Oracle Special Edition
Tech Trends 2017
The kinetic enterprise

Deloitte.
University Press

Trending the trends: Eight years of research

DIGITAL | **ANALYTICS** | **CYBER**

Asset intelligence	User engagement	Wireless and mobility	Information management	Information automation	Cyber security
Social computing	User engagement	Applied mobility	Visualization	Real analytics	Cyber intelligence
Gamification	Social business	User empowerment	Enterprise mobility unleashed	Geospatial visualization	Big data goes to work	Digital identities
Gamification goes to work	Social reengineering by design	Mobile only (and beyond)	Finding the face of your data	No such thing as hacker-proof
Industrialized crowdsourcing	Social activation	Digital engagement	Wearables	Cognitive analytics	Cyber security
Dimensional marketing	Ambient computing	Amplified intelligence	Cyber implications
AR and VR go to work	Internet of Things	Industrialized analytics	Blockchain: Democratized trust
Mixed reality	Machine intelligence	Dark analytics	Blockchain: Trust economy

2010 2011 2012 2013 2014 2015 2016 2017

	Exponentials watch list	IT unbounded	Inevitable architecture	Everything-as-a-service
Social impact of exponentials	Right-speed IT	Autonomic platforms	Reimagining core systems
Exponentials	IT worker of the future	CIO as chief integration officer	Software-defined everything	API economy	Core renaissance
Exponentials	CIO as venture capitalist	Real-time DevOps	Cloud orchestration	In-memory revolution	Technical debt reversal
Design as a discipline	Business of IT	CIO as postdigital catalyst	IPv6 (and this time we mean it)	Reinventing the ERP engine
Measured innovation	Hyper-hybrid cloud	Outside-in architecture
CIOs as revolutionaries	Capability clouds	The end of the "death of ERP"	"Almost-enterprise" applications
Value-driven application	CIO operational	Virtualization	Cloud	Best-of-breed enterprise	Services

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Deloitte Consulting LLP's technology practice is dedicated to helping our clients build tomorrow by solving today's complex business problems involving strategy, procurement, design, delivery, and assurance of technology solutions. Our service areas include analytics and information management, delivery, cyber risk services, and technical strategy and architecture, as well as the spectrum of digital strategy, design, and development services offered by Deloitte Digital. Learn more about our Technology Consulting practice on www.deloitte.com.

This report is an Oracle practice perspective on trends identified in Deloitte Consulting LLP's Tech Trends 2017 report.

Contents

Introduction

L EGENDARY basketball coach John Wooden once said, "failure itself is not fatal, but failure to change might be." Any company competing in today's rapidly mutating business climate should take coach wooden's wisdom to heart. Seemingly without warning, powerful technology forces give rise to ripe opportunities while simultaneously rendering existing business models obsolete. Just as quickly, customers tailor their expectations to include new channels, products, and modes of engagement. Companies that don't anticipate and embrace this change may find themselves sinking slowly in its wake.

The theme of this year's tech trends report is the kinetic enterprise, an idea that describes companies that are developing the dexterity and vision required not only to overcome operational inertia but to thrive in a business environment that is, and will remain, in flux.

This is no small task. Though the technology advances we see today embody potential, only a select few may ultimately deliver real value. Indeed, some are more hype than substance. We need to do a better job of sifting through the noise to identify truly groundbreaking innovations that can deliver value. Then we need to act. Passively wondering and waiting are not options. As in newtonian physics, the task before us is turning energy's potential into reality.

Together with oracle, deloitte has been investing in a broad range of technology advances. Through this work and amid the incredible pace of change, we can recognize familiar themes. For example, the five macro forces—digital, analytics, cloud, the reimagining of core systems, and the changing role of it within the enterprise—have remained constant, year after year driving disruption and transformation. Despite the omnipresence of these five forces, enterprise adoption of them continues to vary widely. Some companies are only beginning to explore these trends, while others have advanced rapidly along the maturity curve. To the former, arriving late to the party doesn't necessarily diminish the opportunities you are pursuing. You have the advantage of being able to leverage compounded years of evolution within, say, mobile or analytics without having to work sequentially through the incremental advances in the technology trends.

Oracle has been evolving as a company and transforming itself to become a leader in cloud, platform, and infrastructure services. The combination of oracle's deep technology DNA and deloitte's acumen for business transformation has created significant opportunities for our clients to leapfrog their competition. Our joint thinking is helping companies adapt to the emerging technology trends and leverage them to become more efficient, innovative, and profitable.

Over the past few years, the only constant has been change. We hope this inaugural edition of Oracle Tech Trends helps your organization understand the changes under way more clearly. And, with a nod to Coach Wooden, we also hope it helps you respond to these changes by creating deliberate plans for turning business potential into kinetic energy.

When the rules of the game are changing, you can't afford to sit idly on the bench.

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FINAL STOP

IT unbounded

The business potential of IT transformation

AS ORGANIZATIONS MODERNIZE THEIR IT OPERATING AND DELIVERY MODELS, SOME are creating multifunctional teams and breaking down silos across IT. They are also looking beyond organizational boundaries to explore the open talent market and to form new types of relationships with vendors, incubators, and academics. Finally, with technology dominating strategic business priorities, some companies are educating executives and staff to increase awareness and understanding of both core and emerging technologies. For many, embracing this multifaceted approach may require adjustments to org models, IT processes, and supporting systems. The good news is that irrespective of an organization's legacy footprint, there are systematic approaches that can make the task more manageable. And the outcome may justify the effort: Services become "unbounded" and more efficient, transforming the IT organization.

THE age of digital transformation is upon us, and while businesses are feeling the pressure to keep pace, many may not be sure what that journey entails. Digital transformation is the culmination of emerging technologies converging with a shift in mindset to enable businesses to function at their highest potential. The transformation can be characterized as a shift from doing digital to being digital. Without this fundamental shift, organizations may expend energy and resources on upgrading to the latest technologies, without the digital culture required to sustain their performance in the face of technology, business, and workforce disruption.

The collaborative and dynamic environment of the digital transformation era has paved the way for "IT Unbounded," a new way of doing business that eliminates the longstanding boundaries between business and IT. IT Unbounded shifts IT's focus from maintenance and support of systems to driving innovation and overall business strategy, which may be enabled by collaborating with external partners, improving efficiency through automation and DevOps, and creating multifunctional teams that combine IT and business. IT organizations are no longer working as service providers, but rather are integrating with the core business functions. Additionally, previously outsourced IT functions increasingly are elevated to shift vendor relationships to partnerships. IT Unbounded means shifting from siloed to collaborative, from static to on-demand, from usability to productivity.

Emerging in parallel to IT Unbounded is the trend of embracing cloud technology. Cloud offers an unbounded approach towards software, serving as an enabler to organizations seeking to unite their business and IT divisions. Rather than expending effort on the continuous customization and support of software, cloud technology allows organizations to focus on end-user adoption and process improvement. Cloud enables organizations to keep pace in an increasingly digital world.

On-premises solutions involve large, lengthy implementations, often requiring an external system integrator to provide expertise and customization

to fit the needs of the business. Cloud shifts away from this practice, by providing a standardized solution to streamline implementation and maintenance. Additionally, regular functionality releases keep organizations abreast of the latest trends without cumbersome upgrades every few years. Indeed, cloud offerings require minimal upkeep, freeing organizations of their tether to large, expensive IT teams hired to support complex, customized ERP solutions. Instead, some businesses manage the software internally, including the uptake of regular releases of the latest functionality. With cloud blurring the lines between business and IT responsibilities, it is more important than ever before to collaborate across the organization.

Case studies

- **Case study 1**

  A leading global retailer has adopted IT Unbounded principles to position itself for long-term sustainment. The company began with standard industry practices—separate business and IT teams operating under distinct leadership with competing KPIs. The 150-person ERP IT support team was comprised of approximately 50 developers, 50 functional analysts, and 50 business analysts. Recently, the company's IT organization upgraded to Oracle Cloud, while collaborating with the business team from the start. The Unbounded approach allowed the business team to be closely involved in the planning and design phase, sharing their knowledge of the functionality requirements. Ultimately, business and IT shared ownership of the final solution, which better served the needs of the business because of the specialized input from the business team.

  Today, the team has approximately 25 developers and 10 functional analysts. Additionally, the business analyst role was transferred to the business process organization, which resides outside of IT. The business process organization now manages the Cloud quarterly releases through a training and business adoption plan. The company was able to reduce its costs significantly by streamlining

its team and investing in training early on. Because the business was involved throughout the implementation, it better understands the functionality, and the regular releases have been less taxing on human capital. The positive effects of this collaboration will likely be recognized for years to come and will be an integral part of the sustainment of the solution over time.

- **Case study 2**

  A regional retail and commercial bank implemented Oracle Cloud last year in order to maintain a competitive advantage. It used Agile-based methodologies to optimize the overall implementation. From the beginning of the project, the business team worked closely with IT. Throughout the design phase, the business team defined user stories, set timelines, and iterated on the prototypes. The testing phase went much smoother than in standard ERP implementations, with minimal late requirements and low amounts of defects. After go-live, adoption was extremely high because of the early and meaningful participation and influence of the business. Furthermore, the business served as champion of the solution because it felt a sense of ownership. The iterative approach to implementation allowed the organization to foresee potential roadblocks and respond quickly to changes. The Cloud implementation came to completion six months faster than the average ERP implementation of comparable size, with high satisfaction from the business.

- **Case study 3**

  A leading motor transportation company upgraded its ERP system using human-centered design. The company designated the end users—the long haul semi-truck drivers—as the key persona on which to focus during the design phase of the project. By honing in on what the persona needs rather than features and functions, the project team discovered "moments that matter" that otherwise would not have been found in traditional process-based design. The team created a system featuring text message reminders, automatic alerts, and

an easily accessible app with simple navigation rather than a complex, desktop-based screen with VPN authorization requirements and other cumbersome information-entry methods not conducive to roadside access. The final solution delivered the capabilities that would impact business outcomes significantly because they catered to the persona that interacted with it most. Design thinking added value to the client in ways that would not have been possible with the typical process-based approach to ERP design.

Digital transformation Key principles

The success stories highlighted above are far from isolated cases. Your business can achieve positive results by considering these three principles throughout your digital transformation.

Sustain a close partnership between business and IT. With the disruption of the standard ERP system, adopting a new mindset is a necessity. The new operating model requires an integrated business and IT team in order to sustain cutting-edge technology over the long term. Companies may not be able to maintain a competitive advantage if they rely on an external group to advise, design, and implement system upgrades every year. This model is generally not cost-effective nor responsive enough to changing technologies.

Employ Agile tools and methodologies. The regional retail and commercial bank is an effective example of the successful adoption of Agile practices. The iterative lifecycle of an Agile project enables a company to respond more nimbly to changes in requirements and industry trends, allowing organizations to see change as an opportunity to add value rather than a roadblock to avoid. It's an adaptive approach to software implementation that emphasizes flexibility, integrated customer involvement, and rapid delivery of value. Agile also enables an IT Unbounded approach by producing a lean IT organization, better able to support cloud implementations through a delivery model that specializes in frequent, small releases. Organizations that fully embrace Agile methodologies will likely experience more immediate customer feedback, faster value-add, and continuous improvement.

Focus on human-centered design. In the third case study, human-centered design was a key factor in developing a leading-practice ERP system. This approach to design places the persona at the forefront with the goal of creating a product that best serves its needs. Through design thinking, organizations spend time with, and gain empathy for, their customers, then identify their most pressing pain points. Next, the business interprets these pain points to form the persona's story. Insights are gained and opportunities identified in this story, and finally, the organization can bring the solution to life and deliver it broadly to users. Human-centered design is more than an implementation method; it's an approach to innovation shown to increase customer satisfaction and improve business performance.[i]

Applying the above principles can enable your business to unbound IT and accelerate digital transformation. For this, Deloitte has an innovative approach that brings together sustainment, Agile, and design thinking, along with best practices, industry experience, and a suite of amplifiers to accelerate your Digital Transformation.

