Cutter Business Technology JOURNAL

"Transitioning to a digital world is front-of-mind for many business executives, yet finding the right path is an ongoing challenge."

— the *Cutter Business Technology Journal* Team

Technology Trends, Predictions, and Reflections 2017

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Cutter Business Technology
JOURNAL

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Opening Statement

by the *Cutter Business Technology Journal* Team

Just as recent global events have given us reason to pause and reflect, the pace of technology emergence and disruption is proving to be a source of inspiration and uncertainty. Transitioning to a digital world is front-of-mind for many business executives, yet finding the right path is an ongoing challenge. So we asked Cutter's team of experts for their insights on some of the technologies, trends, and strategies that will be relevant in 2017 and beyond. In typical *Cutter Business Technology Journal* fashion, our call produced a wide range of opinions and reflections worthy of consideration as you chart your business technology journey for the new year.

First up, Steve Andriole shuns a "Top 10" of individual technologies in favor of looking at five technology clusters. This idea stems from the interrelationships among the technologies and their dependence on each other for implementation. Andriole advises us to focus on investing in multiple technology clusters, as this will have the greatest impact on our business models.

Next, Nate O'Farrell takes a look at how blockchain technology is making its way into business sectors across the globe. With efforts underway toward more sustainability and accessibility, blockchain "holds great potential to disrupt how businesses perform basic transactions, from payments, to programmable, self-executing contracts, to identity verification."

Paul Clermont builds upon his 2016 predictions about the challenges business technologists face in the IT environment. He calls for stronger security measures to counter and prevent data breaches, the development of more sophisticated algorithms to combat the use of social media as a vehicle for false news, and opportunities for more experts in metadata encryption to investigate or head off all too frequent terrorist attacks.

Curt Hall then predicts a breakout year for cognitive computing. He recommends that companies consider the application of cognitive computing in research and discovery, decision support and advisory, customer engagement and customer experience management, Internet of Things (IoT), and cybersecurity.

The surprising results of two recent major political decisions inspired Roger Evernden to consider a need for more architectural thinking to manage the complexities of modern life. He also ponders how a faster Internet can be leveraged to improve and optimize healthcare, transportation, and global energy resources.

The growth in the "gig" economy led David Coleman to delve into the future of collaboration in the workplace. He explores how project work is becoming the norm, how we are moving from networks to ecosystems, and how augmenting human work with AI systems can improve employee productivity and morale.

Next up, Alex Rodrigues reflects on how artificial general intelligence (AGI) will be used. Will we see AGI used for "healthy" applications, such as to support business models, or will it emerge as a major threat to human welfare if used in "unhealthy" ways, such as hacking, rampant job elimination, or misuse of robotic technologies?

It's important not to overhype the potential of technologies such as big data, 3D printing, IoT, self-driving cars, and AI, according to Robert Charette. He predicts that 2017 will be the year we learn to approach these and other technologies with humility and diligence to extract the most value from their true capabilities.

Next, Emir Ugljanin et al. anticipate how the IoT and business processes will evolve together to form the concept of the Process of Things, or PoT. PoT will facilitate a successful connection between things, ensuring that "things will not function as silos but contribute collectively to offering value-added services to enterprises."

Taking a step back, Carl Pritchard warns against becoming an overly connected society with perpetual threats of security breaches and personal data loss. He advises conducting business in a safer space by dialing back technology and taking control of 24/7 connectedness.

Finally, Darren Dalcher speaks to the strategic project management trends that will require attention in 2017. He points to new priorities in terms of leading people, repositioning projects, redefining success, and engaging on a deeper level with the business to deliver more meaningful and sustainable projects.

Together with this outstanding group of authors, we hope this issue helps you determine the strategies and operating models that will bring the most value to your organization now and in years to come.

Five Disruptive Technology Clusters

by Steve Andriole

Every year pundits, hardware vendors, software vendors, consultancies, academics, and even government agencies publish their technology "picks" for the following year. One cannot help but notice that just about all of the lists identify the usual suspects; cloud computing, AI, predictive analytics, wearables, and augmented reality are among about five others that make nearly everyone's "Top 10."

The approach I take here is a little different. I look at *clusters* of technologies. I do this because of the overlap among the usual suspects and because of the interrelationships among the technologies. The identification of clusters is also useful because it acknowledges the interdependencies among technologies as well as the integration and interoperability required to optimize whole technology clusters and meaningfully impact business rules, processes, and models. In other words, it's operationally impossible to acquire, pilot, deploy, and support technologies individually because they're always dependent upon each other and always connected.

The five clusters that scream change in 2017 *and beyond* appear in Figure 1. The arrow that connects the clusters is extremely understated in its importance. Not only do the clusters build upon each other, but they also depend upon each other for implementation. For example, sensor analytics technology assumes the existence of massive amounts of real-time streaming sensor data and some intelligent processing as well as cybersecurity technology to keep it all secure. Similarly, small software technology requires advanced interaction technology to deliver functionality to consumer and corporate clients. There are also numerous technology standards around sensor interfaces and open APIs that will accelerate the adoption of disruptive technologies. The discussion around clusters here assumes these (and other) standards will evolve.

Intelligent Systems Technology

Artificial intelligence is now embedded in a wide array of software applications, infrastructures, business rules, processes, and even whole business models. IBM's Watson is the face of popular AI, but intelligent systems technology encompasses so much more, including:
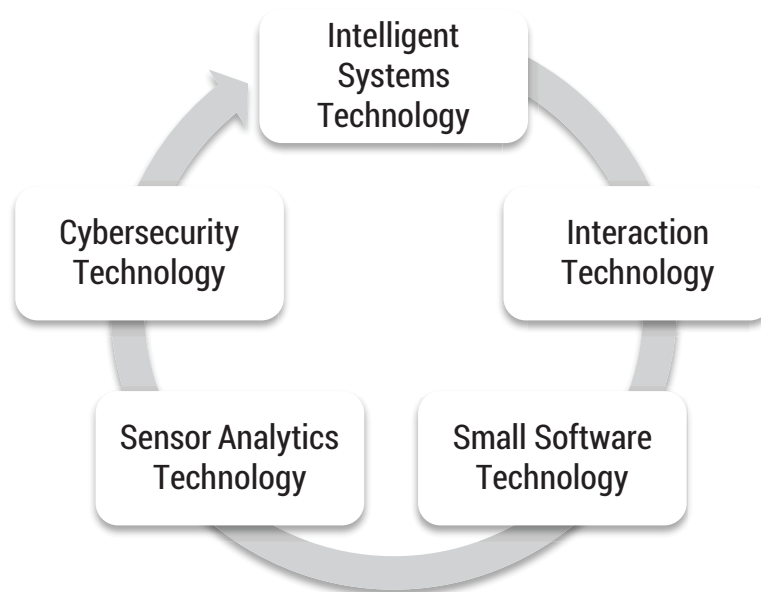

Figure 1 — Five disruptive technology clusters.

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- Deductive and inductive inference

- Deep learning

- Machine learning

- Tools and techniques used to represent and process data, information, and knowledge (such as neural network modeling)

- Applications of the technology to a host of problems, such as conversational speech, language translation, predictive analytics, diagnostics, autonomous vehicles, network management, weapons systems, and augmented and virtual reality, among so many other applications that will affect us all (overtly and covertly)

The development, embedding, and application of intelligent systems technology is accelerating and will continue to do so through 2017 and well beyond. We should track the entire range of this technology, not just the individual pieces, with an eye toward piloting and deploying that range against a set of ROI metrics.

Interaction Technology

The way we interact with all things digital — and physical — is changing. We see and experience content virtually and through augmented reality. We use wearables to track ourselves, our health, our friends, our transactions, and just about everything else we do, see, and hear. Many parents, for example, use smartphone applications to track the whereabouts of their children. We allow location-based services to follow us around, and we buy just about everything with applications on mobile devices. We converse with knowledge bases with relatively crude tools like Siri and Alexa, but within a few years we'll be having "meaningful" conversations with increasingly intelligent assistants and — eventually — managers.

In addition to voice interaction, we're well on the way to gesture and other controls that mimic the way we interact with humans. For example, consumers can use gesture control to look at products they might want to buy, and retailers can collect the gestures used to inspect their products and services, such as how often a consumer points to a product over time or how long a consumer lingers on a product icon (versus competing products at which they gesture positively or negatively). Some of this technology already exists for handicapped users of digital technology. Extending it to consumers provides retailers with a new, powerful way to track what their customers are doing with their products.

Small Software Technology

Small software delivered from the cloud is a major technology cluster. The age of monster software applications — like huge multi-module ERP applications — is over. Software is decoupling and shrinking. Even software that stubbornly hasn't decoupled (yet) is offered in pieces from the cloud to clients who can select the modules they need — and ignore the ones they don't. For those who want newer, smaller, cheaper packages, there are software vendors (e.g., Zoho and Zendesk) that have reduced functionality to its most useful features.

The small software technology cluster will grow until software becomes like LEGOs that can be assembled and disassembled at will. As the open source API world expands, small software technology will become greater than the sum of its parts. The key trend here is the under-reliance on large integrated software applications and the adoption of smaller, more focused applications accessible on every screen we have.

> **The age of monster software applications — like huge multi-module ERP applications — is over. Software is decoupling and shrinking.**

Sensor Analytics Technology

Ubiquitous sensors capable of tracking, analyzing, and predicting all sorts of activities will soon connect everything. The Internet of Things (IoT) and then the Internet of Everything (IoE) will generate enormous real-time data/information/knowledge streams that must be managed and, more importantly, optimized.

