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EXECUTIVE SUMMARY

# Tech Trends 2019

## Beyond the digital frontier


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ANALYTICS & COGNITIVE
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User engagement
Wireless and mobility
Information management
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Cloud revolution
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LOOKING back a decade to headlines of the day, we are reminded how at that now-distant moment much of the world was still grappling with a cataclysmic recession. In the technology sector, Oracle announced it was acquiring Sun Microsystems.[1] Apple was gearing up to launch the iPad® mobile digital device,[2] and a mean-spirited worm called Stuxnet was changing the rules of cybersecurity.[3]

And a small number of dedicated tech enthusiasts at Deloitte Consulting were preparing to launch our firm's first annual *Tech Trends* report. Though this freshman effort was only one-third the length of subsequent *Tech Trends* reports, it effectively captured the awe that we and our clients felt about the incredible pace of technology-driven change underway, and the profound impact that change was having on business. This report featured chapters on cloud, cyber security, the internet of things, mobile's looming impact on the enterprise, and user-centered design—all topics that at the time felt overwhelming and fantastical. Interestingly, many of things that seemed so incredible 10 years ago are now foundational.

Looking back, we can see the value these emerging innovations offered, but in the moment, their promise seemed less clear. It is, therefore, remarkable how quickly organizations across sectors and regions navigated through the "so what" and into the "now what" for these trends, and went on to successfully traverse the new digital landscape.

This journey from uncertainty to digital transformation informs our latest offering, *Tech Trends 2019: Beyond the digital frontier*. A persistent theme of every Tech Trends report has been the increasing, often mind-bending velocity of change. A decade ago many companies could achieve competitive advantage by embracing innovations and trends that were already underway. Today, this kind of reactive approach is no longer enough. To stay ahead of the game, companies must work methodically to sense new innovations and possibilities, make sense of their ambitions for tomorrow, and find the confidence to boldly go beyond the digital frontier.

So here's to the next decade of opportunity, whatever it may be. Along the way, embrace that queasy feeling of uncertainty. Be excited about it. Because what you are actually feeling is tremendous, unimaginable opportunity. Today, when every company is a technology company and everyone is, in some way, a technologist, there could not be a more exciting time, a more opportune time to leave your mark your company, your industry, and on an entire world of possibility that awaits just beyond the digital frontier.

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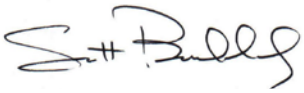

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# Macro technology forces at work

## Technology trends past, present, and future

DIGITAL EXPERIENCE. ANALYTICS. CLOUD. In the previous nine issues of *Tech Trends*, we have examined these powerful forces as they evolved from promising innovations and novel approaches into full-fledged trends. We recognized their disruptive potential and looked to the horizon to find innumerable strategic opportunities they could—and eventually would—present. Indeed, each proved to be far more than a trend; over time they evolved and expanded across industries. Today they are considered foundational components not only of enterprise IT, but of corporate strategy.

So in the context of technology trends, there is nothing much left to say about digital, analytics, and cloud, right? Not so fast. Despite their ubiquity and proven value, these technologies' full potential remains largely untapped. Investments in them are often departmental and limited in scope. Likewise, in some companies, analytics, cloud, and digital initiatives are disjointed, even competing efforts.

Meanwhile, three newer trends—digital reality, cognitive technologies, and blockchain—are growing rapidly in importance. In the last several issues of *Tech Trends*, we discussed how virtual reality and augmented reality are redefining the fundamental ways humans interact with their surroundings, with data, and with each other. We tracked blockchain's meteoric rise from bitcoin enabler to purveyor of trust. And as cognitive technologies such as machine learning, robotic process automation, natural language processing, neural nets, and AI moved from fledgling siloed capabilities to tenets of strategy, we have explored their profound potential for business and society. These three trends are poised to become as familiar and impactful as cloud, analytics, and digital experience are today.

