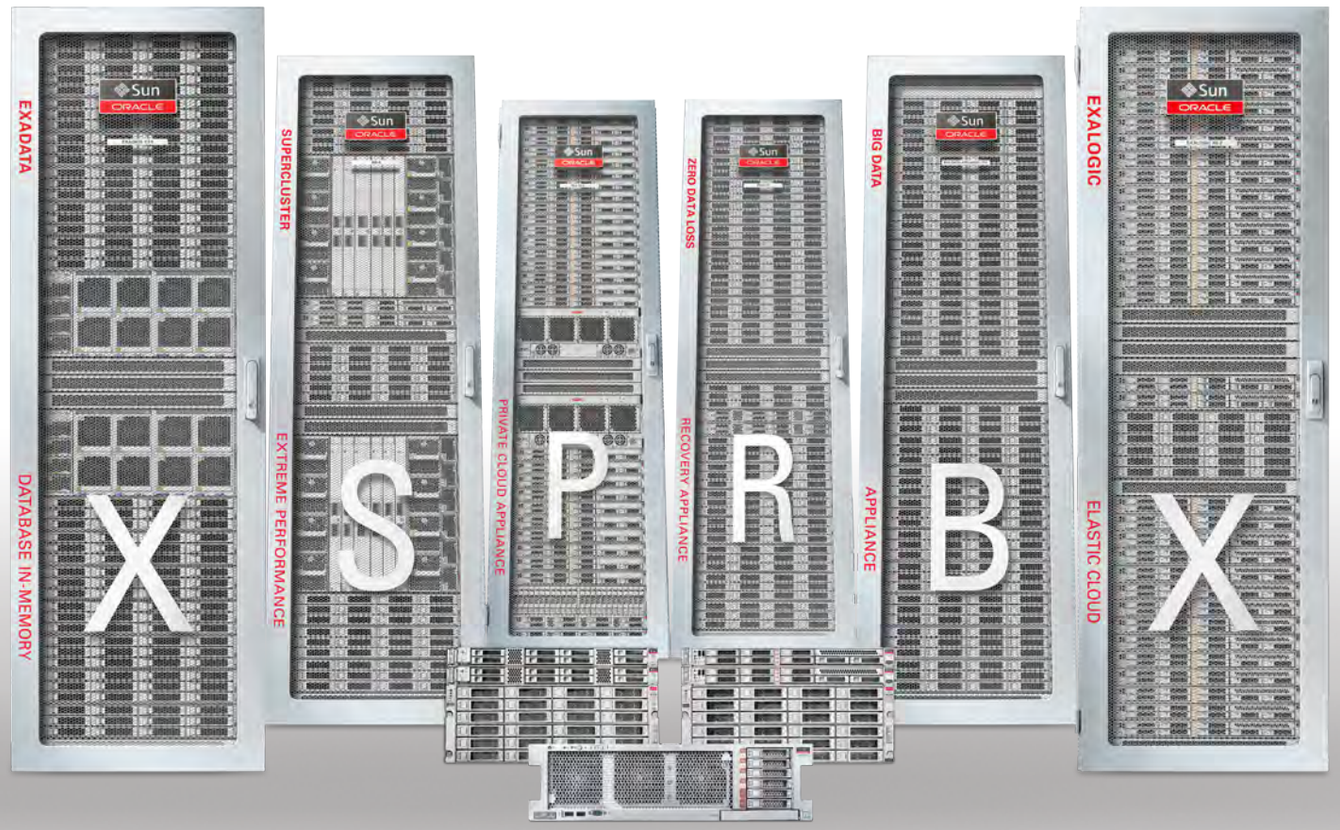

OPTIMIZE TO WORK TOGETHER

ORACLE®

Getting Help, Giving Back: The Way Forward, Part 2

OAUG president talks about the importance of diversity, networking, and giving back.

BY LESLIE STEERE

In Part 1 of this interview, published in Oracle Magazine, March/April 2018, Oracle Applications User Group (OAUG) President Christine Hipp discussed emerging technology and the various paths OAUG members are taking toward cloud computing. Here, Hipp dives into the other topics important to OAUG members, including diversity in the workforce, mentorships, and networking.

Oracle Magazine: What was your introduction to Oracle technology and OAUG?