The ubiquity of sensors will change today's understanding of analytics, especially because they will be "always on" and therefore in real time. The deployment of sensors should be tracked as assiduously as we track advances in data science. The more sensors, the greater the data and analytical requirements, and therefore the greater the number of predictive and prescriptive opportunities, such as the ability to predict threats and generate strategies in response to likely threats in real time.

Companies should invest in expanded analytics with the assumption that data, information, and knowledge will be continuously exploding and that fixed-time, limited variable–driven "analytics" as we practice it

today will disappear. It will be replaced by smarter integration across multiple technology clusters. Said a little differently, next-generation analytics will be driven by massively complex multiple regression equations capable of explaining and predicting variance along multiple dependent variables.

> **All security architectures must continuously adapt while recognizing that the security industry is essentially a reactive one destined to chase solutions to problems it had no idea existed a week, a day, or an hour ago.**

Cybersecurity Technology

All of the technology clusters underscore the importance of digital security. There's the business of security — audits, compliance, policies, and procedures — and the security technology itself. The business side lags the technology side (which lags the device and application sides). All security architectures must continuously adapt while recognizing that the security industry is essentially a reactive one destined to chase solutions to problems it had no idea existed a week, a day, or an hour ago.

Several of the enabling technologies include the broad blockchain family, which in truth is less like a happy family than a set of dysfunctional cousins who seldom if ever communicate — except to solve a really big problem. While blockchain and similar technologies that disconnect and decentralize processes (and assemble them later for clarity) are here to stay thanks to the inherent security features they offer, issues like centralized versus distributed integration and legacy architecture compatibility will persist.

Consequently, there will be significant cooperation required among implementation parties for blockchain to become core to many flavors of transaction processing (beyond cryptocurrency). Some of this cooperation will occur outside of the corporate firewall where digital third parties will inspect and connect transaction components. Some will occur internally as legacy applications are replaced to optimize the technology. The business challenge for blockchain companies will be market share: will blockchain be open and diffuse ("neutral")

or aggressively proprietary and "closed"? The cybersecurity technology cluster requires continuous attention, investment, testing, and implementation within an array of clusters including *and beyond* those discussed here.

Conclusions

There are several problems with lists of clusters like mine. First, they are never exhaustive. They are also presented at high levels of abstraction. At the same time, they help us break free of bounded definitions of technologies that appear on everyone's Top 10 lists. The clusters presented here are intended to change everyone's perspective on emerging and disruptive technologies from definitions and descriptions of individual technologies to a focus on how technologies form clusters that exist in an endless world of interdependencies. This perspective suggests that companies should step back from specific investments in individual technologies and invest instead in multiple technology clusters. It further suggests that those who champion particular technologies — like AI, wearables, and big data analytics — instead think about whole clusters of technologies and how the clusters are greater than the sum of their parts.

Stephen J. Andriole is a Fellow with Cutter Consortium's Business Technology & Digital Transformation Strategies and Data Analytics & Digital Technologies practices. Dr. Andriole's focus is digital business transformation and emerging digital technologies. His recent consulting has focused on digital transformation at clients such as Comcast, Shire Pharmaceuticals, and Villanova University.

Dr. Andriole was Director of the Cybernetics Technology Office of the US Defense Advanced Research Projects Agency (DARPA), where he managed a $25 million R&D program that led to several vital scientific and technological advances in the broad-based information, decision, and computing sciences. He served as CTO and Senior VP of Safeguard Scientifics, Inc., and was also CTO and Senior VP for Technology Strategy at CIGNA Corporation, a $20 billion global insurance and financial services company. As an entrepreneur, Dr. Andriole founded International Information Systems (IIS), Inc., which designed interactive systems for a variety of corporate and government clients. He is also cofounder of The Acentio Group, a strategic consulting consortium that identifies and leverages technology trends to help clients optimize their business technology investments.

Dr. Andriole is currently the Thomas G. Labrecque Professor of Business Technology at Villanova University, where he teaches and directs applied research in business-IT alignment and pervasive computing. He is the author of 30 books and more than 500 articles and papers in such publications as Cutter Business Technology Journal, Software Development, *and* IEEE Software. *He can be reached at sandriole@cutter.com.*

Rapid Technology Innovation in Blockchain:
Should You Be on the Front Lines?

by Nate O'Farrell

One of the most prevalent blockchains in the world, Ethereum, is poised to switch from a proof-of-work (POW) algorithm to a proof-of-stake (POS) algorithm, likely in 2017, with the release of the Casper codebase. Why does this matter? Because blockchain technology is becoming increasingly relevant and prevalent in businesses across the globe. It holds great potential to disrupt how businesses perform basic transactions, from payments, to programmable, self-executing contracts, to identity verification.

In the latest issue of *Harvard Business Review*,[1] Harvard Business School Professor Marco Iansiti and Harvard Business School Professor and Cutter Fellow Karim Lakhani discuss the transformative potential of blockchain technology, comparing it as it stands today to the TCP/IP protocol in its early stages. ARPANET (the Advanced Research Projects Agency Network) was using TCP/IP for interoffice emails in the 1970s, and now, nearly 50 years later, lives around the world depend on this fundamental, open source protocol that gives the Internet its ability to transfer data.

TCP/IP adoption didn't happen overnight, even though it was clear the technology had many powerful use cases. It took us until now to realize the potential and to construct fundamental business processes upon this protocol. As Iansiti and Lakhani point out, the technology adoption path that TCP/IP followed is something to consider as blockchain continues to make its way into the business sector.

POW = Proof of ... Waste?

One of the main issues to be overcome as Bitcoin and blockchain increase in popularity across the globe is blockchain's sheer wastefulness. A POW blockchain such as Bitcoin requires high-powered computers that endlessly process transactions and solve algorithms, rewarded upon discovery of the right solution. This creates an extreme draw on electricity, with data centers

producing excess heat into the atmosphere and hardware turnover well above average. Considering only Bitcoin, the largest of roughly 800 cryptocurrencies, there is currently as much running hardware as material used to build the Eiffel Tower.[2] By 2020, the electricity consumption of the Bitcoin network alone will exceed that of the entire country of Denmark.[3] Chip technology improves, and application-specific integrated circuits (ASICs) become more efficient in their electricity consumption as years go on. Nevertheless, the amount of electricity and resources needed to efficiently run the Bitcoin network is becoming increasingly unsustainable.

> **One of the main issues to be overcome as Bitcoin and blockchain increase in popularity across the globe is blockchain's sheer wastefulness.**

Casper the Eco-Friendly Blockchain

This isn't new news. We knew this would happen, and the leading thinkers behind blockchain technology are focused on developing new algorithms to reduce this hardware and infrastructural consumption to make blockchain technology more sustainable and more accessible. Vitalik Buterin, creator of Ethereum, the second biggest blockchain, leads a team of developers that are working to combat some of the deficiencies of this wasteful POW system. This brings us to Casper, the POS fork of the Ethereum blockchain, in development and slated to be released in 2017. This would not be the first blockchain using a POS method, but it would be by far the largest.

The basic idea behind proof of stake is that it eliminates the need for wasteful data centers full of the expensive,

power-hungry, environmentally unfriendly machines used to solve and maintain transactions on the blockchain. It replaces them with lightweight algorithms that calculate a worker's power based on how much currency the worker holds. Think of it as how much mining and calculation power they could *theoretically* buy.

Fair and Aboveboard

Replacing a POW system with a POS system does more than simply mitigate the electricity and environmental challenges faced by nearly all blockchain systems. It also introduces a fairer system, where anyone can decide to be a miner without having to invest in physical hardware, data center space, electricity, and security.

> **As blockchain systems developers continue to innovate, they are improving the technology by providing new features, enhanced security, and improved ease of access.**

Another major pro of a POS system is that it mitigates against a 51% attack. In a traditional POW system, any user or group of users could theoretically unite until they possess 51% of the network's hashing power. At that point, they would have complete control of the network and blockchain, allowing them to modify transactions and double spend currency. This obviously would have a devastating effect on companies, users, and adopters who have become deeply invested in this new technology. Moving to a POS system creates an interesting dynamic where even if someone or some group were able to control 51% of the digital currency on that blockchain, it would not be in their best interest to create an attack on something in which they are already a majority stakeholder. Furthermore, with market caps now in the billions, a majority share in a POS blockchain currency is becoming prohibitively expensive.

Will Your Organization Lead the Charge?

As blockchain systems developers continue to innovate, they are improving the technology by providing new features, enhanced security, and improved ease of access. Companies need to be aware of these developments and adjust their processes in order to incorporate these new features into their fundamental workflow. Basically, companies need to be as agile with their processes as blockchain developers are with their codebases. It's clear that blockchain technology can be as beneficial to business as TCP/IP has become.

While we move toward this decentralized open ledger, we need to remain cognizant of the obvious hurdles to jump and problems to overcome. But the roadmap has been drawn by trendsetters such as Buterin and his Ethereum project. Blockchain is here to stay, and while it will take some time to perfect as it becomes more mainstream, businesses should be asking, "Do we want to be on the front lines of in this area of technology innovation?"

Endnotes

[1]Iansiti, Marco, and Karim R. Lakhani. "The Truth About Blockchain." *Harvard Business Review*, Vol. 95, No. 1, January–February 2017 (https://hbr.org/2017/01/the-truth-about-blockchain).

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[3]Deetman (see 2).

Nate O'Farrell is a Senior Infrastructure Engineer and AWS Architect at Barton Associates Inc. with a passion for solving the toughest problems and exploring and implementing emerging technologies to find better business solutions. He is a blockchain enthusiast and an active participant in numerous blockchain innovation groups. He can be reached at nate@nateofarrell.com.