Of course, any pursuit of tomorrow's promise should start from the technical realities of today. Three formative forces have proven essential in the pursuit of digital transformation past, present, and future: modernizing core systems to serve as a foundation for innovation and growth; elevating cyber and the broader risk domain from a compliance-based activity to an embedded, strategic function; and reengineering an organization's technology function to deliver against the promise of technologies emerging and existing—or risk failing at its mission.

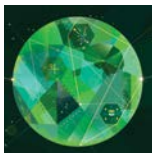
Just because these nine forces—digital experience, cloud, analytics, blockchain, cognitive, digital reality, business of technology, core modernization, and cyber—are no longer particularly novel doesn't mean they are not vitally important. In fact, one of the most pressing challenges technology and business leaders face is how to excavate and harness the value these macro forces *can* deliver *collectively*.

For example, the factory of the future needs to bring together next-gen ERP, machine learning, embedded sensors across the production floor, augmented reality training, mobile visualization and predictive flow scheduling, secure networks, and cloud-based tools for managing workflow across the supply chain. Not to mention the need to retool workers and cross-pollinate between traditional information and operational technology roles and skills.

**CASE STUDIES & EXTERNAL PERSPECTIVES**

Read the full report to find out more about how **Walmart**, **Talanx AG**, and **KONE** are tackling the macro forces.

Through their collision and the innovation unleashed, these forces will likely dominate enterprise IT, business, and markets to an even greater extent than they have as individual technologies. With macro forces, it's the controlled collision that leads beyond the digital frontier.



# AI-fueled organizations

## Reaching AI's full potential in the enterprise

THE JOURNEY TO FULLY AUTONOMOUS artificial intelligence is part of a growing trend in which companies transform themselves into *AI-fueled organizations* where AI is an integral component of corporate strategy. This trend is also about a sustained commitment to redesigning core systems, processes, and business strategies around AI and its possibilities. Its end goal: an organization in which humans and machines work together within designed digital systems to harness data-driven insights.

The number of companies following in the footsteps of AI pioneers will likely increase in the next 18 to 24 months as more leaders identify ways to use cognitive technologies to achieve strategic goals. In two consecutive Deloitte global surveys (2016–17 and 2018), cognitive technologies/AI have topped the list of emerging technologies in which CIOs plan to invest.[4] Though these CIOs—much like society at large—may be fascinated by cognitive technologies' sci-fi-like possibilities, their AI ambitions are likely grounded in more practical (and achievable) benefits: AI can increase productivity, strengthen regulatory compliance through automation, and help organizations derive meaning from ever-larger data sets.[5]

And as organizations move from using the technology in isolated pilots to deploying larger AI systems, they should consider three system models that are currently in play:

- **Cloud-native**. Given AI's ascendance in the enterprise technology arena, it is conceivable that an AI-as-a-service platform could be the next big operating system.
- **Package-adjunct**. In an alternative approach to the cloud-native model, several vendors are investing in AI platforms as complements to their core functionality.
- **Open-algorithm**. Numerous startups and boutique software shops are developing AI solutions to meet specific business needs, use cases, and verticalized issues.

AI-fueled organizations place artificial intelligence, machine learning, and other cognitive technologies at the very center of business and IT operations, which can result in disruptive ramifications that ripple across the enterprise, with particular impact in data management, training machine learning, ethics, talent, and culture.

### CASE STUDIES & EXTERNAL PERSPECTIVES

Read the full report to find out more about how **Anthem**, **Pfizer**, **Canada**, **The Adecco Group**, and **Google Cloud** are becoming AI-fueled organizations.

Traditionally, CIOs have spent much of their workdays (and careers) maintaining legacy systems and "keeping the lights on." As AI, ML, and other cognitive tools drive automation across the IT ecosystem, CIOs and their teams may spend less time on maintenance and more time helping the enterprise with informed decision-making about how they use and what they expect from technology. Ultimately, the AI-fueled journey presents CIOs with an opportunity to redefine their own role, from chief information officer to "chief insight officer"—the organizational leader who serves as custodian, facilitator, and catalyst for informed decision-making at the corporate level.[6]

Enterprise tech leaders, start your engines. The time to launch your company's AI-fueled journey is now.