Figure 1: The shift from *doing* to *being*

⊘ **Cloud-enabled practices**
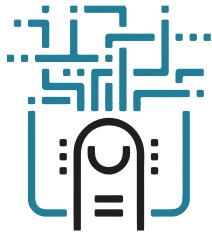
TECHNOLOGY & TRANSFORMATION

WATERFALL TO	**AGILE** ⊘
USERS TO	**PERSONAS**
PROCESS DESIGN TO	**DESIGN THINKING**
REQUIREMENTS TO	**USER STORIES** ⊘
USABILITY TO	**PRODUCTIVITY**
COST TO	**VALUE**
VENDOR TO	**PARTNER** ⊘
OFFLINE TO	**REAL TIME** ⊘
CONFERENCE ROOM PILOT TO	**PROTOTYPE**
SILO ED TO	**CROWDSOURCING**
SYSTEM INTEGRATOR TO	**DELIVERY COACH**

MINDSET
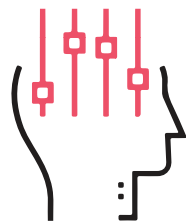
LOCAL TO	**GLOBAL**
CUSTOMIZE TO	**STANDARDIZE** ⊘
UNCHANGEABLE TO	**FLUID**
STATIC TO	**REAL TIME & ON DEMAND** ⊘
STRATEGIC TO	**SUSTAINABILITY** ⊘
EMPLOYEE TO	**CUSTOMER**
GENERALIST TO	**ADVISOR**
REACTING TO DISRUPTION TO	**DISRUPT YOURSELF**

ORGANIZATION

PROCESS AT THE CORE TO	**CUSTOMER EXPERIENCE AT THE CORE**
MANUAL PROCESSES TO	**ONLINE PROCESS ENABLEMENT** ⊘
OPERATIONAL REPORTING FOR FEW TO	**EMPLOYEE INSIGHTS FOR ALL**
INCONSISTENT SELF-SERVICE TO	**CONSISTENT EMPLOYEE EXPERIENCE**
TRANSACTIONS TO	**INTERACTIONS**
SILOED TO	**COLLABORATIVE** ⊘

Bottom line

While Digital Transformation is disrupting business, organizations can equip themselves with the tools needed to respond effectively. Unbounding IT is central to the success of an organization seeking to maintain leading technology practices. Sustaining a merged business-and-IT support organization, adopting Agile tools and methodologies, and focusing on human-centered design will help give companies the proper toolset to optimize operations in a digital environment.

Authors

Chris Winn

Chris Winn is a Principal with Deloitte Consulting LLP, where he leads the Oracle Cloud Delivery initiative. From a client service perspective, he focuses on global, Oracle-enabled business transformations in the consumer and industrial products industries. He has led several of the Oracle practice's largest, most complex engagements during his 17-year career with Deloitte.

Digital analytics

Crossing the chasm from tradition to digital analytics

UNTIL RECENTLY, TAKING A PASSIVE, BACKWARD-LOOKING APPROACH TO DATA AND analytics was standard practice. With the ultimate goal of "generating a report," organizations frequently applied analytics capabilities to limited samples of structured data siloed within a specific system or company function. Moreover, nagging quality issues with master data, lack of user sophistication, and the inability to bring together data from across enterprise systems often colluded to produce insights that were at best limited in scope and, at worst, misleading.

AS organizations evolve towards advanced analytics capabilities enabled by the advent of technologies around Big Data, Internet of Things, predictive analytics, geospatial analytics, and other forms of data consumption, the short-comings of leveraging a traditional approach of producing backward-looking analytical reports is becoming apparent. Companies are finding it increasingly difficult to stay competitive in the marketplace without adopting the newer technologies.

In today's business climate, data is the competitive currency. There is a momentum shift in the marketplace where companies are leveraging advanced analytics to identify problems early on in the value chain and take preventive action to realize significant savings on expenses. For example, some transportation and logistics companies are leveraging sensors to relay data on storage conditions of goods and taking timely corrective actions to prevent inefficiency. In addition, data collected from these sensors identifies root causes of deterioration in climate-controlled devices. In another instance, brick and mortar retailers use analysis of customer buying patterns to live stream digital displays that customers see as they browse store aisles.

Today, CIOs prioritize digitization and weave analytics into core business processes. They harness distributed data architectures, in-memory processing, machine learning, visualization, natural language processing, and cognitive analytics to answer questions and identify valuable patterns and insights that would have seemed unimaginable only a few years ago. Indeed, analytics now dominates IT agendas and spend. In Deloitte's 2016 Global CIO Survey of 1,200 IT executives, respondents identified analytics as a top investment priority. Likewise, they identified hiring IT talent with analytics skills as their top recruiting priority for the next two years.1

Today's IT organizations are striving to reach a level of maturity that can deliver lasting competitive advantage in the digital world. In this context, there is currently a shift in thinking around IT architectures. Organizations are looking beyond leveraging traditional ERP systems and data warehouses to modern architectures that can

provide predictive and prescriptive analytics across the full range of business processes.

Modern IT architectures have the capability to house unprecedented volumes of data from a variety of data sources - from structured data readily available within the organization to unstructured data sources such as sensors, social media, web, mobile, audio and video files. These architectures make it possible to manage stored data effectively while making it available for use by data analysts and data scientists. In addition, artificial intelligence platforms can plug into these data sources and push the boundaries on human-machine interaction.

Architecture for next-generation digital analytics

Increasingly, companies are modernizing their IT architectures by leveraging Oracle platforms. These efforts can range in scope from multi-year modernization programs to targeted tactical projects designed to meet short-term objectives.

For example, the Oracle Big Data Appliance leverages Hadoop and a Big Data discovery platform to generate data visualizations. Using integration tools such as ODI and GoldenGate, companies have been able to integrate a variety of data sources into centralized data reservoirs. This approach has facilitated shorter project turnaround times than those achieved in many traditional data warehouse implementations. Wherein a traditional data warehouse requires significant upfront solution design to create centralized data models, ETL interface designs, and semantic layer designs, Hadoop can take raw data and quickly generate integration designs. Indeed, data modeling takes place at the time of consumption, which means only needed datasets are modeled.

Advanced analytics architectures offers additional capabilities as well:

- Sourcing the data for consumption multiple times across multiple platforms

- Simplified provisioning of analytical sandboxes with relevant data sets

- Setting up of specialized data stores for data scientists where they can leverage tools such as Oracle R for statistical analysis and Oracle Data Miner for predictive models

While advanced analytics platforms are designed primarily to meet the needs of data scientists, many companies leverage Oracle Business Intelligence Enterprise Edition to help meet their enterprise reporting needs. OBIEE, used in conjunction with engineered systems such as Exalytics, is a robust reporting platform that is designed to cater to the needs of enterprise reporting. With built-in integrations to other Oracle products such as Essbase - typically used for planning and budgeting functions, some companies have been able to deploy executive dashboards to provide visibility into key metrics on organizational performance.

Case studies

- **Case study 1**

  In recent years, a global manufacturer experienced large-scale growth through mergers and acquisitions. To provide analysis of market segments, pricing, branding, and changing business conditions consistently to business units across its expanding enterprise, the company determined it needed to deploy advanced analytics capabilities and broadly adopt a data-driven approach to business intelligence. Additionally, its manufacturing and quality control departments wanted to apply analytics to key operational characteristics in order to measure system-wide throughput and eliminate bottlenecks in the supply chain. The challenge was in getting fast access to Big Data and gaining business-relevant insights. Implementing a traditional data warehouse solution was prohibitively time-consuming and lacked the ability to provide analysis on unstructured data such as machine data.

  The manufacturer embarked on a program to define a data lake architecture that could integrate data across roughly 200 operational systems, including unstructured data from its production lines. The Oracle Big Data Appliance served as a

platform to build the data lake. Structured and unstructured data were then loaded into Big Data Appliance using Oracle Data Integrator.

The project highlighted the benefits of leveraging a Big Data architecture in lieu of a traditional data warehouse model. With a shorter turnaround time for deployment and the ability of consumers to identify the specific data sets they wanted, the onus for making data available in a digestible format throughout the company shifted from the IT team to the consumers of data themselves.

- **Case study 2**

A US healthcare organization embarked on an initiative to build a platform to helped consumers share information across popular health and fitness apps. Its goal was to use data to create a personalized, coherent user experience—one that allowed consumers to manage their health. Advanced analytics became a foundational component of the platform. Applied to massive stores of customer data, it helped to identify and recommend health apps for specific customer segments that might use the platform.

The Oracle Big Data Appliance served as a platform to store, process, and analyze data sets. Query tools such as Spark packaged with the BDA materialized data for analytics. Oracle R and Big Data Discovery respectively were leveraged to track progress on consumer adoption rates and produce visualizations for executive reporting.

The project spotlighted how efficiently organizations can integrate a variety of data sets into a Big Data environment. In addition, the ability for tools such as R to plug into the environment and natively run statistical models underscored the need for appliances with plug-and-play capabilities to enhance the user experience across the big data ecosystem. Today's customers are recognizing the value for packaged analytics solutions. In response to the growing demand, Deloitte Consulting LLP has developed the following complementary analytical solutions:

Deloitte analytics objects

Deloitte Analytics Objects (DAO) for Workforce is an extendable cloud-based packaged solution that supports workforce analytics. Business users can rely on a full suite of reporting and machine-learning functions that proactively answer pivotal business-related questions in the area of workforce management.

It provides insights into key workforce metrics such as attrition, recruitment effectiveness, location optimization, and workforce and manpower planning. It is hot-pluggable into Oracle's BI cloud (OAC) environment and is data source-agnostic.

The solution can be used either in conjunction with Oracle's HR Analytics or as a standalone analytics application in the cloud. The predictive nature of the solution can provide deep insights into talent retention and recruitment program design.

Deloitte analytics frameworks

Deloitte Analytics Frameworks (DAF) for Workforce is a family of industry and domain pre-packaged, configurable, and extensible data visualization frameworks built on the Oracle Data Visualization platform used to explore data and gain business insights.

Data analysts can rely on a full suite of reporting and analytic functions that enable them to be proactive around pivotal business and talent-related questions. DAF acts as an accelerator for an organization to convert data exploration activities into impactful business stories and narrate them through interactive charts and graphs to gain meaningful business insight.

Bottom line

Modern IT organizations can no longer afford to run on data silos. As part of a growing trend, IT organizations are moving higher on the maturity spectrum by leveraging digital analytics tools and processes. Advanced analytics architectures are gaining popularity. Meanwhile, there is an increased push for platform standardization. With platform functionalities maturing and interoperability between heterogeneous platforms increasing, companies are also recognizing the value that packaged analytical solutions can deliver. Rather than build analytical models from the ground up, many companies are looking for analytical solutions designed in accordance with leading industry practices for common business functions such as finance and HR.

Authors

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Richard Solari is a Managing Director in the Deloitte Analytics and Information Management Practice and currently serves as the Oracle Analytics Lead. Mr. Solari's primary area of focus and expertise is Oracle business intelligence, analytics, Big Data, and machine learning technologies and applications. For more than 27 years, Mr. Solari has led or contributed to dozens of large enterprise global transformational analytics projects worldwide in a wide range of industries for many Fortune 500 and 100 clients.

Endnotes

[1] Khalid Kark, Mark White, Bill Briggs, and Anjali Shaikh, Navigating legacy: Charting the course to business value, Deloitte University Press, November 10, 2016.

Machine intelligence

Technology mimics human cognition to create value

ARTIFICIAL INTELLIGENCE'S RAPID EVOLUTION HAS GIVEN RISE TO MYRIAD DISTINCT— yet often misunderstood—AI capabilities such as machine learning, deep learning, cognitive analytics, robotics process automation (RPA), and bots, among others. Collectively, these and other tools constitute machine intelligence: algorithmic capabilities that can augment employee performance, automate increasingly complex workloads, and develop "cognitive agents" that simulate both human thinking and engagement. Among others, RPA and AI enabled / Smart Enterprise Solutions will likely see broader adoption in the next 18 to 24 months, as business cases continue to merge in both the public and private sectors.

TODAY, much of a business's data trove resides in mature ERP and other software systems. While these systems collect and process enormous amounts of data, not all companies are able to mine the data for actionable business insights. However, by leveraging the power of machine intelligence (MI) and harnessing analytics to illuminate patterns, insights, and opportunities hidden within ever-growing data stores, companies have been able to develop new approaches to customer engagement; to amplify employee skills and intelligence; to cultivate new products, services, and offerings; and to explore new business models. Machine intelligence can provide visibility into what has already happened, what is happening now, and what is likely to happen next. This can help business leaders develop prescribed actions that may transform business outcomes.