The IT Scene in 2017

by Paul Clermont

Last year, I declined to make specific predictions about specific technologies, what they'd disrupt, and their impact on society — a decision based on a mix of humility and cowardice. Instead, I made three predictions about challenges in the environment in which IT exists. These challenges have only become more real, making the predictions at least directionally accurate. My previous predictions are italicized below with updated comments added.

Challenges in the IT Environment (Update)

1. Security

The increased frequency of hacking into company and government computers and the data theft we've been seeing will result in more and stronger actions on the security front. This is surely ongoing, but the headlines this year were grabbed by the apparent ease of hacking into email accounts. People have been warned for years not to put anything in emails they'd be embarrassed to have made public; perhaps now they'll believe it, especially well-known people in sensitive roles where there are lots of "gotcha" players. It's unprovable but surely possible that the recent US election was swayed by Hillary Clinton's email problems and likely Russia-based hacking into the Democratic National Committee's correspondence. More intensive action to better hack-proof the technology should be expected and is most likely already underway. That said, total impenetrability conflicts with governments' desire for access when chasing down criminal and terrorist activity, as mentioned in item 3 below. In the broader world, security will remain fertile ground for clever innovators. As with any form of crime, hacking's modus operandi will remain a moving target, making this a safe long-term prediction.

2. Social Networking

The Wild West of social networking will start to be tamed as concerns regarding its use by really bad people for really bad purposes … will call into question the libertarian paradigm in which it has thus far operated. This is happening at a rapidly accelerating pace, driven in recent weeks not so much by threats from terrorists as by the proliferation of false news posted on Facebook and other social media platforms,[1] combined with the sobering realization that a huge proportion of the US population gets its news solely from such social networks. The planting of fake news has even been automated in the form of chatbots.[2]

> **Figuring out how to vet what purports to be news while avoiding even the appearance of bias or crossing the line into censorship will be a challenge.**

Again, close elections can be swayed by the kind of deliberate, supermarket tabloid–worthy misinformation that would never pass muster in responsible media outlets. Providers of social networks will have much more trouble making the case that they're just common carriers with no responsibility for what passes through their servers. Indeed, at least one major player[3] is already backing away from this increasingly indefensible stance.[4]

Figuring out how to vet what purports to be news while avoiding even the appearance of bias or crossing the line into censorship will be a challenge. Algorithms need to be developed, but they will never be able to do the whole job, as evidenced by the incident in which Facebook briefly took down the iconic 1970 image of the naked, fleeing, napalmed Vietnamese girl as if it were child pornography. Facebook and the like's business model probably never accounted for such a relatively labor-intensive task, whether done by staff or contracted out. That said, there will be substantial demand for ever more sophisticated algorithms that can adapt as the originators of fake news try to stay ahead of them.

3. Data Policy

In the wake of the Paris and San Bernardino attacks of late 2015, governments had a stronger argument for the mass collection, storage, and analysis of metadata and their ability to decrypt actual data. In the area of decryption, high-profile situations failed to produce broad policy, with individual cases being treated on an ad hoc basis. With a new president in 2017, it remains unclear at this point how the US government's positions and policies will evolve as the tensions among libertarianism, privacy, and the national security state play out. Whatever materializes, I stand by my previous prediction that opportunities will keep emerging for inventors and purveyors of sophisticated algorithms and heuristics to analyze the metadata and whatever is decrypted. Expertise in search and pattern recognition in both text and images will be good to have.

Endnotes

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Paul Clermont is a Senior Consultant with Cutter Consortium's Business Technology & Digital Transformation Strategies practice. He has been a consultant in IT strategy, governance, and management for 30 years. His clients have been primarily in the financial and manufacturing industries, as well as the US government. Mr. Clermont takes a clear, practical view of how IT can transform organizations and what it takes to direct both business people and technicians toward that end. His major practice areas include directing, managing, and organizing IT; reengineering business processes to take full advantage of technology; and developing economic models and business plans. In his consulting engagements, he follows a pragmatic approach to the specific situation and players at hand and is not wedded to particular models, methodologies, or textbook solutions. He has spoken and written and taught executive MBA courses on the challenges of getting significant and predictable value from IT investments.

Before going into individual practice, Mr. Clermont was a Principal with Nolan, Norton & Co., a boutique consultancy that became part of KPMG. Before joining Nolan, Norton & Co., he directed IT strategy at a major Boston bank and launched its IT executive steering committee. His undergraduate and graduate education at MIT's Sloan School of Management was heavily oriented toward operations research. He can be reached at pclermont@cutter.com.

Cognitive Computing 2017: What's Up and Where to Begin?

by Curt Hall

Let's take a look at a technology poised for a breakout year: cognitive computing. There is a considerable amount of innovation in the development and application of cognitive computing across almost every industry. Consequently, companies should start examining how they can benefit from applying cognitive computing, focusing on five key domains: (1) research and discovery; (2) decision support and advisory; (3) customer engagement/customer experience management; (4) Internet of Things (IoT); and (5) cybersecurity.

Research and Discovery

Cognitive research and discovery applications, due to their ability to ingest and analyze huge amounts of structured and unstructured data, are being applied in many industries and domains today. Good target areas for cognitive research and discovery applications include market analysis, marketing, and product R&D. In addition, those in highly regulated industries should examine how cognitive systems can benefit their risk management, compliance, and antifraud efforts, as these areas are experiencing significant commercial cognitive solutions development.

Communications, marketing, and advertising firms are using cognitive research and discovery to uncover consumer trends — including behavioral and personality patterns — from social media, surveys, and other data to facilitate richer customer profiling. As a general trend, the use of cognitive systems for automating and enhancing social media analysis will increase considerably over the next few years.

Decision Support and Advisory

This domain includes the use of cognitive systems for implementing decision support systems and advisory applications that promote automated, easy-to-use approaches to customer service, issue handling, and product inquiries.

Healthcare represents the leading area of usage in cognitive decision support and advisory systems. Providing researchers, physicians, clinicians, and other practitioners with advice on illnesses has become a wide-open field. As a result, healthcare organizations are implementing cognitive applications for advising on everything from cancer, heart disease, and kidney trouble to general health and wellness.

Banking and finance are also investing in this particular cognitive domain to assist human financial advisors, for example, to conduct highly targeted search and trends analysis into market history and current events in order to optimize investment decisions and recommendations for clients.

Although still experiencing limited use of cognitive computing today, insurance is another industry where we are starting to see the use of smart cognitive decision support and advisory applications. I expect such use (for both internal and customer-facing operations) to increase considerably over the next few years.

We are also witnessing usage in other industries, including education (to provide advice to students on enrollment and other activities) and government (where cognitive systems serve to advise both staff and citizens on such topics as city operations and planning and the availability and requirements for social services and other programs).

The oil and gas industry is also employing cognitive advisors, particularly to facilitate knowledge management and more productive group interaction as well as to help disseminate oil and gas exploration and engineering expertise across organizations.

As a general trend, we should expect advisory and decision support to be the leading area for applying cognitive technology for the foreseeable future. Ideally, companies should look to implement cognitive decision support and advisory systems that can serve both internal operations and customer-facing scenarios.

Customer Engagement/Customer Experience Management

Organizations should investigate how cognitive technologies — especially natural language processing and conversational interfaces — can make interacting with

their company more intuitive, satisfying, and engaging for customers. This includes examining the use of cognitive-powered intelligent virtual agents, smart advisors, and chatbots for facilitating new (truly) real-time customer engagement on popular social media, text, and messaging platforms.

Today, companies are applying cognitive systems to customer engagement scenarios with two main goals: (1) to achieve a greater level of automation for optimizing customer service operations, including encouraging customers to take a self-service approach; and (2) to facilitate easier, more satisfying, and engaging dialogues between customers and the company across various digital channels.

In short, there is a great deal of innovation, with companies employing cognitive systems to support a range of customer-focused scenarios — everything from mobile apps designed to assist shoppers with choosing the correct product, to online wellness programs offering personalized recommendations pertaining to lifestyle choices, to intelligent banking apps designed to assist consumers. As a general trend, expect cognitive systems for customer engagement and customer experience management to become a leading area for applying the technology over the next two to three years.

Internet of Things

Although cognitive systems are currently experiencing limited usage in this capacity, their ability to ingest and analyze extremely large volumes of data (in varying formats) makes them well suited to automating IoT maintenance and analysis operations.

Real-world (i.e., production) cognitive IoT applications require the collection, management, and analysis of rapidly streaming, time-sensitive data. A good example is offered by elevator and escalator manufacturer and servicer KONE, which cut a multiyear deal to use IBM's Watson IoT Cloud Platform to connect, remotely monitor, and manage millions of elevators, escalators, doors, and turnstiles in buildings and cities worldwide. Analyzing data from sensors embedded in equipment will enable KONE to identify and predict issues and minimize downtime.

As more companies ramp up their IoT initiatives over the next few years, the use of cognitive IoT applications will accelerate as companies begin to struggle with the difficulties involved in managing and analyzing data generated from millions of connected devices. Watch for IoT platform providers to incorporate cognitive capabilities in their offerings.

Cybersecurity

A recent use case seeing much commercial development is cognitive application for cybersecurity, where the technology can identify potential threats, predict the likelihood of an attack, and interdict attacks as they occur.

IBM and its partners have been busy in this area, working to apply Watson to cybersecurity for various scenarios ranging from general IT security to fraud and breach solutions targeting banking, finance, retail, and other industries. A potentially game-changing development is cognitive behavioral biometric analysis capabilities for IBM's digital banking fraud-prevention solutions. Behavioral biometric capabilities apply machine learning (ML) to help understand how users interact with banking websites, creating gesture models based on patterns of mouse movements.