# NoOps in a serverless world

## Shift IT's focus from operations to outcomes

TRADITIONALLY, THE CIO'S RESPONSIBILITY of keeping business-critical technology systems running has absorbed up to 70 percent of IT's budget as well as considerable amounts of labor bandwidth. Cheaper storage, cloud, and outsourcing have lowered this budgetary outlay by 20 percent or more. Yet in an era of perpetually tight IT budgets, finding ways to redirect financial and human assets from operations to innovation remains a top CIO goal.[7]

**CASE STUDIES & EXTERNAL PERSPECTIVES**

Read the full report to find out more about how **Gene Kim**, **Cargill**, **Commonwell Mutual Insurance Group**, and **Verizon** view the *NoOps in a serverless world* trend.

In many reengineering initiatives, automation is the keystone that makes meaningful efficiency and cost reduction achievable. Now, as part of a growing trend, CIOs are taking their automation efforts to the next level with *serverless* computing. In this model, cloud vendors dynamically and automatically allocate the compute, storage, and memory based on the request for a higher-order service (such as a database or a function of code). In traditional cloud service models, organizations had to design and provision such allocations manually. Now they are seeking to create a NoOps IT environment that is automated and abstracted from underlying infrastructure to an extent that only very small teams are needed to manage it. CIOs can then invest the surplus human capacity in developing new, value-add capabilities that can enhance operational speed and efficiency. In NoOps environments, traditional operations like the code deployment and patching schedules remain internal responsibilities—they are simply automated to the extreme.

Serverless computing offers CIOs a toolkit for transforming their IT operations. Its potential benefits include effectively limitless scalability and high availability, NoOps (or at least less ops), and no idle time costs. This does not replace or compromise the potential of DevOps. In fact, it reinforces the need to rethink technology culture, roles and responsibilities, enabling tools, and processes.

Transitions from traditional to serverless environments do not happen overnight. During these transitions, operations talent may still have to do some routine database tasks and make sure that core systems are tuned and maintained. But they will now have the bandwidth to upskill and redefine their roles.

As you explore serverless offerings, be aware that this computing model is still evolving—it should not be construed as a cure-all for development and operations problems. The journey from legacy internal servers to cloud-based compute, storage, and memory will not be without challenges. But as more and more CIOs are realizing, an opportunity to fundamentally transform IT from being reactive to proactive is just too good to ignore.

# Connectivity of tomorrow

## The spectrum and potential of advanced networking

TRADITIONALLY, NETWORKING HAS LIVED in the shadow of high-profile disruptive enterprise technologies—such as digital experience, cognitive, and cloud—that capture imaginations and headlines. Networking, though mission-critical, is not particularly sexy. This is about to change.

Increasingly, network-dependent technology forces are transforming enterprise architecture. For example, proliferating mobile devices, sensors, serverless computing, exploding volumes of shared data, and automation all require advanced connectivity and differentiated networking. Indeed, advanced connectivity is fast becoming a linchpin of digital business. As they develop advanced networking strategies, CIOs should start by examining how core capabilities may be able to advance their digital transformation agendas. Consider these advanced connectivity building blocks:

- **5G**. The fifth generation of cellular wireless technology represents a sweeping change with greater speed, lower latency, and—importantly—the ability to connect massive numbers of sensors and smart devices within a network.[8]
- **Edge computing**. Applications such as industrial automation, virtual reality, and autonomous decision-making will require high computation capabilities with very low latency (round trip time from the device to the cloud and back). In these situations, data processing can be partitioned with a portion executed in a "mini cloud" as close as possible to the device—ideally, embedded within the device or the end point itself.[9]

And CIOs are virtualizing parts of the connectivity stack using the following network management techniques:

- **Software-defined networking**. SDN is a software layer that sits atop a physical network composed of networking appliances such as switches and routers. Long restricted primarily to use within the data center, the technology is now being extended for wide area networking to connect data centers or other multilocation applications.
- **Network function virtualization**. NFV replaces network functions such as routing, switching, encryption, firewalling, WAN acceleration, and load balancing provided by dedicated physical network appliances with virtualized software and can scale horizontally or vertically on demand.[10]

CIOs can use these advanced connectivity building blocks together with existing local area networking technologies such as Ethernet, Wi-Fi, and wide-area capabilities such as Gigabit broadband and 4G LTE to create configurable networks that can be tailored to fit a variety of enterprise needs. Similar to how enterprises utilize elastic cloud computing infrastructure, with SDN and NFV they will be able to spin up, tear down, and optimize network capabilities on demand to fit specific application or end-user requirements.