Robotic process automation – Business transformation through machine intelligence
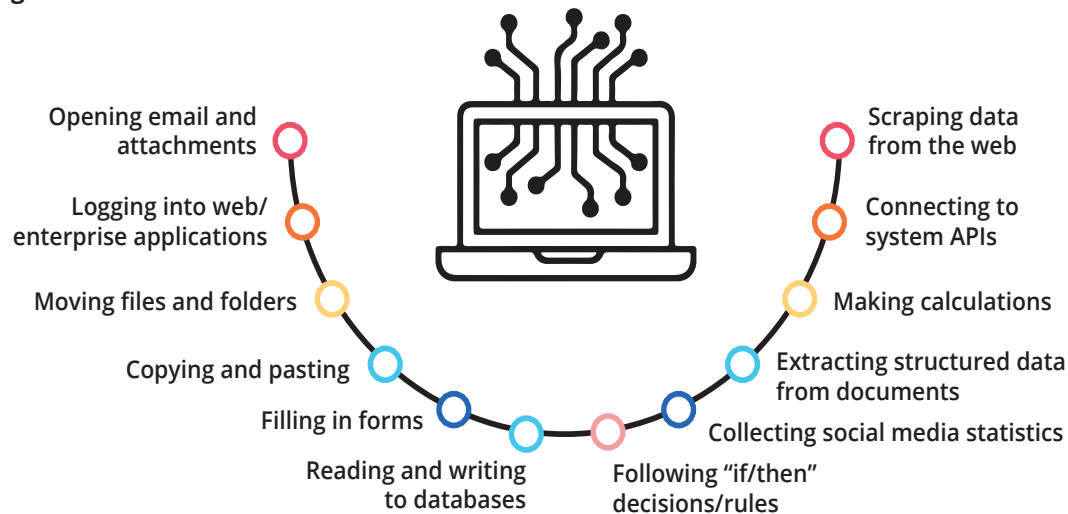
The Robots are here – and they are drastically reshaping the ways companies think about their digital strategies. Across an ever-changing and increasingly competitive landscape, robotic process automation can provide organizations with a critical first step in building their workforce of the future. This year the market for RPA products and services will reach $433 million, according to HFS Research, and may climb to $1.2 billion by 2021, a compound annual growth rate of 36%. [ii]

RPA is a tool used to automate repetitive, rules-based tasks. Typical candidate processes for automation reside in shared service centers or other back office functions; however, RPA solutions have

been implemented across a diverse set of activities requiring significant manual processing. Put simply, RPA replicates any mouse or keyboard actions a human would perform across any applications on their PC. RPA can do everything from open email

and attachments, to collect social media statistics and to follow if/then decisions and rules. Below are some of the operations RPA's can do with relative ease.

Figure 1

Opening email and attachments

Logging into web/ enterprise applications

Moving files and folders

Copying and pasting

Filling in forms

Reading and writing to databases

Scraping data from the web

Connecting to system APIs

Making calculations

Extracting structured data from documents

Collecting social media statistics
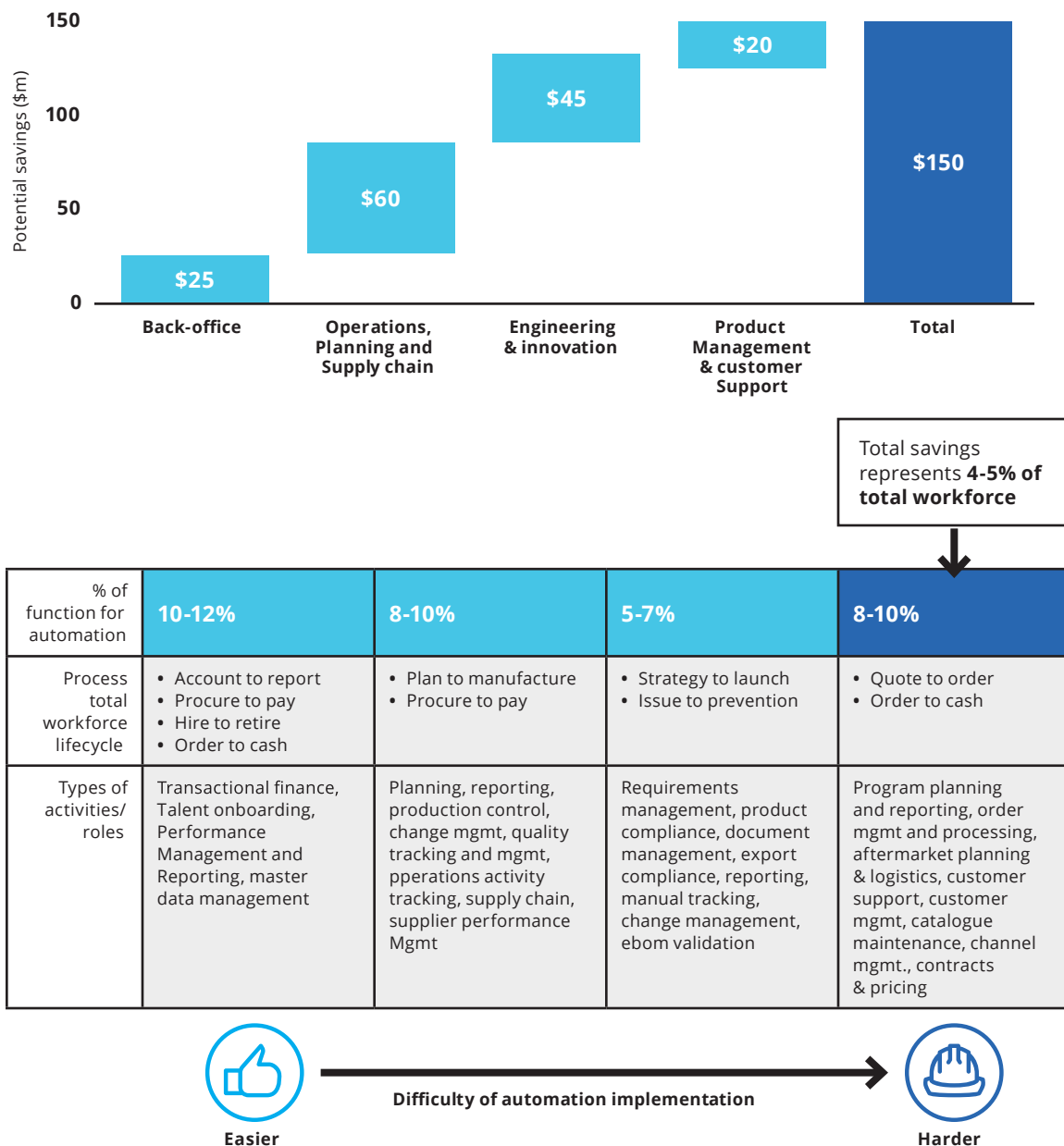
Following "if/then" decisions/rules

RPA software can capture and interpret existing IT applications and processes, enabling data processing, data manipulation and communication across the full spectrum of an organization's systems. RPA can be rapidly implemented and scaled to act as a "digital workforce," acting alone or in collaboration with human users to produce fast, accurate results. In our experience, "digital employees" have demonstrated the ability to operate at roughly three times the capacity of a single human worker and cost roughly one-third of what companies typically pay for a globally sourced employee. What's more, digital employees often make fewer errors. Most importantly, these solutions exist in a monitored environment which increases control across the entire span of the process.

Business case for leveraging RPA with Oracle applications

Because RPA interfaces directly with existing technologies, including the ERPs which underlay the majority of transaction activity, the successful interaction between these systems and the RPA software is a critical enabler for successful robotics implementation.

Organizations using Oracle applications (on-premises or Cloud) are in a unique position to benefit from the implementation of a comprehensive RPA program. The stability of an RPA solution and the value created by its implementation could increase if there were a mature standardized IT application such as Oracle eBusiness Suite or Oracle Cloud applications supporting the business processes.

Figure 2: Overall Case Study: Automation potential of $150M in annual costs at $10B manufacturer across the broad organization

Total savings represents **4-5% of total workforce**

% of function for automation	10-12%	8-10%	5-7%	8-10%
Process total workforce lifecycle	• Account to report • Procure to pay • Hire to retire • Order to cash	• Plan to manufacture • Procure to pay	• Strategy to launch • Issue to prevention	• Quote to order • Order to cash
Types of activities/ roles	Transactional finance, Talent onboarding, Performance Management and Reporting, master data management	Planning, reporting, production control, change mgmt, quality tracking and mgmt, pperations activity tracking, supply chain, supplier performance Mgmt	Requirements management, product compliance, document management, export compliance, reporting, manual tracking, change management, ebom validation	Program planning and reporting, order mgmt and processing, aftermarket planning & logistics, customer support, customer mgmt, catalogue maintenance, channel mgmt., contracts & pricing

Difficulty of automation implementation

Easier　　　　　　　　　　　　　　　　　　　　**Harder**

Oracle does not currently offer a robotic automation platform, however it lends the majority of its application to RPA by allowing effective interactions between Oracle Applications and industry leading RPA software platforms.

In a recent assessment conducted at a $10B manufacturer, Deloitte identified $150M in

potential annual cost savings across the organization associated with the implementation of an RPA program. A significant number of use cases that factored into the automation potential were enabled by layering RPA onto the existing Oracle ERP.

Deploying RPA with oracle applications

Compared to traditional ERP or custom system implementations, RPA programs can be deployed with relative ease, short deployment timelines, and quicker time to value. The process of deploying RPA solutions on Oracle ERP requires much rigor and a deep knowledge of the underlying application.

Figure 3: Deploying RPA with oracle applications

1 **Business architects**
Specify the detailed instructions for robots to perform and "publish" themto the robot controller repository

2 The **Control room**
is used to assign jobs to robots and to monitor their activities

3 Each **Robot**
is located on an organization environment-which may be virtualizedor physical (i.e., desktop computer) - where it interacts directly with business applications

4 **Business users**
review and resolve any expectations or escalations

5 Robots are capableof interacting with a wide range of **Applications** including Oracle products

1 Business architects   **2** Control room   **4** Business users

3 Robot   **5** Oracle & other applications
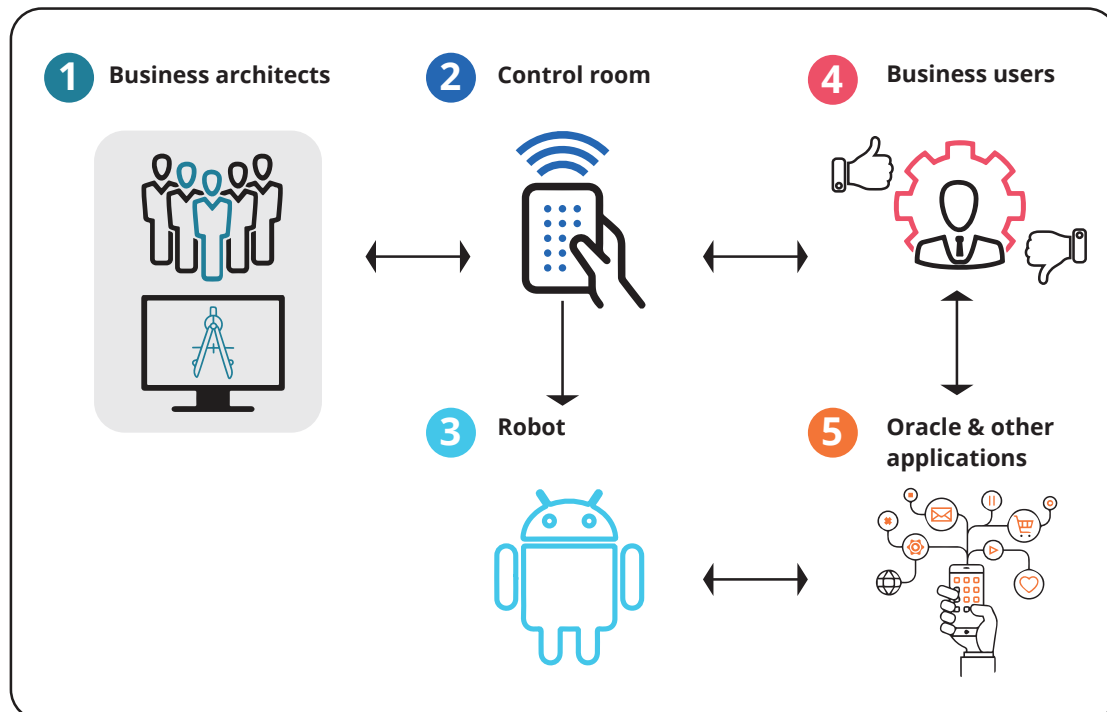
To automate business processes on Oracle applications, RPA business architects must first develop detailed business process instructions for the RPA bot to execute on Oracle and other integrated applications. These instructions are then assigned to available bots using a control room that monitors and controls all bot activity, and are used by the bots to interact with a wide range of Oracle and other applications to complete the business process.