Such cognitive analysis can help determine fraudulent activities — such as when unauthorized users attempt to take over a bank account by using stolen credentials — by detecting anomalies from the real customer's interaction with a banking website. The technology understands the context and meaning of subtle mouse movements/clicks and uses this information to continually generate increasingly more accurate gesture models (via ML) over time. Although the technology was initially developed for banking, with the proper data sets cognitive biometric models could also be trained to support antifraud and other cybersecurity scenarios for other industries.

Conclusion

Cognitive computing is proceeding rapidly, and we are seeing considerable application of the technology across many domains and industries. Organizations should investigate how the technology could benefit various areas of their operations, including internal and customer-facing ones. Finally, due to a lack of experienced cognitive application developers, many organizations would do well to utilize commercial domain-specific or industry-focused cognitive solutions, of which a growing number are entering the market.

Curt Hall is a Senior Consultant with Cutter Consortium's Data Analytics & Digital Technologies and Business & Enterprise Architecture practices. His expertise includes the IoT (platforms, architectures, and use cases); artificial intelligence, cognitive systems, and conversational computing; big data platforms and use cases; and business intelligence (BI), predictive modeling, and other analytic practices. Mr. Hall also focuses on mobile technology in the enterprise (including mobile BI and collaboration) and social media monitoring and analysis (aka "social CRM"). He can be reached at chall@cutter.com.

Architectural Thinking to the Rescue

by Roger Evernden

Living in a Post-Truth World

2016 surprised most of us with two big political decisions that we didn't expect. Britain had a referendum that returned a vote to leave the European Union — popularly known as "Brexit." And the US voted for a business and property magnate who had never held elective office as its next president.

Commentators around the world have analyzed these two results, and the consensus seems to be that these political battles have ushered in a new era of politics in which the truth and rational debate are less important, and emotion, lies, and propaganda are more likely to sway voters.

What does this mean from an enterprise architecture perspective?

Well, first of all, it shows that we have reached a tipping point in our use of information, communications, social, and Internet technologies. In some situations, facts and understanding don't matter; only opinions and emotions do. This is actually quite a radical change!

And this change has increased the need for architectural thinking, which means:

- Thinking about things holistically
- Thinking about how changes in one arena have a huge rock-on impact in other areas
- Thinking about interdependence
- Thinking about interrelated systems
- Thinking about chaos and complexity, and so on

When a majority of people are not thinking about these connections and links, it behooves others who have the needed skills, experience, and techniques to do so.

So my first prediction is that we will need a whole lot more architectural thinking to explain the complexities of modern life so that ordinary people will have a balanced view that includes emotions *and* facts, opinions *and* reality. Only in this way can we come up with clever ways to make our planet sustainable and fair for all living creatures.

From Installing High-Speed Internet to Leveraging It

My second prediction is that, while some parts of our world are still without any form of Internet, those that have it are steadily working to make it faster and faster. OK, we know that bit. But what hasn't happened yet is figuring out how to truly exploit that newfound speed. Many people and enterprises get faster Internet and just use it to do the same old things, only quicker.

> **We will need a whole lot more architectural thinking to explain the complexities of modern life so that ordinary people will have a balanced view that includes emotions *and* facts, opinions *and* reality.**

So my prediction is that we will increasingly see people taking another look at what high-speed Internet gives us and leveraging it in exciting new ways. We might ask, for example, how we could use better and faster connectivity to:

- Improve the provision of healthcare
- Ease traffic congestion and provide genuinely well-integrated transportation networks
- Optimize our use of scarce, global energy resources
- Deal with the threats of epidemics, terrorism, and/or environmental disasters

You May Say I'm a Dreamer ...

Maybe I'm dreaming. Maybe I'm too optimistic about the possibilities of architectural thinking and leveraging our information assets. But maybe making predictions is all about putting ideas out there and letting them grow into trends that really do make a difference! Whatever happens, I wish you the very best for 2017.

Roger Evernden is a Senior Consultant with Cutter Consortium's Business & Enterprise Architecture practice. He has been an enterprise architect since 1984, specializing in the highly practical use of EA to manage organizational transformation. Mr. Evernden acts as advisor, mentor, and coach on EA initiatives, leads training workshops, and writes regularly about strategy and architecture. He provides a unique combination of training and tools to help architects and their teams throughout an EA program and at each capability level. Mr. Evernden's hands-on training workshops provide a thorough grounding of all key techniques, with practical examples, exercises, and demonstrations.

As architect of the Information FrameWork (IFW), Mr. Evernden pioneered many contemporary techniques, including the use of industry reference models, business capability analysis, and component-based building blocks. His work has been the basis for more than 400 business and IT architecture initiatives worldwide. Past clients include Alcatel-Lucent, Allied Irish Banks, AstraZeneca, Bancomer, Bank Austria, Barclays, Credit Suisse, DnB NOR, HSBC, IBM, ING, Lombard, Lloyds Banking Group, Microsoft, National Australia Bank, and Westpac. Mr. Evernden has written articles appearing in major publications and books, including the seminal article on IFW in the IBM Systems Journal. He is the author of two books about EA: Enterprise Architecture — The Eight Fundamental Factors and 101 Lessons from Enterprise Architecture. He can be reached at revernden@cutter.com.

The Future of Collaboration

by David Coleman

Today's work environment is changing rapidly, so much so that the ever-increasing velocity of innovation and technology will create a workplace five years from now that looks nothing like the one of today. The big three factors in this coming change are:

1. The "gig" economy, or project work, becoming the norm

2. Moving from networks to ecosystems

3. Augmenting human work with AI systems

The Gig Economy

I have been a member of the "gig" economy for the last 20 years — I just didn't know it. Because of my expertise in collaboration, I have been called on by both vendors and end-user organizations for everything from product design to training and coaching, competitive analysis, and motivational team workshops. More recently I have been testing audio components in a meeting room lab; by having meeting participants wear wireless EEG (electroencephalogram) helmets, my colleagues and I are trying to correlate their behavior from the audio interaction with their internal state (mad, sad, glad, paying attention, etc.). What all of these activities have in common is that they are all projects, and they are all being done for different organizations.

A recent study by Intuit predicted that by 2020, 40% of US workers will be part of the gig economy (contractors),[1] and as a result we have seen the rise of a number of work platforms such as Elance, oDesk (now combined into Upwork), and many others. Some focus on geographies, while others focus on specialties and expertise (e.g., Maven).

A recent study published by MavenLink and GigaOM looked at the state of the services economy.[2] In this survey of almost 500 executives, 78% of respondents perceived that the pace of change is not only quickening, but it is doing so faster than ever before. It is this velocity of innovation and disruption that is having such a great impact on the way we work today and will work in the future. Of those surveyed, 58% noted that the average length of their contracts was shortening (from years to weeks), and that over 90% of this work was primarily project work rather than retainer work. The bigger the company, the more swiftly they are changing to project work. And nearly all (96%) of service-oriented providers (lawyers, software developers, research scientists, accountants, etc.) are seeking new contractor relationships.

What this means for IT and most businesses is that more of your inhouse staff will be managing contractors external to the organization. Training in this type of team or project management would greatly increase the likelihood of these projects going smoothly. Creating a stable of regular contractors with whom you have built trust is also a good idea.

The way teams work has also been changing. Teams used to be colocated, but today the norm is for teams to be geographically distributed. Talent knows no boundaries, and thus team members can be from anywhere. Yet the biggest challenge to teams is not geography or technology (which helps to provide a common context for work), but behavior. Work by Pamela Hines of Stanford University and Catherine Cramton of George Mason University looks at addressing the behavioral disconnects in cross-cultural teams:

> It takes time to learn about cross-cultural differences, understand distant team members' context, and determine ways to reconcile these differences and adapt for the good of the collaboration. Long-term, interdependent teams with stable membership show that the organization values its investment in the team.[3]

Once a high-performing (distributed) team is stable and able to complete a project effectively, that team will often stay together to work on other projects. Or, as in the movie or construction industry, if members of these teams move on to other different work, they often come back together in the future to work on new projects.

But while teams are changing, work is changing even faster. It will require entrepreneurs and small businesses to start evolving their networks into ecosystems.

From Networks to Ecosystems

The gig economy is helping to drive this transition from networks to ecosystems. If you have been in business for any length of time, you know lots of people, and these people you know make up your network. Today, however, networks are not enough — relationships are the key. What matters is the ability of two or more individuals or organizations to have a common goal or desired outcome and to work toward that in a coordinated manner. Working with others you can trust and count on, and whose experience and expertise you can leverage, is what is needed to create an ecosystem.

> **AI systems (and robots) have the potential to make changes to our society that are as sweeping as those of the Industrial Revolution.**

To develop an ecosystem, you must find a few network partners and establish a closer relationship with them. But more than just an ecosystem, it has to be a purpose-driven business ecosystem (PDBE); that is, there must be a project with a business goal and outcome that all of the partners participate in. The best source of information on this phenomenon is a recently published book by Robert "Kim" Wilson titled *They Will Be Giants*,[4] which deals with PDBEs for entrepreneurs.

As part of Wilson's GIANTS ecosystem, I have started to contribute by suggesting collaboration software to provide the glue for the ecosystem and recommending other methods for sales and marketing. "Ecopartners" also reciprocate, so one of the partners is helping to create a new website with different offerings for my business.[5]

The common goal of the GIANTS ecosystem is to provide mentoring and services (sales, marketing, and strategy) to entrepreneurial organizations. We do this through the expertise of our members as well as through our partners. The GIANTS ecosystem itself currently provides strategy, marketing, sales, and customer development services to startups, and through our ecopartners we provide legal, recruiting, PR, and accounting services, too.

As an ecosystem, GIANTS is also looking at ways we can augment our experience, expertise, and reach. One of the ways to do that is through artificial intelligence.