Advanced networking is the unsung hero of our digital future, offering a continuum of connectivity that can drive development of new products and services or transform inefficient operating models. In the coming months, expect to see companies across sectors and geographies take advantage of advanced connectivity to configure and operate tomorrow's enterprise networks.

**CASE STUDIES & EXTERNAL PERSPECTIVES**

Read the full report to find out more about how **Professor Theodore Rappaport**, **BHP**, and **MSC Cruises** view *connectivity of tomorrow*.

# Intelligent interfaces

## Reimagining the way humans, machines, and data interact

IN AN EMERGING TECHNOLOGY TREND THAT could redraw—or even erase—boundaries between humans and computers, a new breed of intelligent interfaces is turning the farfetched into reality. These interfaces combine the latest in human-centered design techniques with leading-edge technologies such as machine learning, robotics, IoT, contextual awareness, and advanced augmented reality and virtual reality. Working in concert, these techniques and capabilities are transforming the way we engage with machines, data, and each other.

For example, using cameras, sensors, and computer vision, a retailer can track and analyze shoppers' store movements, gaze, and behavior to identify regular customers and gauge their mood. By cross-analyzing the information with these customers' purchase histories, the retailer can push promotions in real time to shoppers' mobile devices—or, in the not-too-distant future, be able to predict a need based on a customer's subconscious behaviors and preemptively place an order on her behalf.

Currently, voice use cases are proliferating in warehouse, customer service, and, notably, field operation deployments where technicians armed with a variety of voice-enabled wearables can interact with company systems and staff without having to hold a phone or printed instructions. Though conversational technologies may currently dominate the *intelligent interfaces* arena, many see a different breed of solutions gaining ground. They feature, among other capabilities, computer vision, gesture control devices, embedded eye-tracking platforms, bioacoustic sensing, emotion detection/recognition technology, and muscle-computer interfaces. And soon this list also may include emerging capabilities such as brain-controlled interfaces, exoskeleton and gait analysis, volumetric displays, spatial computing, and electrovibration sensing.

Intelligent interfaces offer B2C and B2B opportunities in several areas:

- **Tracking customers' offline habits**. Just as search engines and social media companies can track their customers' digital habits, some intelligent interface capabilities already make it possible to track physical behavior.
- **New products and solution sets**. Understanding customers at a personal, detailed level will make it possible to "micro-personalize" products and services.
- **Efficiency**. Today, companies are exploring opportunities to use VR, AR, mixed reality, 360, AI, and sensor technologies to enhance operational efficiency and individual productivity.

Any intelligent interface initiative involves underlying technology capabilities to bring it to life. As the fidelity and complexity of these experiences evolve, developing the supporting infrastructure necessary to harvest, analyze, and disseminate infinitely more data from more input sources will make or break experiences. There are also data syndication, capture, storage, compression, and delivery considerations, and this is where having an IT strategy for managing the backbone elements of intelligent interfaces will be crucial.

To say this trend is potentially disruptive would be an understatement—simply put, it represents the next great technology transformation. And this transformation is already underway. If you are not exploring the role that voice, computer vision, and a growing array of other interfaces will play in your company's future, you are already late to the game.

**CASE STUDIES & EXTERNAL PERSPECTIVES**

Read the full report to see what **Professor Pattie Maes**, **Sony Entertainment & Technology**, **Snap**, and **Delta Air Lines** are doing with *intelligent interfaces*.