Case studies

- **Case study 1 – Month end close automation**

  A leading global technology company sought to increase the capacity of its existing workforce, improve cycle time and synchronization of month-end close activities between production and test environments, and explore opportunities to increase controls within its accounting organization. Due to the high number of repetitive, rules-based tasks, the company chose to explore automation opportunities that leverage RPA solutions against their Oracle EBS ERP system.

  The current process involved the manual updating of accounting periods within Oracle EBS for multiple modules across several integrated test environments. Due to the manual nature of the work, the team's capacity to initiate or execute other higher-value projects dependent on proper update of accounting periods was severely constrained by the completion speed of these manual tasks.

  The application of RPA to this current process provided immediate benefits. First, that digital employees worked 24/7 made it possible for talent to focus on value-adding tasks. Also, RPA's ability to provide real-time email reporting allowed process owners to monitor task completion and exceptions. Finally, RPA's scheduling capability allowed period updates in the non-production environment to synchronize with production environments, which provided a consistent view for users across the organization.

- **Case study 2 – Customer refunds automation**

  A global firm was seeking to implement RPA across the full spectrum of its finance function. The firm undertook a 10-week RPA proof of concept (POC) to validate the technology, generate use cases, and develop a list of candidate processes for future program phases.

  One candidate process identified during the POC required employees to manually cancel and reissue refund checks to customers in Oracle EBS accounts receivables. Because this work was manual and repetitive, workers often made errors, which made the process an effective use case for RPA.

  Automating this Oracle-based transaction process provided significant benefits to the organization, including reducing in-customer call volume associated with improperly processed refund transactions, and eliminating the need to add resources to handle an increasing volume of refund requests. The interoperability between the RPA software and Oracle allowed for a rapid implementation, which made it possible for the transaction processing team to pivot resources to value-adding activities.

- **Case Study 3 – Integration and regression testing automation**

  A global consumer and industrial product organization implementing Oracle Cloud Procurement and Financials wanted to shorten its implementation timeline and lower post-implementation release-management costs. The organization conducted an eight-week study to explore how RPA could automate integration testing during the implementation program, which would help it achieve its two goals. The study identified several processes that could significantly benefit from an RPA approach.

  One of the target processes involved automating the integration and regression testing cycles for the Accounts Payable (AP) module. The automated bot was able to execute all

steps intended for a manual tester and log defects it encountered during the test execution.

Applying RPA to this process provided immediate relief to the implementation team, which was working against aggressive timelines. Additionally, the bot provided the organization a launching pad to automate testing of other Cloud ERP modules and leverage the same RPA bots post implementation to perform release management regression testing at relatively low costs.

Leveraging machine intelligence with oracle applications

One recurring use case across multiple industries concerns visibility into supply chain (SC) operations. The current trends of customer dynamic demand, personalized design, outsourcing and omnichannel sales make supply chains more complex, requiring much more data from suppliers, partners, and customers. Supply chain executives are seeking a more comprehensive view of their operational performance, as well as more effective and efficient methods of detecting and responding to potential supply chain disruptions.

In response, Deloitte has combined its knowledge of machine intelligence with Oracle Cloud ERP. The resulting solutions help provide real-time views of supply chain operations to facilitate more dynamic responses to disruption, made possible by leveraging a suite of powerful cognitive computing tools.

For example, the solution provides the capability to create a rules-based supply chain bot in Oracle Cloud ERP; utilizing machine learning, it can mimic human actions and judgement to detect potential supply chain disruptions and recommend mitigating actions. Through machine learning, the bot learns where to look for potential issues, helping supply chain executives more efficiently predict and prevent potential disruptions.

A typical interaction between an SC executive and the Oracle Cloud ERP system could be modeled as below. By using machine learning-enabled devices such as Smart Assistant, business users can quickly understand the problem and receive either suggestions for possible actions to take or updates on automated actions the bot has already performed. For purposes of this document, we will refer to the AI agent as SC Bot. A typical daily interaction could proceed as follows:

[SC Executive]: SC Bot, what is the status of my operations performance today?

[SC Bot]: Overall performance is green. On-time delivery is 96 percent. Inventory level is $32 million. No exceptions are reported by suppliers and partners.

[SC Bot]: Product ABC Inventory is reduced by 60 percent due to a large order from Company A. An email was sent to John Smith (inventory manager) to check potential shortage.

[SC Executive]: SC Bot, how is my suppliers' performance?

[SC Bot]: Overall on-time receive rate is 90 percent, reduced 5 percent from yesterday. Ten purchase orders were not received in Los Angeles from D.C.; it may be due to the Los Angeles port strike. An email was sent to Joe Doe (purchasing manager) to follow-up and report.

The SC executive not only gains instant visibility into the supply chain performance, but also is informed of potential disruptions and recommended solutions. This example of machine intelligence can increase supply chain efficiency and reduce costs by avoiding delays and disruptions. And because SC Bot can be configured and trained to learn from past experience, it will broaden its scope for detecting disruptions and suggest more accurate mitigating actions over time.

Bottom line

Fast-moving enterprises should leverage machine intelligence–cognitive technology systems that derive actionable insight by mining data stores–to engage with employees, to modernize the existing enterprise solution, and optimize smart and AI-enabled devices. Implementation of these systems can provide organizations with real, scalable benefits while establishing the processes and governance models required to continue their digital journeys. As machine intelligence and digital capabilities continue to evolve and mature, companies that have developed functional RPA programs will likely be prepared to capitalize on continued technological evolutions.

Authors

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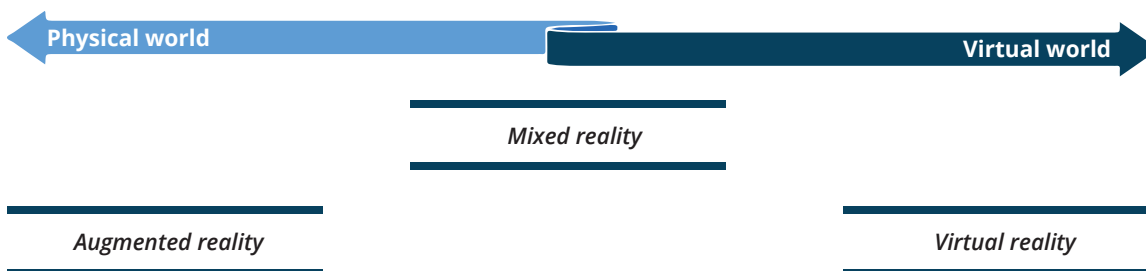
Mixed reality

Experiences get more intuitive, immersive, and empowering

FROM THE PAGES OF SCIENCE FICTION, THE AUGMENTED REALITY EXPERIENCES have become technologies with applications in everyday life. Human interaction with the digital world has evolved from typing and clicking on a keyboard or mouse to touch and talk on tablets or wearables. With technology advancements, even gestures and gazes have become mediums of interaction. Digital devices are now sensing and responding to ambient cues and intentional movements to create empathetic, personalized experiences. Virtual reality (VR), augmented reality (AR), and mixed reality (MR) are offering experiences built around these natural modes of interaction, thus shifting attention from a glass screen in our hands to the real or simulated worlds around us. As VR and AR find more enterprise applications, MR is opening up new paradigms for communication and collaboration by leveraging 3D, high definition, sensors, and markers.

VR replicates an environment that simulates a physical presence in the real world or an imagined world, allowing the user to interact with that world. AR provides an overlay of content on a view of the real world, but that content is not anchored to it. AR works by adding multi-dimensional content on top of real world objects or locations, allowing the user to unlock additional information that may be relevant, which has the effect of turning the physical world around them into digital media. MR is a controlled collision of AR/VR and Internet of Things (IoT). It merges real and virtual worlds to produce new environments and visualizations where physical and digital objects co-exist and interact in real time. MR technology bundled into a single device can provide the user with the ability to overlay augmented holographic digital content into real-time space and create scenarios in which the user participates. Indeed, MR facilitates complex user experiences and enhances the real world with visual overlays, spatial audio, and haptic feedback.

Figure 1

Physical world — Virtual world

Mixed reality

Augmented reality

Virtual reality

The mixed reality trend is being fueled by investments in platforms, devices, and software. Use cases and patterns have emerged around early investments. The ultimate goal of these investments is to replace keyboards and flat displays with entirely new paradigms for communication and collaboration. If successful, this would represent the biggest fundamental shift in user engagement we have in seen in the modern technological era. Each successive improvement to user interface patterns—from function keys and typing, to point and click, to touch and swipe, and now to talk—offers a chance to move "beyond the glass" of static displays, and to reimagine engagement around gestures, grasps, and glances. Mixed reality has the potential to allow a global workforce of remote teams to work together to tackle an organization's business challenges. No matter where they are physically located, an employee can strap on their headset and noise-canceling headphones and enter a collaborative, immersive virtual environment.

MR advances are already profoundly affecting how we relate emotionally to these novel ways of working. The ability to grab information from things around us—and for that information to respond to our visual. Though it may be several years before mixed reality's ultimate end game materializes, the time to begin exploring this dynamic new world—and the digital assets it comprises—is now.

Immersive and empowering experience in enterprise

Mixed reality, which found early use cases in the entertainment industry, is establishing a foothold in traditional businesses. Meanwhile, the enterprise potential of AR and VR continues to grow as companies explore use cases and move beyond pilot applications. Many professional applications are emerging for both technologies in areas like health care, architecture, education, product design, manufacturing, retail, transportation, logistics, and the military. Increasingly, these efforts intersect with opportunities made possible by Internet of Things technology—sensors and connected devices that help build a more integrated and extended digital and physical landscape. Design patterns are evolving dramatically, with 2D screens giving way to tools that use sensors, gestures, voice, context, and digital content to help humans interact more naturally with the increasingly intelligent world around us. While the consumer world waits for dominant AR and VR players to emerge, the enterprise can fast-track adoption of MR and begin the process of fundamentally reimagining how work gets done.

Leveraging mixed reality with Oracle applications

MR can simultaneously track an environment and an individual's relationship to that environment. This allows virtualized objects and information to respond realistically to what that individual is doing. MR may also bring together relevant data to provide insightful interactions, which presents an opportunity to integrate MR with the digital core to access information residing in ERP, CRM, HR, marketing, and other systems. Conversely, MR can also be an important tool for digitizing work—potentially automating underlying workloads, updating data with supplemental supporting information, or allowing MR steps to be a part of a longer-running business process.

MR experiences can be augmented by feeding relevant back-office data and analysis into the user's field of vision. Oracle is not an MR device or IoT sensors producer, but rather it has an applicable set of applications, tools, and designs that can aid in implementing enterprise MR use cases. These tools and technologies can also help enterprises gather and process data while at the same time interfacing with and extracting data from MR devices.

As enterprises develop use cases for MR, there is no one-fit or right-fit tool for all. The choice of application depends on the need at the moment and availability of required data. The following are a few Oracle applications that can provide MR-required operational and analytical information:

Oracle IoT Cloud: Oracle Internet of Things applications deliver a set of IoT apps for enterprise assets, production lines, transportation fleets, and mobile workers. With predictive machine-learning algorithms, enterprises can extend core SCM, CX,

HCM, and ERP processes with real-time IoT data and insights.