Augmenting with AI

A natural extension of our PDBE would be to start using AI technologies in different ways. For example, we are using WizCal (an AI-driven calendaring system) to help set up optimal meeting times and the like, since as a geographically distributed team we have to deal with that problem on a daily basis.

Indeed, AI systems will begin taking on numerous tasks, from scheduling our days to driving our kids to school, from IT administration to data mining. We are starting to see virtual assistants of many kinds popping up in our lives. Apple, Amazon, and Google all have devices on the market that can help play your music, adjust your lighting or heat, do searches for you, or remind you to do something later. They can also help you create meeting agendas and reports and find critical data for budgeting,

AI systems (and robots) have the potential to make changes to our society that are as sweeping as those of the Industrial Revolution. Many jobs done today by people will become jobs that robots and AI can do better. Once autonomous trucks are certified, for example, truck drivers will need to find new jobs. This is already happening with taxi drivers thanks to the use of shared cars through Uber and Lyft. Ironically (or perhaps fittingly), Uber drivers themselves will be out of business just as soon as Uber can automate its fleet. Even writing editorial copy is a task that is already yielding to AI.

But the news is not all bad. There may be some less-skilled jobs lost, but there are many more-skilled jobs waiting to be filled. What is needed is a massive retraining program, like the US's Depression-era New Deal, only building on the information highway instead of physical dams and bridges. Some of these jobs may be in cybersecurity or programming. According to an analysis by Stanford University's Peninsula Press, there were over 1 million open cybersecurity jobs in 2016 in the US alone.[6] And the US Bureau of Labor Statistics projected that computer programming jobs in the US would increase by 28.2% in 2016.[7]

That said, there are many other jobs that might be more appropriate for newly retrained low-skill workers. It does not take great imagination to see someone who used to drive and fix trucks now working on wind turbines or solar panels. Jobs that require judgment and knowledge of the surrounding environment can often be done better by people than AI systems or robots. Many individuals who find themselves out of jobs will

create their own new jobs as entrepreneurs, creating products and services that we have not yet thought of!

For most businesses, I would suggest adopting AI systems slowly, using them in areas where people don't currently occupy those jobs. For instance, there are most likely AI systems that can help determine optimal network configurations and routing paths on your corporate network (which could save you lots of money in data storage and network infrastructure). Another example is sorting through huge mounds of data. As analytics expert Tom Davenport observes:

> I initially thought that AI and machine learning would be great for augmenting the productivity of human quants. One of the things human quants do, that machine learning doesn't do, is to understand what goes into a model and to make sense of it. That's important for convincing managers to act on analytical insights. For example, an early analytics insight at Osco Pharmacy uncovered that people who bought beer also bought diapers. But because this insight was counter-intuitive and discovered by a machine, they didn't do anything with it. But now companies have needs for greater productivity than human quants can address or fathom. They have models with 50,000 variables. These systems are moving from augmenting humans to automating decisions.[8]

Likewise, using AI to augment what people can currently do is a better way to start than by wholesale replacement of jobs. For example, IBM's Watson is developing systems that will "help healthcare providers better understand patients' diseases and recommend personalized courses of treatment."[9] Watson-like tools can also assist experts in doing their jobs better.[10] Not only can they help experts improve their decision making, but they can also aid in the continual learning and training that experts require.

Conclusion

The nature of work is changing, team demographics are changing, and even the idea of an organization is changing. In many ways this velocity of change is causing us to need greater bonds of trust (ecosystems), rather than broadly scaled networks (or social networks). We have reached an inflection point where people by themselves will no longer be able to keep up with the rate of change and what they need to know, so having AI systems augment those human capabilities is the first step in dealing with a constantly evolving future.

For IT, some things will remain the same (at least for the next few years) and other things will change more quickly. We are already seeing the move of ERP systems

to the cloud, and more and more companies are using consultants or contract hires. About 40% of the teams my Collaborative Strategies colleagues and I have surveyed are geographically distributed, and we expect that figure to be about 60% by 2018. As noted earlier, 40% of the US workforce will be part of the gig economy by 2020,[11] so that transformation is happening very rapidly.

> **Using AI to augment what people can currently do is a better way to start than by wholesale replacement of jobs.**

Finally, we are starting to see AI used in everything from meeting scheduling to medical diagnosis. My best advice here is to pick your battles. Add AI systems where they can intelligently help and mostly aim to augment the abilities people already have. Look at your most overwhelmed employees and ask yourself, would the application of an AI system or additional contract resources improve that employee's productivity, morale, and likelihood of staying with your organization? If the answer is "yes" to any of those, then you will be swiftly moving into the futures I have predicted.

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David Coleman is a Senior Consultant with Cutter Consortium's Data Insight & Social BI practice. He is also the founder and Managing Director of Collaborative Strategies, Inc. Mr. Coleman works with both collaboration vendors and end-user organizations to help solve collaboration challenges that are common to both. He has been an industry analyst and author for over 25 years, focusing on the social and collaboration markets. Prior to establishing Collaborative Strategies, Mr. Coleman held the positions of Director of Marketing and Product Line Marketing Manager at Oracle. He is the author of four books on collaboration and innumerable articles, presentations, and blog posts on the topic. He can be reached at dcoleman@cutter.com.

AGI: A Threat, an Opportunity, or an Inevitable Unknown for 2017?

by Alexandre Rodrigues

Artificial general intelligence (AGI) is currently emerging as an area where recent developments are likely to have a major impact on the way organizations do business, societies organize themselves, and even on how we address values and ethics.

The fact is that AGI already exists in our daily life. A common example is the GPS systems present in many new cars manufactured today; and let's not forget the drones being used to deliver pizzas and cars that drive themselves. While automatic pilots have been used in commercial planes for quite some time, what AGI is about to offer to general business and human activity is well beyond what most of us have seen so far.

Machines That Learn

Developments in AGI are moving artificial intelligence to a point where learning to learn is becoming ever more a reality, and it can be applied to machines, or robots, to enable them to carry out common daily activities that are either too tedious, dangerous, or otherwise difficult for humans to perform. Robots can do them better, with no life-threatening risks, and they do not get bored with repetition. In fact, they will learn rapidly from repeating tasks — or better said, challenges.

This process of automation and optimization via "intelligent machines" (which we can call "AGI-enabled" or just "AGIs") creates immense opportunities for the software and hardware industries to deliver ever better-performing robots, drones, self-driving cars, and so on. It also creates even more opportunities for all kinds of businesses to make use of this new resource, which will inevitably become more cost-efficient and less problem-prone as compared to humans.

Healthy, Harmful, or Merely Inevitable?

The Healthy

AGIs can be seen either as an opportunity for "healthy" applications or as a major threat to human welfare. On the opportunity side, we can consider humans being freed to work less time and/or do more intellectually interesting work. We can expect improvements in medicine, space exploration, security, and services in general. At the physical level, robots may perform dangerous tasks on our behalf or perform error-prone complex activities (e.g., air-traffic control) more reliably. Information security is also likely to improve, since information and data protection is becoming increasingly based on complex algorithms for surveilling and detecting potential intrusions.

Another potential benefit is reduced consumption of natural resources owing to the overall increase in efficiency. In a finite world, there is a growing focus on more "intelligent" use of the available resources via reuse/recycling, waste reduction, and shifting to renewable energy. The challenge to achieving sustainability is that the high rate at which current economies consume and waste resources (to the point where they even *depend* on unnecessary waste and consumption) seems to outpace by far their capability to develop, improve, and mass-deploy the technology required for sustainable alternatives. Automation and optimization, both of which lie at the very heart of AGI, are key factors in increasing energy efficiency and reducing waste.

Consider the example of the energy required to control the temperature in office buildings and houses. Today a massive amount of energy is consumed unnecessarily due to the lack of intelligent and automated control of the energy-supplying systems, just because humans are unable to perform continuously and in real time all the activities required to minimize the use of energy and optimize available renewables (e.g., solar energy). Or consider self-driving cars, which operate in a much more efficient way than human-driven vehicles do, thus consuming less fuel. It is not hard to see that an AGI — conceived and developed to apply all its fast-performing intelligent capability to a specific problem, with no interference from emotions or a legacy of outdated behavioral genes — will easily outperform humans both in effectiveness and efficiency.

Fukoku Mutual Life Insurance must have seen this, too, because at the very outset of 2017, the Japanese insurance firm announced that it would replace 34 of its staff members with an AI system that can calculate insurance claim payouts.[1] The firm believes that the IBM Watson–based system will increase its productivity by 30%. Meanwhile, "three other Japanese insurance companies are considering adopting AI systems for work like finding the optimal cover plan for customers."[2] Moreover, a 2016 study by the World Economic Forum predicted that the advent of AI and robots "will result in a net loss of 5.1 million jobs over the next five years in 15 leading countries," whose economies account for approximately 65% of the total global workforce.[3]

> **When the mass market starts using AGIs as a commodity to support its business models, AGI will become a game changer.**

Is this job loss the "threat" side of AGI? Not necessarily. I believe human societies will realize the benefits of having AGIs perform ordinary, supporting, and logical activities, which they can do much better than humans while consuming fewer resources and producing less waste. In turn, humans will naturally tend to focus on organizing their lives around intellectual and creative work, which is much less prone to consuming unnecessary resources and producing waste, while increasing overall welfare significantly.

The Harmful

That said, AGI does pose major perils, which can be grouped into three categories:

1. The "unhealthy" use of AGI by humans (e.g., for hacking)

2. Artificial constraints on access to AGIs (a commodity that would otherwise be accessible to the whole population) so that "savage capitalism" can prosper based on such artificially managed scarcity

3. AGIs themselves outmaneuvering and dominating humans

The last possibility is the least likely in the new year ahead, but perhaps one that deserves our immediate consideration.