# Beyond marketing: Experience reimagined

## CMOs and CIOs partnering to elevate the human experience

MARKETING TECHNOLOGY IS UNDERgoing a renaissance. Channel-focused solutions such as websites, social and mobile platforms, content management tools, and search engine optimization are fast becoming yesterday's news. As part of the growing *beyond marketing* trend, organizations are adopting a new generation of martech systems that deliver unprecedented levels of customer intimacy, targeted engagement, and precision impact. By deploying new approaches to data gathering, decisioning, and delivery, companies can now create personalized, contextualized, dynamic end-to-end experiences for individual customers. These experiences, in turn, can help customers create deep emotional connections to products and brands, which drive loyalty and business growth.

With its emphasis on the human experience, the *beyond marketing* trend represents a turning point in marketing strategy and practices. Traditionally, marketing's broad goal was to bend consumer will in ways that advance a seller's strategy. Going forward, its goal will be to adapt the seller's objectives and methods of engagement to meet specific customer expectations. To do so, some companies are looking beyond longstanding relationships with marketing services providers and ad agencies and are bringing data management and customer engagement processes back in-house. They are trading in "black box" customer marketing solutions for cloud-based, flexible, automated marketing systems that offer greater control of data. Organizations further along in their *beyond marketing* journeys are exploring opportunities to integrate first-, second-, and third-party data, cognitive analytics, machine learning, and real-time/right-time touchpoint delivery into their data management stacks.

Technology has created a multitude of ways to engage customers on their paths to purchase. But the tech stack required to engage and deliver an end-to-end customer experience can be incredibly complex and challenging if not developed within the parameters of a digital strategy. CMOs increasingly charged with owning the delivery of the entire customer experience, which includes customer experience systems, suddenly find themselves taking on facets of the CIO's traditional role. At the same time, CIOs are being called on to transform legacy systems and build new infrastructure to support next-generation data management and front-office customer engagement systems. CIOs and CMOs are finding they will have to collaborate more closely than ever in order to deliver not only on their company's new marketing strategies but also on established digital agendas.

**CASE STUDIES & EXTERNAL PERSPECTIVES**

Read the full report to see how the **United States Tennis Association**, **Tyson Foods**, and **Nationwide Insurance** are approaching the *Beyond marketing: Experience reimagined* trend.

From a technology perspective, the *beyond marketing* trend involves reengineering your company's current approach for data (the starting point for all efforts), decisioning (automated determination of how and when to provide an experience), and delivery (dynamic content delivered consistently across channels) to meet consumer expectations. But this does not require ripping out your legacy technology stack and replacing it with a host of shiny new tools. Rather, your goal should be to integrate the technologies and processes that can make your existing systems smarter, and provide real-time, seamless interactions with customers.

In today's world, the customer is in charge. And in a marketplace of endless options and channels, companies should elevate their marketing operations from art to a blend of art and science, while keeping the customer firmly in the center of all decisions.

# DevSecOps and the cyber imperative

## Elevating, embedding, and evolving your risk response

DEVOPS TACTICS AND TOOLS ARE dramatically changing the way IT organizations innovate. In the midst of this transformation, IT leaders are finding that longstanding approaches for integrating security into new products are not keeping pace with high-velocity, continuous delivery software development. Indeed, in the DevOps arena, traditional "bolt-on" security techniques and manual controls that rely on legacy practices often are perceived as impediments to speed, transparency, and overall security effectiveness.

Now, in a growing trend, some companies have begun embedding security culture, practices, and tools into each phase of their DevOps pipelines, an approach known as *DevSecOps*. Deployed strategically, DevSecOps can help improve the security and compliance maturity levels of a company's DevOps pipeline, while boosting quality and productivity and shrinking time-to-market. Building on your experience of developing and operating applications, DevSecOps enables you to automate good cybersecurity practices into the toolchain so they are utilized consistently, helping ensure every product you stand up is a known entity—tested, secure, and reliable.