Oracle supply chain management (SCM), oracle enterprise resource planning (ERP) applications: Factories, shop floors, distribution centers, and many other enterprise departments operate on information in ERP and SCM applications. Oracle provides access to these applications, thereby aiding the manager or worker to complete tasks at hand.

Oracle platform and infrastructure as a service (PASS and IASS): Legacy custom applications do not have modern capabilities to connect with MR devices. Oracle PaaS and IaaS tools can potentially fill this gap and modernize capabilities.

Use cases

- **Use case 1 – Product design**

  Using feedback received through Oracle Social Cloud, a product engineer is working to enhance the aesthetics of automobile rooftop railings. He shares a potential design with his team using Oracle Product Information Management (PIM). With the same system, the team submits their ideas, which are discussed and voted upon. Multiple designs make it to the prototype phase. But instead of developing traditional, physical prototypes, the engineer generates holographic images of railing designs on the attributes stored in Oracle PIM. Using augmented reality device, he overlays the hologram onto a real car, the image of which appears in the field of vision of users. For each of the designs he continues to check various parameters by using voice commands or gestures and without using any other

physical device. He examines the overall look and feel and modifies its color. He then asks the smart assistant to get a cost estimate for building the various rails from Oracle Costing. Finally, using Oracle Procurement applications, he confirms that components are available. With all these steps completed, the engineer uploads his final design directly into the Oracle Product Management application for additional teams to develop further.

- **Use case 2 – Service collaboration**

  A machinery company has stringent service level agreement (SLA) contracts with a coal mining organization to resolve any machine equipment issues within 24 hours. Usually these issues are minor—replace a part or make an adjustment. To control costs, the machinery company keeps only one employee at the mine site. When miners log a service ticket through Oracle Service Cloud, the repair worker realizes that he might not have enough information to fix the malfunctioning equipment. Wearing an augmented reality headset, he examines the equipment in question, and then connects to the Oracle Content Management Cloud to get more product information documents and videos. He identifies the problem, and then connects to Oracle Service Contracts and Installed Base applications to get details of whether the faulty part was serviced earlier and if there are any alternatives for repairing it. He also launches a collaborative session with a product engineer at the factory where the product is manufactured to validate his findings.

  In the end, the worker fixes the problem, meeting the 24-hour service window efficiently and at a low cost.

Bottom line

Even as we elevate mixed reality above its piece-parts of AR, VR, and IoT, the under-lying technologies themselves are continuing to advance. Individually they represent very different solutions, domains, and potential applications. However, if companies pursue them in isolation, their full potential likely never will be realized. The goal should be evolving engagement—building more intuitive, immersive, and empowering experiences that augment and amplify individual users, leading to new levels of customer intimacy, and creating new solutions to reshape how employees think and feel about work. Oracle Application products have been on an accelerated evolution path, and the total number of product offerings has increased to support a wide range of requirements that may aid MR use cases.

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Inevitable architecture

Complexity gives way to simplicity and flexibility

ORGANIZATIONS ARE OVERHAULING THEIR IT LANDSCAPES BY COMBINING OPEN source, open standards, virtualization, and containerization. Moreover, they are leveraging automation aggressively, taking steps to couple existing and new platforms more loosely, and often embracing a "cloud first" mind-set. These steps, taken individually or as part of larger transformation initiatives, are part of an emerging trend that some see as inevitable: the standardization of a flexible architecture model that drives efficiency, reduces hardware and labor costs, and foundationally supports speed, flexibility and rapid outcomes.

I N an era of rapid-fire innovation—in which cloud, mobile, analytics, and other forces implemented on the edge of the business fuel disruption and new opportunities—architectural maturity is becoming a persistent challenge directly linked to business problems. In the next 18 to 24 months, CIOs and their partners in the C-suite may find the solution to such challenges in a flexible architecture model that has demonstrated efficiency and effectiveness in start-up IT environ¬ments; its broader adoption in the marketplace may be inevitable. In this cloud-first mod¬el, and in the leading practices emerging around it, platforms are virtualized, containerized, and treated like malleable, reusable resources. Systems are loosely coupled and increasingly automated to be self-learning and self-healing. Likewise, on-premises, private cloud, or public cloud capabilities may be deployed dynamically to deliver each work¬load at an optimum price and performance point. Taken together, these elements may make it possible to move broadly from managing instances to delivering outcomes.

These trends are emerging in Oracle hardware, software, application, and Cloud service innovations that allow enterprises to start realizing envisioned benefits. In the coming months, expect to see organizations follow suit by experimenting with one or more of the following inevitable architecture elements.

Autonomic platforms

Inevitable architecture demands automation throughout the IT lifecycle, including automated testing, building, deployment, and operation of applications, as well as large-scale autonomic platforms that are largely self-monitor¬ing, self-learning, and self-healing. Autonomic platforms build upon and bring together two important trends in IT—software-defined everything's climb up the tech stack and the overhaul of IT operating and delivery models under the DevOps movement. With more and more of IT becoming expressible as code— from underlying infrastructure to IT department tasks—organizations now have a chance to apply new ar¬chitecture patterns and disciplines. In doing so, they may remove dependencies between business out¬comes and underlying solutions,

while redeploying IT talent from rote low-value work to higher-order capabilities.

Fault expecting

For decades, developers focused on design patterns that make systems fault-tolerant. Inevitable architecture takes this tactic to the next level by becoming "fault expecting." Famously illustrated in Netflix's adventures of Chaos Monkey, fault expecting is like a fire drill involving real fire. It deliberately injects failure into a system component so that developers may understand how the system likely will react, how to repair the problem, and how to make the system more resilient in the future. As CIOs work to make systems more component-driven and less monolithic, fault expecting could become one of the more beneficial inevitable architecture attributes.

Figure 1: Key architectural principles

APIs can be conceptualized as web pages for programs. They allow different applications to communicate with each other via a standardized language, without exposing back-end logic or data.
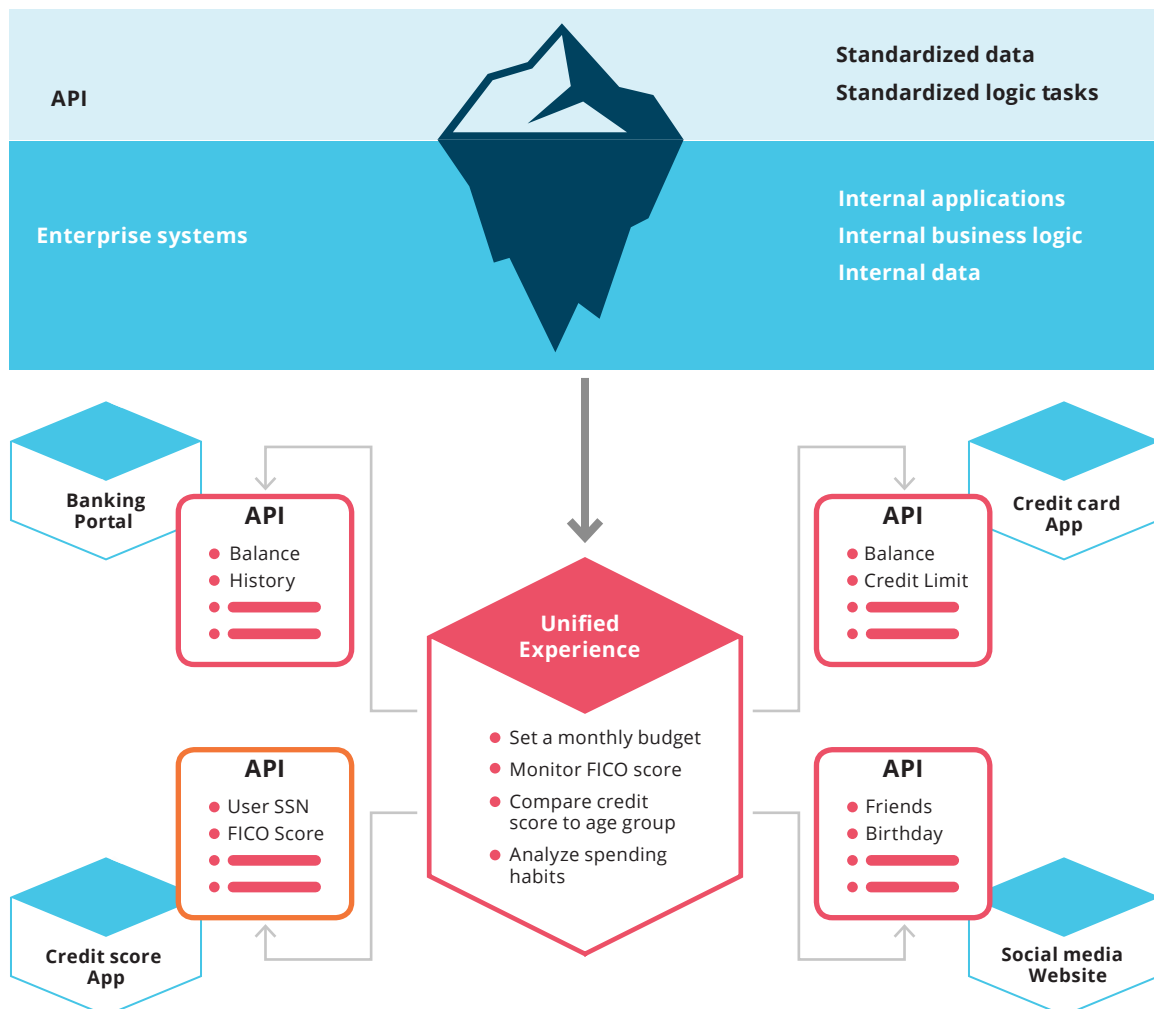
- APIs expose data in a **universal language** that can be read by other applications, and allow permitted users to write data back to the API
- Organizations can restrict who can access this data, and **enforce security requirements** for when it can be accessed
- Back-end systems are **completely hidden** from view from users of the API, and no details of internal systems are revealed

Loosely coupled systems

Loose coupling joins multiple computer systems—even those using incompatible technologies—regardless of hardware, software, and other functional components. In today's ever-evolving technology world, use of APIs and micro services to build enterprise applications is becoming the default scenario. As more and more applications are being deployed to cloud, it's becoming increasingly difficult to manage monolith applications, as a change made to one part of the application might require an entire monolith to be rebuilt and redeployed. These challenges have led to building applications as micro services to allow smaller services written in different programming languages and managed by different teams.

Containers

Figure 2: Overview of containers

Containers are a method of operating system virtualization that provides the necessary computing resources to run an application independently on a shared OS

Key characteristics

- Intended to run a single application
- Bundles all application dependencies such as libraries, binary files, and other configuration files into a package, making it portable
- Creates isolation boundary at the application level, allowing multiple applications to reside and share the same OS
- Created containers can be deployed to different servers, leading significant software lifecycle benefits
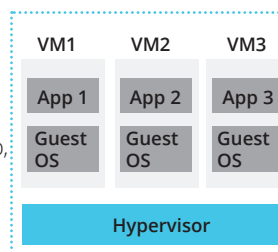
Difference between virtual machines and containers

- The key difference between containers and virtual machines is   the way the operating system resources are used and the   location of the virtualization layer
- Each virtual machine runs a unique OS , whereas containers shares the host OS
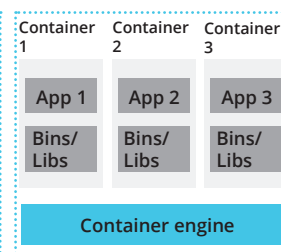- Virtual machines might take several minutes to boot up, but Containers take only few seconds

	Virtual machine	Containers
Start time	30-45s	<50ms
Stop time	5-10s	<50ms
Workload density	1x	10-100x

Containers are packaged software that can run—isolated—on a shared operating system. However, unlike a virtual machine (VM), they don't run a complete instance or image of an operating system, with kernels, drivers, and shared libraries. Instead, an entire stack of containers, whether it be dozens or hundreds or even thousands, run on top of a single instance of the host operating system, in a tiny fraction of the footprint of a comparable VM running the same application. Additional containers can be spawned in microseconds, versus minutes or even longer for VMs. This makes for efficient, lightweight, self-contained systems and guarantees that software will always run the same, regardless of where it's deployed.