The Inevitable

In 2017, we will see AGI continuously entering our daily life. In my view, this will produce some interesting breakthroughs in the commercial business world, mainly through the emergence of new product concepts. While we may tend to welcome these wonders of technology, we must keep in mind that long-term "misusage" of AGI could also lead to irreversible negative consequences in our global human society.

It Starts Now

Organizations that start thinking early on how to transform their businesses to embrace AGI will prevent the serious risk of rapid obsolescence (remember what happened to Nokia for not embracing smartphones soon enough). The true potential of AGI is most likely already being devised by a few organizations. When the mass market starts using AGIs as a commodity to support its business models (as Fukoku Mutual Life has done), AGI will become a game changer. The trend will be to have some form of intelligence embedded in most products we use for work and leisure.

Endnotes

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Alexandre Rodrigues, PMP, is a Senior Consultant with Cutter Consortium's Agile Product Management & Software Engineering Excellence practice and Executive Partner of PMO Projects Group, a group of companies that specializes in helping organizations adopt project and program management best practices. Dr. Rodrigues holds a licentiate degree in systems and informatics engineering and a PhD in management sciences. He is a regular contributor to the development of international standards issued by organizations such as ISO and the Project Management Institute. Throughout his 25-year career, Dr. Rodrigues has lectured at several universities and delivered consulting and training services to major organizations around the globe. He can be reached at arodrigues@cutter.com.

2017: The Year of Exchanging Technology Hype for Humility and Hard Work

by Robert N. Charette

There has scarcely been a day the past few years in which there hasn't been a breathless press release or article touting some new technological advance and how it will "literally change the world as we know it — forever." We've seen in quick succession big data, 3D printing, and the Internet of Things (IoT), to mention just a few, given the mantle of being *the* next big societal revolutionary change agent.

Big Data Lays an Egg

Take big data, for instance. In October 2012, an influential article in *Harvard Business Review* proclaimed that being a data scientist was "The Sexiest Job of the 21st Century."[1] According to some industry analysts at the time, there was going to be, conservatively, a major US shortage of data scientists ranging from 140,000 to 190,000 by 2018.[2] Furthermore, despite the shortage, Gartner claimed that big data was still going to create 1.9 million new IT jobs — a 50% increase in the then total number of IT workers — as well as generate another 5.7 million new non-IT jobs in the US by 2015.[3] Yet the latter number is significantly greater than the average annual rate of private and government jobs (excluding farm jobs) created in the US over the past 76 years![4]

The supposedly infallible predictive power of big data analytics was on display in the recent US presidential election, with some big data–driven pollsters calling for a 95% or even higher probability of Hillary Clinton winning the election.[5] As we all know, those predictions were a wee bit off; in fact, the true outcome served to expose the big data emperor as having fewer clothes than pre-election hyped proclamations to the contrary. Big data answers are not fate, after all, despite what many big data advocates have been strongly selling.

There is now a sense that the field has been greatly infected by "big data hubris," which in turn has called into question how much decision value big data analytics can actually create.[6] One common excuse for the election prediction failure has been the old IT maxim of "garbage in, garbage out," which requires one to know what garbage looks like, of course. Maybe if the data scientists behind the recent election predictions had bothered to look into those earlier grandiose predictions of big data job creation, some humility might have tempered the arrogance in their forecasts. For instance, a quick check of the actual US computer and mathematical employment in 2015 showed that it stood at 4,369,000 workers,[7] up from 3,814,700 in 2012.[8] Where were all those new IT jobs that analysts claimed were being spawned by big data, let alone the millions of big data–driven non-IT jobs? It doesn't take a lot of effort to recognize — or smell, for that matter — garbage inputs.

> **Big data answers are not fate, after all, despite what many big data advocates have been strongly selling.**

3D Printing Jams

As recently as 2015, 3D printing was the "hottest new thing" that would change the world forever, since soon there would be a 3D printer in every house. In addition, industry observers claimed there was an acute, massive shortage of 3D printing engineers available to be hired.[9] However, the story today already centers on the lost promise of 3D printing as, unsurprisingly, it turns out that it is a lot harder and more expensive than it first appeared.[10] 3D printer companies are in trouble, with some closing their doors for lack of demand. Those left in the business admit that there is still a large gap between the hype being sold and reality, and that they now need to focus on making 3D printing simpler and more useful to customers in order to repair their damaged reputation.[11]

Internet of Scary Things

Another overhyped technology is the Internet of Things, or perhaps better called the Internet of Thieves. Back in 2012, some analysts excitedly claimed that there would be 1 trillion connected devices in the IoT by 2015.[12] However, the latest best estimate is now closer to 30 billion connected IoT devices — by 2020. What's also becoming alarmingly apparent is that the world of IoT is not very secure, with many of the connected devices readily available to be used in mass denial-of-service attacks, for instance.[13]

> **Totally autonomously driven vehicles and artificial intelligence are likewise becoming, or already are, overhyped technologies.**

Security expert Bruce Schneier warns that "with the advent of the Internet of Things and cyber-physical systems in general, we've given the Internet hands and feet: the ability to directly affect the physical world. What used to be attacks against data and information have become attacks against flesh, steel, and concrete."[14] Industry IoT groups say not to worry, security standards are on their way, but they admit there is no universal agreement among the various IoT standards bodies on what they should be.[15]

Self-Driving Cars, AI Also Overhyped

Totally autonomously driven vehicles and artificial intelligence are likewise becoming, or already are, over-hyped technologies. Tesla, Volvo, and Mercedes-Benz have been warned about misrepresenting their vehicles' self-driving capabilities, which could lead their customers into thinking they don't have to pay attention to their driving while employing them.[16] Similarly, artificial intelligence researchers are worried that the term "AI" has been "hijacked by marketers and advertising copyrighters" who will misrepresent what can and cannot be realistically done by current AI systems and turn people away from usefully applying AI because the technology doesn't meet inflated expectations.[17]

Today's Hot New Style: Humility

None of this is to imply that there is no value in big data, 3D printing, IoT, autonomously driven vehicles, or AI, only that there is no value — and potentially a lot of harm — in overhyping their vaporware capabilities. Look again at the world of 3D printing. How much further along would the industry be today if there had been more humility about 3D printing capabilities and warnings of the hard work needed to make those capabilities materialize as promised?

Worse, the oversold capabilities being marketed are likely to be wrong, anyway. The late Roy Amara, a researcher, scientist, and past president of the Institute for the Future, made a sharp observation a number of years ago that has been termed Amara's Law: "We tend to overestimate the effect of a technology in the short run and underestimate the effect in the long run."

I predict that after the past year of technological over-promises, in 2017 we will start to see a refocus on acknowledging the hard work required to make a technology successful, as well as a bit more humility about what can be accomplished with it today and in the near future.

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Robert N. Charette is a Fellow with Cutter Consortium's Business Technology & Digital Transformation Strategies practice. Dr. Charette is also President of ITABHI Corporation, a business and technology risk management consultancy. With 40 years' experience in a wide variety of international technology and management positions, he is recognized as an international authority and pioneer regarding IS, IT, and telecommunications risk management.

Dr. Charette serves as a senior risk advisor to Global 100 CEOs, CFOs, and program and project managers. He is a trusted risk advisor to senior-level defense, civil, and local government officials worldwide on the effectiveness, impacts, rewards, and risks of their high-tech programs and policies. Dr. Charette acts as chief risk consultant to financial organizations and companies when investments, mergers, or takeovers are considered. His experience in both government and business provides a unique perspective on addressing the risk management issues confronting today's public sector. He can be reached at rcharette@cutter.com.

Process of Things: Ensuring a Successful Connection Between Things

by Emir Ugljanin, Zakaria Maamar, Mohamed Sellami, and Noura Faci

Internet of Things (IoT), smart cities, wearable devices, and virtual reality are some information and communications technology (ICT) buzzwords that are making the boundaries between reality and fiction vanish. According to Mark Weiser, the father of ubiquitous computing:

> The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.[1]

> **Although the ICT community considers the *task* the basic unit of work that implements a business process, the next trend is to allow *things* to be in charge of this implementation by forming ad hoc collaborative groups.**

While this weave is already happening through smart fabrics, for example, we expect that IoT[2] (or "things" for short) will transparently blend with the know-how of enterprises commonly referred to as *business processes* (BPs). Although the ICT community considers the *task* the basic unit of work that implements a BP, the next trend is to allow *things* to be in charge of this implementation by forming ad hoc (i.e., on-the-fly/opportunistic) collaborative groups. This should happen through the concept of Process of Things (PoT), which will:

- Guide the identification of things according to their capabilities

- Allow things to take over new capabilities (i.e., mutation)

- Facilitate the connection (and disconnection) of things through socially flavored relations

- Incentivize or penalize things in response to their positive or negative participation in processes

PoT is the new way of tapping into the worlds of IoT and BP. PoT ensures that things will not function as silos but contribute collectively to offering value-added services to enterprises such as developing smart applications around connected things and reaching out to more customers through adaptable things. Predefined relations between things (e.g., parental, colocation, ownership[3]) will support the development of networks of (privileged) contacts so that a thing can:

1. Contact other things for possible connection in these networks

2. Avoid conflicts with existing things in processes

3. Recommend other things for either inclusion in or exclusion from processes based on past experiences

The ICT community is already building the Social Internet of Things (SIoT) using social relations[4] among things (not among their owners[5]) and is stressing the importance of exploiting these relations in developing smart applications. In a PoT, capabilities will prescribe a thing's duties once it becomes activated and, thus, ready to form collaborative groups with other things. Capabilities would include sensing, storing, processing, diffusion, and reporting, with the option of combining them (e.g., sensing-and-processing).