DevSecOps is not a security trend in and of itself but, rather, an aspect of the ongoing DevOps revolution that offers companies a *different way of thinking about security*:

- **Open collaboration on shared objectives**. Security architects, developers, testers, and operators share expectations and metrics that align to security and focus on business priorities.
- **Reinforce and elevate through automation**. Automation of recurring tasks throughout the development life cycle, testing, and during operations makes it possible to embed preventative operational controls, create ongoing audit trails, and respond quickly in a repeatable fashion.
- **Risk-oriented operations and actionable insights**. Organizations incorporating DevSecOps into their development pipelines can utilize operational insights and threat intelligence to drive process flow, prioritization, and remediation recommendations.
- **Proactive monitoring and recursive feedback**. Automated, continuous testing helps identify problems before they become issues.

### CASE STUDIES & EXTERNAL PERSPECTIVES

Read the full report to see what **Maersk**, **PayPal**, the **National Institute of Allergy and Infectious Diseases**, and the **US Food and Drug Administration** are saying about *DevSecOps*.

DevSecOps incorporates secure culture, practices, and tools to drive visibility, collaboration, and agility into each phase of the DevOps pipeline. Like any other IT program, DevSecOps should directly tie to your broader IT strategy, which, in turn, should be driven by your business strategy. If a DevOps program supports your IT and business strategy, then embed the "Sec" at the same time. In short order, it may help you bolster your cyber maturity.

# Beyond the digital frontier: Mapping your future

## Digital transformation demystified

TODAY, WE REFER TO THE PROCESS OF using emerging technologies to reimagine an entire business as *digital transformation*. Simply put, digital transformation is the process of future-proofing one's organization. It typically begins with leaders and strategists defining new ambitions—often in the broadest of terms and grandest of visions.

But digital transformation can and should be just as concerned with modest and immediate ambitions as it is with broadly reimagining the future. For example, reengineering individual business units and processes, or creating opportunities for specific products and customers, can have a more immediate impact on long-term competitiveness. By adopting a strategy of putting smaller, more tightly scoped offerings into the market quickly and successfully, organizations can incrementally achieve an end-state business ambition.

Yet all too often, companies anchor their approach to digital transformation on a specific technology advance. To fuel impactful digital transformation, leading organizations combine game-changing technologies with other catalysts of new opportunities—from the connectivity of evolving ecosystems to human-centered design, macroeconomic forces, real-time data intelligence, and more. And they do so with a repeatable, disciplined approach.

Your goal should not be about creating glorified proofs of concepts or spinning up random acts of incremental digital to substitute activity for progress. You should embrace and embed the digital mindset into business, operating, and customer models. The key is to iterate rapidly to get offerings into the market as quickly as possible. Along the way, you will be laying the needed foundation to *imagine*, *deliver*, and *run* the future.

- **Imagine**. The first step is getting the right focus, quickly setting ambitions, and charting a path to success with a deliverables road map. This process involves sensing, scanning, and scouting the market to uncover trends and establishing an initial hypothesis of potentially untapped or trapped value.
- **Deliver**. The next step requires putting your ambition in motion by moving from early ideas to fully tested, refined, and validated offerings rolled out in the market or the enterprise. Two other components are essential at this stage: a digital foundry for agile delivery of new technology, and product teams focused on preparing existing core systems, data, and operations for the reimagined offerings.
- **Run**. Some digital initiatives overlook one of the most important aspects of digital transformation: how to scale and then support fledgling ideas and innovative new offerings. It is important to establish common standards for product scalability and support across all dimensions of a digital transformation effort.

### OPPORTUNITIES ON THE HORIZON

Read the full report to see how digital transformation affects the **Future of Work**, **Future of Mobility**, and the **Future of Health**.

Mapping your digital future is no small order. But if you can be deliberate about sensing and evaluating emerging technologies, considering the nontechnology forces unlocking new opportunity, and creating a series of well-defined but aspirational ambitions, you can make the unknown knowable—creating the confidence and construct to embrace digital, while setting the stage to move beyond the digital frontier.

# Endnotes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Bill Briggs' 20-plus years with Deloitte have been spent delivering complex transformation programs for clients in a variety of industries, including financial services, health care, consumer products, telecommunications, energy, and the public sector. He is a strategist with deep implementation experience, helping clients anticipate the impact that new and emerging technologies may have on their business in the future—and getting there from the realities of today.

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