Hipp: I started working with Oracle technology in 2003,

Christine Hipp, president of Oracle Applications User Group, believes that programs such as OAUG's Emerging Leaders and Collegiate Forum can help attract more women and minorities into tech positions.

when the company I worked for selected Oracle E-Business Suite for its first implementation of an ERP [enterprise resource planning] system. I've been heavily involved with it ever since.

Those years following our original implementation were extremely busy. We were rolling out modules and upgrading continuously, and OAUG became my touchstone. It remained a constant resource for me in my career, even as I changed roles from systems analyst to project manager to IT manager. So it was a natural progression for me to say, "I've received such a great benefit from this organization. I would like to see this continue for other people and give back."

"The reality is that baby boomers are still in the workforce and providing valuable work to companies, and the newer generations are coming in. Our goal is to provide opportunities for members at all phases of their careers."

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

Oracle Magazine: In addition to its focus on education and networking, how else does OAUG support its members?

Hipp: The community looks to OAUG to be up to date on what's happening with Oracle and to pass that information along. Our members need to know that Oracle is there for them as they continue to leverage their Oracle E-Business Suite, Oracle Hyperion enterprise performance management, and other applications investments while they are evaluating, planning, and transitioning to the cloud. Another major component of OAUG's mission is advocacy, and through our partnership with Oracle, we are able to use this influence for our users. Whether they are on premises or in the cloud, our members still want a combined voice to share valuable feedback, which helps Oracle deliver technology solutions that best support their business.

Oracle Magazine: In what ways is OAUG expanding its membership reach?

Hipp: At OAUG we are committed to the next generation of Oracle professionals. We have a committee at OAUG focused on emerging leaders. These leaders range in age—they're not necessarily all 22 and right out of college, but they are people who are in the early part of their careers and looking for opportunities to share information, find mentors, and expand their careers.

This year we're also broadening our focus on professional and career development. The OAUG Collegiate Forum held its first meeting last fall with 40 students from the Penn State Behrend Black School of Business. The program was really well received, and we'll look to continue down this path with a more comprehensive student program.

Mentoring, education, and even assistance with finding jobs are very important to us, because we do want to see people from 20 to 65 at our conferences. The reality is that baby boomers are still in the workforce and providing valuable work to companies, and the newer generations are coming in. Our goal is to provide opportunities for members at all phases of their careers.

Oracle Magazine: Can you talk about the value of finding—or being—a mentor?

Hipp: Personally, as a woman in technology, I think we all have an obligation and an opportunity to encourage and assist others—all others, but especially our female peers.

I have the advantage of having a top IT leader at my organization, who also happens to be a woman, as my mentor. This has been invaluable for me both personally and professionally. You can't always find that within your own company, but there are opportunities to find them within OAUG. The members are open and willing to share their information and insights.

One of my favorite things about OAUG and user conferences such as COLLABORATE has always been the networking. Every time I go to a con-

ference, I meet 5 to 10 new people who are going to be able to help me in my job, or I'm going to be able to help them. But I do think that's something that happens organically, and it would be great to see a more formal opportunity for mentorship.

"I'm a firm believer in the idea of a diversified team, whether it's age, gender, or ethnicity. The more diversity you have on your team, the better your product."

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

Oracle Magazine: Is one of your objectives to bring more women and more minorities into the technology area, and do you see that happening?

Hipp: My personal observation has been that although we have a number of women in technology, they aren't necessarily in positions of leadership. I think it is essential to have women at all levels of the tech industry. Programs such as OAUG's Emerging Leaders and Collegiate Forum can help attract more women and minorities into tech positions. Any activity where we are reaching out—*we* being the senior women or experienced professionals—to this next generation and talking to them about the opportunities is going to have a positive effect. Obviously, if they're studying computer science, we want to tell them how that translates into a real-world job, and we want those jobs to be available for everyone, including women and minorities.

I've been thinking recently about what the critical factor is for attracting more women and minorities into tech positions. And I think, from my experience leading at a STEM conference for fifth- through eighth-grade girls, it is to engage them while they are young. Just the pure interest and lack of barriers that exist at those young ages allow them to believe that they could be interested in computer

science and technology careers—that this could be an opportunity for them.

So code and STEM conferences are great places to start. I also was really excited to read about Oracle's new Design Tech High School, because this kind of vision plays a big part in creating a next generation of technologist that includes women and minorities. I'm a firm believer in the idea of a diversified team, whether it's age, gender, or ethnicity. The more diversity you have on your team, the better your product.

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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NEXT STEPS

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