Despite the ICT community's interest in blending social computing with IoT, a good number of challenges and open issues that emerge out of this blend remain untackled.[6] This includes defining a social-thing architecture, addressing the interoperability of things, discovering things, managing energy consumption of things, and handling the security, privacy, and trust of things, to cite just a few. On top of these challenges and issues, it is important to examine the on-the-fly combination of things, taking into account their dynamic capabilities and end users' dynamic requirements. A PoT should have an operation model that inventories things according to a particular context (e.g., meeting room) and capitalizes on relations between things to expand this model.

Business Processes, Old and New

Enterprises and/or IT practitioners will raise the question of how a PoT compares to a regular process of tasks. There are some similarities:

- Just as a process of tasks has a business logic defining who does what, when, and where, a PoT will have a "story" that defines the necessary things along with their capabilities and connections to other things. To develop such a story, enterprises will need a Thing Definition Language (TDL) and a Thing Connection Language (TCL). Both languages could be built upon the W3C semantic sensor network ontology[7] after enrichment with additional properties that describe context-based social relations between things.

- Like dependencies between tasks in processes, a PoT will count on capacity-driven relations between things, such as precedence (washing machine then dryer), complementarity (coffee machine and toaster), "antagonism" (VCR and DVD), and competition (a new fridge that could replace an existing one). Relations will be context-sensitive and based on the purpose of the future PoT.

And there are some differences:

- Contrary to a process of tasks whose runtime instantiation leads into several process instances that could run concurrently, instantiating the same PoT several times could call for different things depending on their capabilities and availabilities.

- Unlike a process of tasks whose tasks are known in advance, a PoT will have a set of core things (also known in advance) and a set of optional things that are part of these core things' networks of contacts. Upon the recommendation of the core things, optional things can be added to a PoT, subject to the enterprise's approval of the additional cost. Needless to say, dropping a core thing from a PoT results in dropping all of its optional things.

We believe it is necessary to differentiate between the *social Internet of things* and the *Internet of social things*. On the one hand, in the social Internet, things are configured and controlled in preparation for their integration into specialized networks built upon specific relations like those mentioned above. On the other hand, a social thing will be empowered with the capabilities needed for tapping into the opportunities of these networks, such as looking for partners, avoiding partners, forming alliances with partners, and so on, based on past experiences.

Capabilities in Context

To run a PoT, enterprises will have to define contextual boundaries of the future thing-based applications. These boundaries will identify the things that are willing to participate in these applications, taking into account their ongoing commitments and available capabilities. As stated above, each PoT execution can call for different things, since new things could emerge and existing things could, at any given moment, either cease to exist or change their priorities in supporting application development.

An example of a PoT could be a heating system that relies on sensors, actuators, and other devices to ensure comfortable living conditions for people. Mapping the heating system onto a PoT would require scanning the environment to detect things in terms of availabilities and capabilities, defining relations between things, and putting appropriate things together in response to specific requests such as maintaining a certain temperature level. Of course, it is vital to secure each PoT, as hacked things could lead to catastrophic consequences.[8] In a PoT, things are parts of networks, and thus hacking one thing will give free access to the remaining things in these networks. The success of PoT will depend on enhancing things with the necessary capabilities to support them in securely building networks of contacts, responding to users' needs proactively, and — last but not least — questioning our ways of thinking about things.

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Emir Ugljanin is a PhD student at the University of Nis and a teaching assistant at the State University of Novi Pazar, both in Serbia. His current research interests are business process management, the Internet of Things, and the social Web. He can be reached at emirugljanin@gmail.com.

Zakaria Maamar is Professor in the College of Technological Innovation at Zayed University, Dubai, UAE. His research interests include business processes, the Internet of Things, and Web 2.0. Dr. Maamar has a PhD in computer science from Laval University, Quebec City, Canada. He can be reached at zakaria.maamar@zu.ac.ae.

Mohamed Sellami is Associate Professor at ISEP (Institut Supérieur d'Electronique de Paris) and a member of the LISITE Laboratory, Paris, France. His current research interests revolve around service computing, cloud computing, and social computing. Dr. Sellami obtained his PhD from Telecom SudParis, Paris, France. He can be reached at mohamed.sellami@isep.fr.

Noura Faci is Associate Professor in the Department of Computer Science of Claude Bernard Lyon 1 University, Lyon, France. Her research interests include service computing, social computing, and business process management. Dr. Faci has a PhD in computer science from URCA University, Reims, France. She can be reached at noura.faci@univ-lyon1.fr.

The Tech-Driven Tech Backlash

by Carl Pritchard

2017 is going to be a year of strange winners, and perhaps the strangest of all will be a giant leap away from technology and back to solutions that don't rely on 24/7 connectivity. With the onslaught of major hacks and Facebook embarrassment, the antitech crowd may have its best year in decades.

The early evidence is somewhat startling:

- The average US Internet user has 130 online accounts,[1] each of which carries its own username and password. Such a wide-ranging online presence greatly increases the risk of losing personal data. In response to this threat, a Swedish firm is putting the final polish on its new Deseat software, which enables you to delete (or at least scale back) your Internet presence.

- Facebook has run afoul of German hate speech laws, putting the social media giant in the crosshairs of a fury over what a social media organization can and cannot be held accountable for.[2]

- Ransomware became a billion-dollar industry in 2016, including a hit on the San Francisco transit system that demanded payment in Bitcoin.[3]

What do these examples have in common? They're readily resolved by minimizing technology in the equation. Low-tech will be the hot tech trend for 2017.

Rather than looking for the next in the endless procession of new players in the Internet of Things (IoT), companies that want to seize on the hottest tech trends for 2017 need to give serious consideration to unplugging. As hackers continue their dedicated push to break into everything from your laptop to your pacemaker, companies that rely on technology as their backbone will be looking to older tech as their "back brace."

For some individuals, the rationale behind the shift away from connectedness is personal rather than technical. US National Public Radio's *All Things Considered* in November 2016 featured an interview with Rachael Garrity, a specialist in marketing and publishing for nonprofit organizations. She is one of the legions of people who have decided to cut at least part of their Internet "cord." "I am finding Facebook to have a negative impact on my continuing to keep a positive feeling regarding some of the people I have known longest and cherish most," she said.[4]

Individuals and businesses are taking more and more control over their connectivity, and for some that means depending on local data storage and non-Internet-reliant approaches to their endeavors. This doesn't mean that innovation will be quashed in 2017, but rather the opposite. Deseat.me is just the first firm out of the box with termination technology. And while the cloud will continue to grow (Cisco is predicting traffic will be up to 14 zettabytes in just four years — that's 14-trillion gigabytes[5]), the other, quieter growth industry is hard-copy tape backups with physical pickup and delivery by firms like Iron Mountain.[6] The movement to real (rather than virtual) data storage is just one more sign that 2017 will be a year for hedging bets against an unsafe, insecure virtual world.

> **Low-tech will be the hot tech trend for 2017.**

Ways to Disconnect

How can you take advantage of this trend?

It becomes a lesson in creative thinking, and thinking outside the Internet may prove to be the ultimate lesson in both forward thinking and disaster recovery. The questions managers and executives should ask are:

- Can I approach my latest innovation with a tandem (connected/unconnected) strategy?

- Can I convert my products/services in a relative flash to/from a connected environment?

- If I can't do either of those things, have I minimized my exposure to the outside through other strategies?

Tandem Strategies

A peer of mine with a semi-apocalyptic bent has always had a classic VW Beetle. When I probed why he opted for the Bug, his reply was very much in line with the tandem strategy: "I don't have to take it out of the garage very often, but I do, just to make sure it still runs." He went on to explain that if every hacker, electromagnetic pulse, and solar flare hit the earth simultaneously, he could still roll the Beetle down the hill, pop the clutch, and off he'd go. Everyone else would be trying to figure out why their Lexus just turned into a paperweight.

An effective tandem strategy doesn't require a Luddite's mentality. It simply requires that we have the ability to turn on a dime from a high-technology approach to a lower-tech version of the same solution. But it can get expensive and definitely requires a lot of forethought.

> **2017 will bring a renewed emphasis on conducting business in a safe space, including spaces where the Internet cannot reach.**

Conversion Strategies

Until I get my own VW, I have Keith. Keith is a neighbor, a skilled mechanic, and an artisan in the garage. If technology ever gets the best of my computer-driven, high-tech automobile, I know that I can rely on Keith to jury-rig something to get me back on the road in relatively short order. It won't be pretty, but it'll work and get me past any crisis. (Evidence? My son's engine light was permanently on. Keith worked a little magic and squeezed another eight months of life out of my boy's dying car.)

For corporate conversion strategies, we don't have to build in supplemental infrastructure, but we do need our own corporate Keiths. These individuals should be identified for their ability to identify ways to access data, work around systems, and build temporary solutions when technology becomes an enemy rather than an ally.

Minimized Exposure

This is actually where most organizations land, trusting the cloud, trusting multiple backups — and firewalls and antiviral defenses — to keep them safe. It's standard … 2016. As 2017 gets into full swing, anticipate that

some of these traditions will fall, and the realization will strike that all things new are not all things wonderful.

What will 2017 bring? Surprises. And most businesses and government entities really don't appreciate surprises. Nor do they handle them with aplomb. 2017 will bring a renewed emphasis on conducting business in a safe space, including spaces where the Internet cannot reach. 2017 will praise many older approaches as "innovative" and will see great gnashing of teeth when connectivity becomes a profound challenge.

Oh, yes, and 2017 will bring with it flying cars.