Open source

Once, software vendors would say open source software, to put it kindly, wasn't worth monetizing anymore. Now open source has become a preferred way of germinating hot new technology, particularly for startups. GitHub, a leading code repository and versioning system, which is offered as a cloud service where one can find many of the most active open-source projects. GitHub has changed software development by answering a simple question: Why code it yourself if someone else has already done it and is willing to share under a liberal open-source license?

Speed first, then efficiency

As business becomes increasingly reliant on technology for emerging products and services, often there is an urgency for IT to shrink time-to-market schedules. As such, inevitable architecture emphasizes speed over efficiency, an approach that upends decades of processes and controls that may slow progress and discourage experimentation. Though it may be several years before many CIOs wholly (or even partially) embrace the "speed over efficiency" ethos, there are signs of momentum on this front.

Oracle technologies that support inevitable architecture elements

Oracle provides offerings to support accelerated application development and deployment by providing enterprises with a suite of modern, API-first, mobile-first cloud applications with support for container-native, cloud-native, and low-code development.

- **Oracle ravello** enables developers to spin up complete environments in the form of self-contained capsules in the cloud on every commit, without making any changes to their application environment; helps ensures silo developments do not impact an entire application or its users; enables enterprises to run existing VMware workloads on leading cloud solutions without modification; and provides automatic discovery and blueprinting of hosts and network components, retains existing network configurations, and avoids the complexity of moving and read-dressing individual hosts.

- **Internet of things (IOT) cloud service** provides the capability to analyze massive amounts of IoT-related information, at scale, from connected devices in real-time. It is well suited for use in cases like remote equipment monitoring and maintenance for the industrial manufacturing industry and asset tracking in the logistics and transportation industry.

- **Multiple zones,** in cloud computing, refers to groups of cloud computing resources that are physically isolated from one another. Oracle has multiple zones across geographies that may be used to design for fault tolerance. If a service is distributed among several zones, consumers of that service may fail over to other zones.

- **Oracle coherence addresses** one of the challenges with having geographically distributed zones where data must be made available to all of the zones. Oracle Coherence uses a technique known as sharding. Through sharding, a data set is broken into small pieces and distributed across a large cluster so as to reconstruct a data set even if there is failure of individual nodes. This means that only very small chunks of data are replicated across zones at any time, while full data sets are generally available in the local zone.

- **Oracle cloud container service (OCCS)** provides a way to create an enterprise-grade container infrastructure. For organizations getting started with virtualized computing or data centers on the cloud, OCCS enables provisioning containers in a few clicks. For organizations looking for long-term infrastructure, OCCS is built to provision development, test, and production environments relatively easily, thus allowing teams to focus more on the applications and less on the underlying infrastructure.

- **Oracle java is a** large community of Java developers and open-source projects.

- **Oracle MySQL and MySQL cloud service are** open source database software for web, cloud, and mobile applications.

- **Oracle Linux** delivers the latest Linux innovations along with enterprise-quality support at a lower cost.

- **Oracle NoSQL database and NoSQL cloud service** are scalable, distributed NoSQL databases designed to provide highly reliable, flexible, and available data management across a configurable set of storage nodes.

- **Oracle mobile application framework and mobile cloud service** are designed to accelerate agility, speed time to market, and simplify enterprise mobility while reducing costs. Oracle Mobile Cloud Service helps developers define mobile APIs and build mobile apps that connect to enterprise systems quickly and securely using innovative, persona-based tools and services.

- **Oracle API Platform Cloud Service** helps organizations manage a portfolio of APIs with out-of-box functionality for automatic testing of APIs against design and quick change in APIs and their policies. This enables rapid deployment or modification of services and applications, security, and centralized API management.

Case studies

- **Case study 1**

  A digital content-based company offering distribution solutions for app developers, software developers, mobile carriers, and device manufacturers developed a leading application distribution platform to optimize and automate the installation process, analytics, and monetization for application developers. Historically, developing and testing the installers on possible combinations of operating systems and browsers had been extremely challenging and time-consuming. One of the company's key challenges was to scale its offerings across multiple windows client versions.

  Using Oracle Ravello's nested virtualization capabilities, the company was able to automate the development and testing process, effectively increasing quality and scalability without impacting costs. The company used Oracle Ravello APIs to automatically create environments for each operating system version.

  The company has created more than 600 replicas of customer environments for daily testing. In less than 20 minutes, developers can build the environments, run the tests, and report the results, which otherwise take hours and days to

complete. At the end of each batch, it shuts down the environments, resulting in a simple pay-per-use service that reduces infrastructure costs.

- **Case study 2**

An international technology services company wanted to migrate their mission-critical finance application from a vendor's proprietary managed services environment to an open-source infrastructure, enabling both a drastic reduction in the total cost of ownership (TCO) as well as technology independence. In order to implement this change successfully, its team had to guarantee the robustness and the high availability of the application, as well as improve the performance and scalability of the system to address constantly growing transactions volume.

The solution involved adoption of an open-source strategy and re-engineering of the application that relied on a software stack that included Linux, MySQL Enterprise Edition, Apache/Tomcat, and the C and Java languages. It also required implementation of an architecture built around business processes acting as subcomponents, multi-instantiated to allow for better scalability because siloed processes became bottlenecks in the previous architecture. To meet the high availability requirements, synchronous replication between two data centers created redundancy.

Using this open-source strategy, the organization met its objective of drastically reducing TCO, and, additionally, simplified system maintenance while increasing performance.

Bottom line

In a business climate where time to market is becoming a competitive differentiator, the enterprise can no longer afford to ignore the impact that technical debt, heavy customization, complexity, and inadequate scalability has on its bottom line. By transforming legacy architecture to emphasize cloud, containers, virtualized platforms, and reusability, it may be able to move broadly from managing instances to delivering outcomes. As organizations begin exploring transformation possibilities, they should begin by defining end-goal capabilities, breaking down silos to free development and infrastructure teams, and reorienting them as multidisciplinary, project-focused teams that can facilitate the adoption of inevitable architecture's value-added capabilities.

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Everything-as-a-service

Modernizing the core through a services lens

MANY ORGANIZATIONS ARE REORIENTING THEIR BUSINESS CAPABILITIES AND approaching business products, offerings, and processes as a collection of services that can be used both inside and outside organizational boundaries. But doing so means IT may need to revitalize legacy core assets by upgrading to the latest ERP platforms or refactoring aging custom code. Though sometimes-daunting undertakings, these and other legacy remediation efforts can help achieve short-term efficiency gains and cost savings, while laying the foundation for broader strategic shifts.

LEADING **CIOs are transforming systems into services and platforms. This everything-as-a-service (XaaS) approach casts a new light on** core modernization, broadening the effort to create new operational models and modes of service delivery, resulting in better efficiencies and ways to engage customers. More work today can mean a better customer experience tomorrow.

In a constantly evolving market, legacy systems and bespoke applications that aren't enabling a core competency are often viewed as overhead that can be commoditized. One popular approach for achieving this entails service-enabling both the business process and the related application, steps that support focus and flexibility in other areas. Likewise, outsourcing the hosting, continuing maintenance (development/improvement), and administration of such applications can also be prudent. What started with the SaaS model offering a way to think of software has now expanded to a trend in which everything is designed from the ground up as a set of "LEGO® blocks" to be assembled into an IT architecture that is both flexible and cost-effective.

Oracle technologies that support plug and play on the cloud

Oracle is a fast-growing player in the XaaS market space for IT applications (SaaS), infrastructure (IaaS), and platforms (PaaS). A number of companies are moving from maintaining traditional IT assets to an XaaS model to realize cost benefits and increased agility. Oracle's cloud products, which include enterprise business applications (SaaS), infrastructure (IaaS), and platform services (PaaS), have evolved significantly over the past few years. These offerings can provide the benefits of a modern cloud platform and can be used as a foundation for a XaaS transformation.

SaaS enables subscription-based usage of application software in the cloud. Depending on the maturity and complexity of their IT assets and business processes, organizations can choose to implement SaaS applications in various areas including accounting, HR, procurement, project management, service, sales management, marketing, and supply

chain—with new products introduced with each re-lease. Moreover, a SaaS model can help simplify the process of upgrades, and offer flexibility in scale and cost.

PaaS opens up the same technology platform used to build the SaaS applications for open development and integration. Organizations investing in custom development can stay aligned to their SaaS applications and also realize many benefits of the XaaS model, particularly in the areas of maintenance and administration. Oracle offerings include JCS, SOACS, MCS, IoT, and new products being launched with each release.

IaaS makes it possible for organizations with complex business process that run on bespoke applications to move to the cloud. It also allows them to enhance the scalability, agility, and cost-effectiveness for any workload regardless of operating systems, databases, VMs, and other technological considerations. Oracle's IaaS offerings include a set of "bare metal" components like compute, storage, and network resources among others which allows customers to scale as needed. In many cases, migration tools and containers can also help companies transition to the cloud.

Oracle is constantly investing in and expanding its product base with products such as Mobile Cloud Services and Internet of Things. Customers may choose to shift their applications to the cloud through IaaS and slowly transition to a SaaS model as their adoption of cloud technology increases. Deloitte has teamed with Oracle to develop practical XaaS roadmaps and "Cloud Transition Labs," to help companies deploy the right cloud technologies at the right time.

Service-enabling the business

Organizing business processes as services is not a new concept. Companies have been doing it for decades and have been seeing the benefits monetarily and logistically. The recent change has been the development of technology that supports this model for smaller organizations that can scale on demand as they grow.

For example, forecasting, budgeting, and financial planning are essential components of every finance organization. Typically, these processes tend to get overcomplicated and too detailed, resulting in forecasts that aren't realistic and then require significant adjustments or topside "hedges." Standardizing, consolidating, and exploiting economies of scale to use more advanced tools in a cost-efficient manner are all possible by sharing a service-enabled Finance-as-a-Service.

Management reporting, working capital management, and cash flow optimization are some other examples of areas that can be service-enabled with similar benefits and returns on investment. The recent advancement in technology helps smaller organizations to implement such service enablement on a scale suitable to their current size and increase their footprint without major disruption as they expand.

Case study: CISCO

Several years before changes in capabilities, products, and processes began coalescing into what is now recognized as the everything-as-a-service trend, Cisco Systems sensed a change in the operational winds and took action. The global technology products and services provider launched a multifaceted architectural and operational initiative to break down silos, deploy and leverage technology more effectively, and align IT services with both customers and the business.

"This is an ongoing transformation effort," says Will Tan, Cisco's senior director of operations. "We have 30 years of mindset to overcome, but today, what we provide are services, and we need to create an organizational construct to support that."

Cisco's move to the as-a-service model began with examination of the company's operations through a product and positioning lens, especially in the area of cloud offerings. "We realized that we needed to rethink the way we were working, how we thought about value streams, and the way we organized ourselves," Tan says. "Likewise, we began reviewing the relevance of our architecture to determine
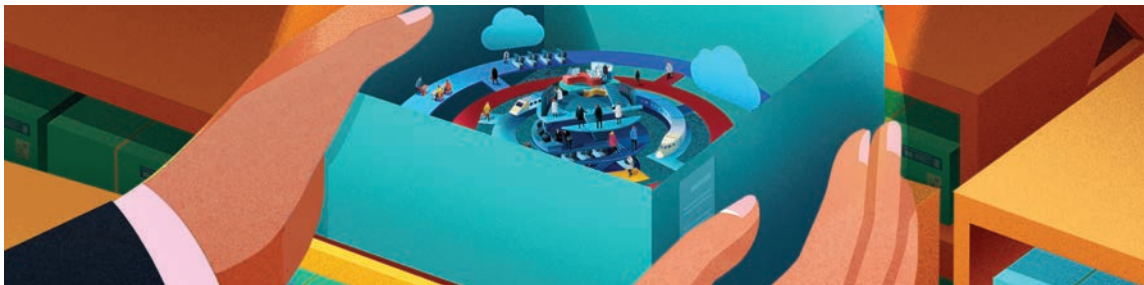
what kind of connectivity we need to meet our XaaS goals."

So, roughly six years ago, Cisco took a first—and fundamental—step in its transformation journey by creating a single, uniform taxonomy that would clearly define the company's services, the architectural components that support them, and, importantly, how these components fit together. Dubbed BOST (the business operations systems and technology stack), this working taxonomy has helped break down functional silos by ensuring that all groups approach services and services architecture consistently.