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Carl Pritchard is a Senior Consultant with Cutter Consortium's Business Technology & Digital Transformation Strategies practice. He is a project management thought leader and the lead chapter author for the Risk Management chapter of the Guide to the Project Management Body of Knowledge, 4th Edition. *Mr. Pritchard is the US correspondent for the British project management magazine* Project Manager Today *and is an internationally recognized lecturer and author with five books to his credit, including* Risk Management: Concepts & Guidance. *He co-produced* The Portable PMP Prep, *a nine-CD audio training program and is a member of the board of directors of ProjectConnections.com. Mr. Pritchard has authored hundreds of articles on management practice and served as a semifinal judge in the Project Management Institute's "Project of the Year" competition. He is a certified Project Management Professional (PMP), a certified Earned Value Professional (EVP), and a graduate of The Ohio State University. Mr. Pritchard resides with his wife and sons in Frederick, Maryland. He can be reached at cpritchard@cutter.com.*

Delivering a Brighter Future for IT Projects

by Darren Dalcher

IT project performance used to be characterized by runaway projects, late delivery, exceeded budgets, reduced functionality, and questionable quality that could translate into cancellations, reduced scope, and significant rework cycles. To combat this less-than-favorable track record of project delivery, the UK's Association for Project Management has formed a rather challenging vision of a world where all projects succeed by the year 2020. On my wish list for 2017, though, is the more modest aspiration for a new kind of better-informed and more successful project management.

In looking forward to a bright future, projects provide an exciting arena where human ambition and daring imagination continue to drive societal endeavors and achievements. Yet even the successful delivery of a project is no longer sufficient. Life does not stand still. The bar, it seems, is always being raised and with it the expectations regarding what can be achieved through projects and the ambition and appetite to deliver more.

Over the years, commentators have noted that achievement often motivates the next cycle of undertakings as humans seek longer bridges, taller buildings, faster cars, and more responsive and integrated systems. Extending our reach inevitably means taking a chance and testing the limits of our capability and knowledge, especially in the context of project work.

Greater ambition also signals the need to accommodate rising levels of complexity, uncertainty, ambiguity, and change. Meanwhile, as we learn to cope with a world that is more volatile, multifaceted, and interconnected — and risky — we need to hone our skills and capabilities.

Attempting more demanding endeavors requires innovative methods for delivering, guiding, and managing projects. Meanwhile, the rise in complexity and uncertainty demands new ways of thinking about projects.

Project Management in 2017

So how do we deliver on the wish of success? This article builds upon the recent trends identified in the book *Further Advances in Project Management: Guided*

Exploration in Unfamiliar Landscapes, an edited volume I recently published with Routledge.[1] Recognizing that concerns around successful delivery, value realization, resilience, and making change stick force a significant reevaluation of the scope and extent of "normal" project discourse, the book brings together many leading thinkers and practitioners in an effort to provide new insights and perspectives and distill new knowledge through narrated exploration. While the book offers a wealth of new ideas, models, and perspectives that encourage new conversations around projects and project management, the following seven overarching themes emerge as the key trends and changes in project management that will require our attention in 2017.

> **As we learn to cope with a world that is more volatile, multifaceted, and interconnected — and risky — we need to hone our skills and capabilities.**

People

Projects are about people, but project management says little about this aspect. Yet people are difficult to include, plan for, and satisfy. Methods to deliver improved project experiences increasingly account for the human aspects of projects and better address stakeholders, motivation, needs discovery, engagement, marketing, influencing, persuading, and understanding of users and their role. Examples of such new methods include:

- Systemically evaluating the spheres of influence
- Driving stakeholder engagement by role and contribution
- Determining the (human) pace of progress
- Repositioning projects as "social endeavors"
- Focusing on gatekeepers, customers, client chains, and contractors as stakeholders

- Utilizing choice engineering
- Fostering project resilience
- Considering the methodology of compelling behaviors[2]

Leadership

A theme that emerges from the different conversations in the project space, including those highlighted in the book, is the need to move from managing to leading. Managing is the hallmark of certainty and a control-oriented perspective, while leadership points to a different and more varied skill set. The combination of uncertainty and a greater reliance on a network of participants requires a more organic approach emphasizing influence, participation, and collaboration.

> **Benefit realization and value delivery capability can be linked to projects, but only via a strategic, or organizational, frame of thinking that extends beyond execution.**

Context

Projects rely on situational and contextual factors that managers need to understand. Interacting with projects in complex environments requires an awareness of the specific characteristics, including informational, contextual, strategic, geomorphological, geological, environmental, and public perception considerations and a willingness to experiment and adapt.

Strategy

Project management is concerned with the delivery of projects, while projects link strategy and execution. Improving the alignment between strategy and execution requires strategic-level engagement from project professionals.

Value

Projects are often created to satisfy strategic needs and objectives, and therefore project management is increasingly called upon to deliver benefits and value. However, it is completed projects that satisfy users by subsequently providing benefits, not project management per se. For example, a completed footbridge does not deliver a benefit stream until pedestrians begin to use it to move across to the other side of town. This is an important lesson to digest. Benefit realization and value delivery capability can be linked to projects, but only via a strategic, or organizational, frame of thinking that extends beyond execution.

Long-Term Thinking

The long-term perspective is often invoked to consider ethics, decision making, ROI, benefits realization, value accumulation, decommissioning, extended lifecycles, and warranty periods. It is here that the distinction between temporal project management (focused on delivery to predefined schedules according to predetermined milestones) and the sustained outcomes, and even outputs of a project, come into play. Sharing knowledge, resources, and talent often requires organizational considerations that extend beyond any single project. Similarly, as project managers are asked to relate to a wider horizon or adopt an extended lifecycle, they enter a different level of conversation about the project and its impacts. They therefore need new ways of reasoning for this type of conversation, such as employing new and extended methods of addressing multiple levels of success, timely engagement modes, and ultimate project outcomes.

Innovation

Innovation and experimentation feature in conversations about requirements, resilience, decision making, and new mindsets as they provide essential learning opportunities for validating and improving performance. Moreover, adaptation, trial-and-error, and resilience enable managers to adjust and respond to the unknown.

What Are the Main Implications of These New Ways of Thinking?

Adopting the emerging themes in 2017 has interesting ramifications for professionals and offers the potential for a repositioning of the discipline of project management.

First, the trends and changes imply adjustments to the role and importance of project managers. Participating in strategic conversations, innovating, delivering value, and aligning projects with business strategy requires a more central position. Engaging in a range of strategic roles may lead to the reemergence of the professional thinker, integrator, and synergy-aware and stakeholder-savvy executive with greater organizational understanding and clearer links to strategy, benefits, value, and impacts.

Second, multiple perspectives, alternative lenses, and the use of fresh metaphors may support the development of complementary options and arrangements for projects and action and lead to fundamental improvements in the approaches employed by project managers in accounting for wider areas and interests. Formulation of projects relies on the perceptions we hold. If we are able to question and challenge the purpose, value, and outcomes of proposed undertakings and view them from alternate vantage points, we may be able to conceive more useful and meaningful projects that deliver essential benefits and address real concerns and issues.

Third, we require a new understanding of project success, an idea that is explored in the various chapters of the book and other recent work.[3] Success in the future will demand deeper engagement with the business. It also implies an acute understanding of the values and preferences of different, yet much wider, circles of stakeholder communities, possibly arranged in complex and interconnected ecologies embracing supply chains, coalitions, spheres of influence, and common values and preferences. The set of concerns is likely to encompass sustainability and survivability issues, extended time horizons, and the impact of wider communities with shared interests. Greater sensitivity to context, consideration of the different phasing of lifecycles, and adding a longer-term perspective would allow the focus to shift from efficiency of execution to an extended lifecycle perspective. This will support change, adaptation, and resilient posturing and enable organizations to better accommodate urgent and unexpected perturbations. The old tools and approaches that characterize the classic mindset will thus be augmented by new thinking mechanisms and reflection skills, such as reasoning about multiple levels of success, determining the pace of projects, utilizing resilience modes, and applying complexity, humanistic, and systemic models, all of which will help practitioners balance ethical, economic, and environmental considerations.

The new themes point to new priorities in terms of leading people, repositioning projects, redefining success, and focusing on the delivery of value in the new world of projects. Many of the ideas can be easily adapted to augment current practices. Others may provide the seed for developing future improvements in project practice.

Used together in 2017, they enable project professionals to begin to address the concerns around projects, update current thinking, and start to repair the track record of IT asset, project, and service delivery.

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Darren Dalcher is Chair Professor of Project Management at the University of Hertfordshire and is the Founding Director of the National Centre for Project Management, an interdisciplinary center of excellence operating in collaboration with industry, government, charities, NGOs, and the learned societies. He has been named one of the top 10 "movers and shapers" in project management by the Association for Project Management and has also been voted Project *magazine's Academic of the Year for his contribution in "integrating and weaving academic work with practice." Dr. Dalcher has built a reputation as a leader and innovator in the area of practice-based education and reflection in project management and has worked with many major industrial, commercial, and charitable organizations and government bodies. He is active in numerous international committees, steering groups, and editorial boards. Dr. Dalcher is heavily involved in organizing international conferences and has delivered many keynote addresses and tutorials. He has written over 200 refereed papers and book chapters on project management and software engineering. He is Editor-in-Chief of* Journal of Software: Evolution and Process *and Editor of the* Advances in Project Management and Fundamentals of Project Management *book series published by Routledge. Dr. Dalcher is a Chartered Fellow of the British Computer Society, a Fellow of the Chartered Management Institute and the Royal Society of Arts, and a Senior Fellow of the Higher Education Academy. In 2011, he was awarded a prestigious lifetime Honorary Fellowship from the Association for Project Management for his outstanding contribution to project management. He can be reached at d.dalcher2@herts.ac.uk.*

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