Following this initial step, Cisco identified two major goals that would drive its transformation efforts going forward. First, came business alignment of IT capabilities; Cisco has worked aggressively to align IT with the business units' missions and operations, reorienting all IT operations so they "lead with a business view." IT now organizes its priorities by the business's strategic and operational priorities, measuring success not just by isolated performance of IT disciplines but by business outcomes.

Second, Cisco anchored IT with a services mindset. IT capabilities began to be defined by the value they were creating, decoupling the underlying technical skills, activities, and solutions from the overarching

business services driving growth and demanding flexibility and agility. This meant the IT operating model and organization had to evolve, along with the underlying technical architecture up, down, and across the stack.

Some companies view XaaS exclusively as a means for controlling costs and creating efficiencies. Cisco sees an equally compelling opportunity to rethink the way it engages and understands customers—and to shift its mindset to how its ecosystem of supply chain and channel partners think about their customer outcomes.

Though Cisco's XaaS journey is ongoing, the company's efforts are delivering tangible benefits, with IT costs coming down and processes becoming more streamlined. And Tan cites other welcome outcomes. "A couple of years ago, we transformed our ERP system into a global platform that consolidated core financials and supply chain. IT has built services that have become global standards, which have helped us scale for the future," he says. "As we have expanded into China and India, we have leveraged this platform not just for cost containment but to accelerate our time to market and to offer business services more effectively."

Bottom line

Given the highly competitive market across industries, many organizations are evolving at a rapid and ongoing pace to stay current and relevant. The ability of IT to stay in lock step is no longer a desired quality but a presupposition. While technology to support service-oriented architectures is available today and mature, there is still the need for new thinking and for a new approach to doing business in order to achieve the potential of XaaS.

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Blockchain: Trust economy

Taking control of digital identity

BLOCKCHAIN IS OUTGROWING ITS ADOLESCENT CRYPTOCURRENCY IDENTITY with distributed consensus ledgers becoming smart contract facilitators. Beyond creating efficiencies by removing the legal and financial intermediary in a contractual agreement, blockchain is assuming the role of trusted gatekeeper and purveyor of transparency. In the emerging "trust economy" in which a company's assets or an individual's online identity and reputation are becoming both increasingly valuable and vulnerable, this latest use case may be blockchain's most potentially valuable to date.

Blockchain is a cryptotechnology that has been called the "information game-changer" of the 21st century due to the combination of its capabilities and benefits. Fundamentally, it is a digital ledger system that relies on well-established cryptographic principles and operates as a distributed repository providing a way for information to be recorded and shared through a peer-to-peer community. Blockchain is characterized by a number of key attributes: Transparency, such that all the blockchain participants are able to view data added to the chain, while the chain improves data integrity by being the single source of truth; establishing trust between participants without them having to know one another, through connected data blocks and distributed validation structures; enabling near real-time recording and validation of transactions, thus removing friction and reducing risk; disintermediation, through the elimination of the need for arbitration/trust intermediaries; and auditability, since the blockchain is, by definition, immutable and everlasting means of record-keeping.

International policy perspectives

Just like with every successful technology before it, Blockchain's success will depend on the scope, diversity, and rate of adoption. There are noteworthy efforts being pursued by policy influencers that are likely to accelerate the adoption of the underlying technology that will impact the finance function in the enterprise.

For instance, in March 2016, hearings in the United States House of Representatives committees deliberated removing hurdles that prevent widespread adoption of financial and non-financial blockchain applications. In January of the same year, the Office of the Chief Scientific Advisor of the United Kingdom released a detailed policy paper, arguing for ways in which the government could use blockchain technology to redefine its relationship with its citizens. At the same time, the Australian Stock Exchange (ASX) announced that it was developing infrastructure to shift operations to a blockchain platform. Even before all of this, in early 2015, the
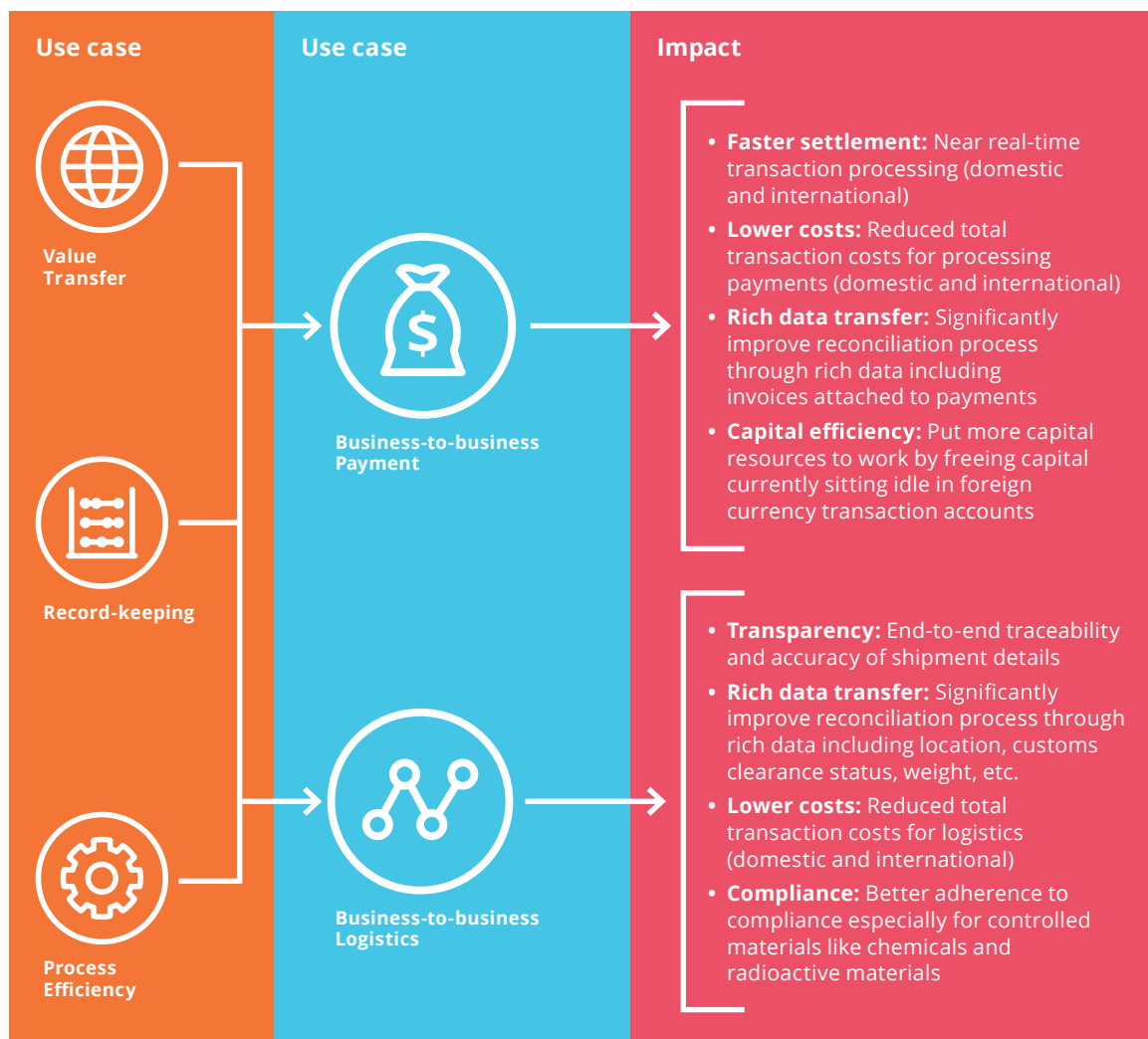
European Union, detailed the setup of an Energy Contracts Ledger to record energy contracts and allow for consumers to transition easily from one supplier to another through self-service.

We highlight these instances not only as a validation of global commitment to blockchain, but also as a lens through which to view the diverse set of use cases where blockchain technology is gaining traction.

Use cases

In the enterprise cloud offerings space, Deloitte continuously works on developing new technologies which offer tangible business value for our enterprise customers. Our internal Deloitte research suggests that blockchain technology finds strong and compelling use cases for the enterprise finance function. To this end, there are three key themes around blockchain technology with potential to develop use cases for the finance function, which are explained below.

Figure 1: Blockchain: Key themes and use-cases

Use case	Use case	Impact
Value Transfer	**Business-to-business Payment**	• **Faster settlement:** Near real-time transaction processing (domestic and international) • **Lower costs:** Reduced total transaction costs for processing payments (domestic and international) • **Rich data transfer:** Significantly improve reconciliation process through rich data including invoices attached to payments • **Capital efficiency:** Put more capital resources to work by freeing capital currently sitting idle in foreign currency transaction accounts
Record-keeping		
Process Efficiency	**Business-to-business Logistics**	• **Transparency:** End-to-end traceability and accuracy of shipment details • **Rich data transfer:** Significantly improve reconciliation process through rich data including location, customs clearance status, weight, etc. • **Lower costs:** Reduced total transaction costs for logistics (domestic and international) • **Compliance:** Better adherence to compliance especially for controlled materials like chemicals and radioactive materials

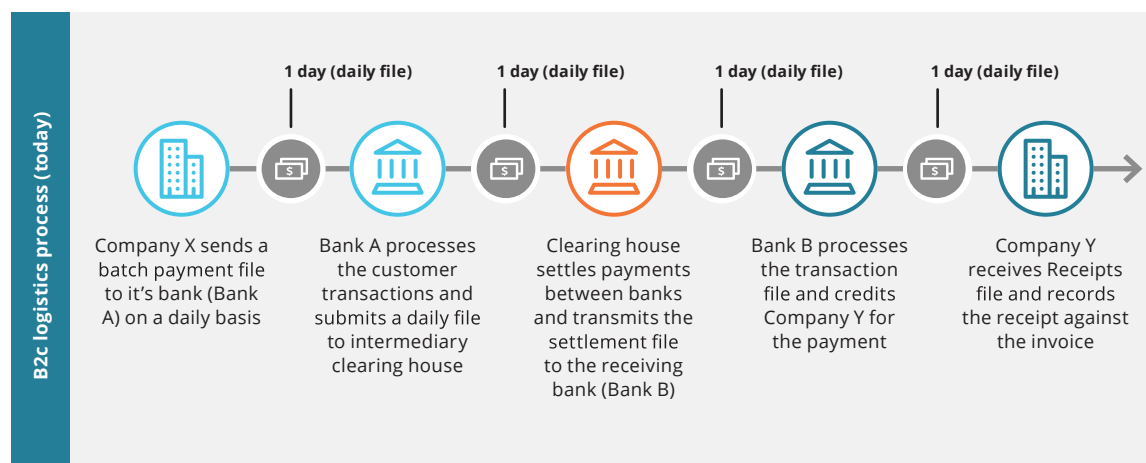## Use Case #1: Business-to-business (B2B) payments

The current enterprise remittance ecosystem includes multiple stakeholders, namely the partners, the intermediary banks, and the clearing houses. Each stakeholder maintains disparate systems and does multi-point reconciliations. When enabling cross-border payments, the complexity of underlying protocols increases failure points and costs.

For instance, a global corporation, let's call it Company X, has a B2B remittance cycle that can take days. The company prepares a batch payment file via its enterprise cloud financial system to its bank, Bank A, on a daily basis. Bank A accepts, parses and processes the customer transactions in the batch file and submits its own daily file onwards to an intermediary clearing house. The clearing house received thousands of such files and settles payments between banks. It then transmits the settlement file to the recipient bank (Bank B), which is the merchant bank for Company A's supplier, Company Y. Bank B processes the file and credits Company Y's account and transmits a receipt which can be used to record the payment at Company Y's end. A reverse acknowledgement process then takes place to ensure validation across all stakeholders.

Figure 2: B2B payments

The following is an illustrative example of a B2B Payment and how it is transformed with a Blockchain solution

B2c logistics process (today)

| 1 day (daily file) | 1 day (daily file) | 1 day (daily file) | 1 day (daily file) |

Company X sends a batch payment file to it's bank (Bank A) on a daily basis

Bank A processes the customer transactions and submits a daily file to intermediary clearing house

Clearing house settles payments between banks and transmits the settlement file to the receiving bank (Bank B)

Bank B processes the transaction file and credits Company Y for the payment

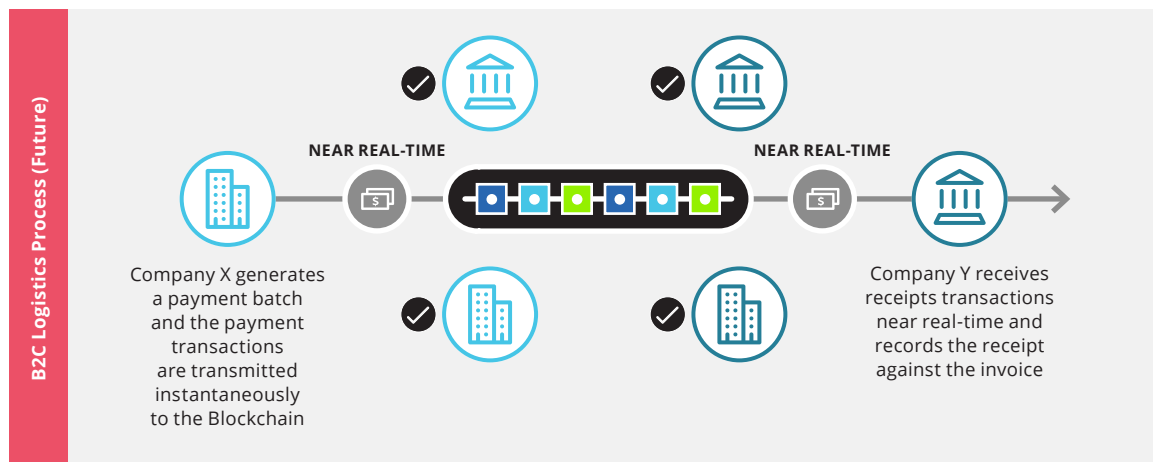Company Y receives Receipts file and records the receipt against the invoice

Not only is this process slow (order of days) with multiple points of potential failure, it is also problematic as the clearing house is a distinct bottleneck to accurate settlement. As with other contractual and financial transactions, there are enough reasons to challenge the age-old business-to-business (B2B) payment process in light of the evolution of blockchain to develop a cutting-edge, real-time B2B payment solution to drive efficiency, reduce operational costs, and improve cash flow.

With blockchain, however, once all counterparties in the ecosystem are on-boarded onto a private, permissioned common blockchain, each payment transaction is transmitted and

Figure 3

B2C Logistics Process (Future)

NEAR REAL-TIME

NEAR REAL-TIME

Company X generates a payment batch and the payment transactions are transmitted instantaneously to the Blockchain

Company Y receives receipts transactions near real-time and records the receipt against the invoice

validated in near real-time by all stakeholders and added to the block for any node to verify. Immutability and trust is maintained on the distributed ledger, thus eliminating the need for a clearing house. Furthermore, failure points are reduced, improving accuracy of settlement. Additionally, enterprises can leverage the shortened settlement cycle for more accurate planning and forecasting. In the case of multi-currency or cross-border settlements, the instantaneous settlement reduces forex risk as well.

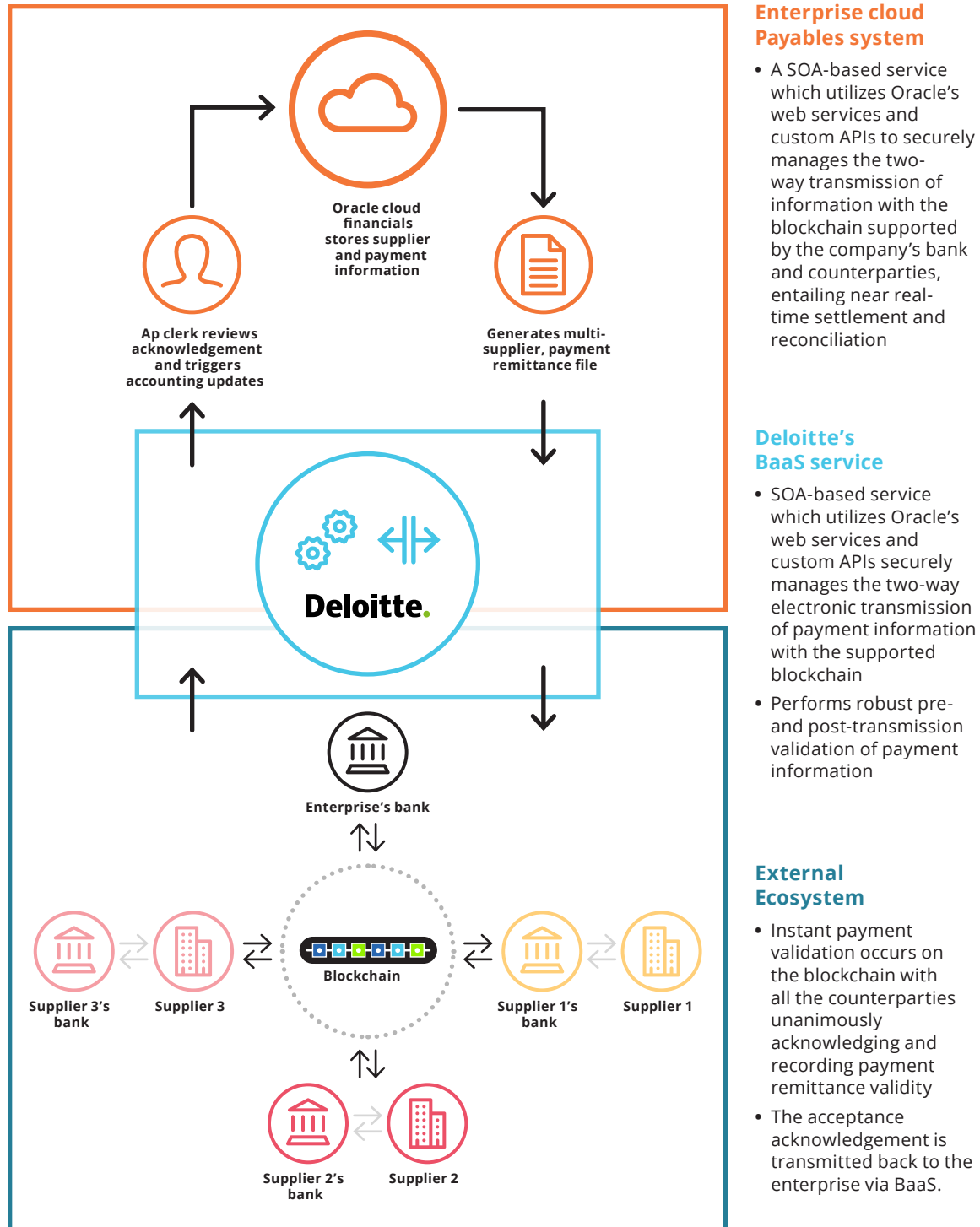## Deloitte's blockchain-as-a-service (BaaS) solution

Deloitte has built a Blockchain-as-a-Service (BaaS) solution that offers a flexible, blockchain-agnostic,

plug-and-play solution for enterprises looking to service their B2B payments by adopting a common blockchain framework with their suppliers, vendors, and banking partners. The Deloitte BaaS sits between a company's enterprise cloud payables system and the external ecosystem of counterparties, namely the suppliers and partner banks, once they have been onboarded onto a common blockchain (Deloitte's BaaS offers integration flexibility with upcoming and popular blockchains).

Deloitte's BaaS is a SOA-based service which utilizes Oracle's web services and custom APIs to securely manage the two-way electronic transmission of payment information with any supported blockchain. There is minimal switching cost and change impact for existing enterprise cloud systems – a payables team can continue to follow the existing processes.

Figure 4: Deloitte's blockchain-as-a-service (BaaS) solution architecture: B2B payment use case

Deloitte's BaaS solution offers a flexible, blockchain-agnostic, plug-n-play solution for enterprises looking to service their B2B payments by adopting a common blockchain framework, along with their suppliers/vendors as well as the intermediary banks.

Oracle cloud financials stores supplier and payment information

Ap clerk reviews acknowledgement and triggers accounting updates

Generates multi-supplier, payment remittance file

Deloitte.

Enterprise's bank

Blockchain

Supplier 3's bank **Supplier 3**

Supplier 1's bank **Supplier 1**

Supplier 2's bank **Supplier 2**

Enterprise cloud Payables system

- A SOA-based service which utilizes Oracle's web services and custom APIs to securely manages the two-way transmission of information with the blockchain supported by the company's bank and counterparties, entailing near real-time settlement and reconciliation

Deloitte's BaaS service

- SOA-based service which utilizes Oracle's web services and custom APIs securely manages the two-way electronic transmission of payment information with the supported blockchain
- Performs robust pre- and post-transmission validation of payment information

External Ecosystem

- Instant payment validation occurs on the blockchain with all the counterparties unanimously acknowledging and recording payment remittance validity
- The acceptance acknowledgement is transmitted back to the enterprise via BaaS.

Use Case #2: High-value Business –to-Consumer (B2C) Logistics

With the ever-growing need for controls in the logistics management process, especially in the case of controlled substances such as chemicals, pharmaceutical drugs, and radioactive materials, it is important for organizations to have a robust mechanism to ensure sanity of touch-point transactions between goods' origins and destinations. This use case looks at ways in which Oracle Logistics Cloud and blockchain technology can be combined to address the regulatory requirements of such logistics while offering greater transparency and richer data for traceability.

The supply chain and logistics ecosystem today is unwieldy, having multiple touch-points and stakeholders, starting from the producer of the goods to the consumer and in the case of controlled materials, multiple regulatory authorities and government agencies, too. Each touch-point in the process demands logging of the status, inspection results, risk assessment, and more, with each stakeholder maintaining the details in their respective transaction recording systems, which differ widely in architectural complexity. Although the evolution of logistics has simplified the logistics scenarios for most goods, there is still a strong need for improving traceability and transparency of controlled/sensitive and high-value logistics between governments and businesses.

For example, traceability of the shipment of controlled radioactive material between two countries starts from the raw material extraction in the source country to its delivery to enrichment facilities, and from there to the consumption endpoint, namely a nuclear power plant in the receiving country. The logistics chain has multiple checkpoints and at each touch-point, numerous metrics have to be recorded, logged, and shared with multiple parties in a secure and robust manner. If an exception occurs, robust and safe recall protocols need to be executed. Real-time handshake and authorization along with data security and integrity becomes extremely important in this scenario, and today the process is extremely slow and error prone as each stakeholder is monitoring, logging, and approving each touch-point offline.

Once all counterparties in the ecosystem are onboarded onto a private, permissioned common blockchain, each touch-point transaction is transmitted and validated in near real-time by all stakeholders and added to the block for any node to verify. Immutability and trust is maintained on the distributed ledger, thus eliminating the need for the slow and error-prone offline authorization and logging of inspection results, status, and risks. No involved party will be able to manipulate the records without unanimous consent, resulting in better accuracy and trust.

Deloitte's Blockchain-as-a-Service (BaaS) Solution for High-Value Enterprise Logistics

Deloitte is working with key industry stakeholders to develop an innovative plug-and-play BaaS solution to enable the end-to-end logistics of high-value/controlled goods on the blockchain. Once established, the solution will be integrated with a company's existing logistics cloud to manage the careful transmission, tracking, and validation of epochs (touch-points), by all onboarded stakeholders (nodes). This is designed to offer a robust and secure logistics management solution.

Bottom line

Businesses and government are increasingly exploring the wide-ranging applicability of blockchain technology including opportunities for reducing costs, gaining operational efficiencies, and finding strategic competitive advantages. Additionally, the rapid increase in compute capabilities has created a "goldilocks zone" for blockchain technology to take off in popularity. From distributed databases to smart contracts, from fail-safe privacy to real-time logistics, there continue to be new use cases for blockchain technologies. Although there are challenges related to the technology's scalability, lack of broader standards, and questions associated with its inherent operational immutability, these are likely growing pains. There are many early indications that point toward the technology's potential in the enterprise technology space – including its capabilities to integrate with Oracle's cloud suite of "X-as-a-Service" offerings.

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