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Demystifying intelligent automation

The layman's guide to the spectrum of robotics and automation in government

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Introduction

While we all have some sense as to what intelligent automation means, the terminology can be quite confusing. A common challenge among government and private sector executives alike is that there is game-changing technology out there, camouflaged by overly complicated terminology, that can be difficult to explain in plain English. There is currently no standard government-wide or industry-wide terminology when discussing intelligent automaton. Adding to the confusion, there is a very robust difference between the tool capabilities and approaches leveraged. One person may be talking about automating somewhat rudimentary operations, such as data extraction and pasting, while another is thinking about cognitive solutions.

A technical description might sound something like this: "It is a cognitive autonomic, data-analytic, neurally heuristic knowledge engine." Well, that is a show stopper for most people. Terms such as robotic process automation (RPA), digitalization, and smart systems capture the concept KPMG LLP (KPMG) refers to as intelligent automation. But these terms can conjure up vastly different interpretations. Put simply, intelligent automation is the "automation of mission delivery and business processes by leveraging digital technologies to support tasks undertaken by knowledge workers." Applying this framework, intelligent automation promises to change the way government does business in ways even the technology's most ardent supporters are still figuring out.

Intelligent automation is certainly not new for government, such as its growing use in call center operations and the adoption of a host of other smart applications. For example, the Department of Defense has "smart" weapons, and our space program is driven by the most advanced technology.

At the same time, intelligent automation is relatively new to the back room of government, which is largely driven by legacy systems and long-standing ways of doing business. Rapidly advancing intelligent technology and the explosion of readily accessible data offers ever-increasing capabilities.

Enabling technology will be a major driver in transforming management of the federal government. In this regard, on March 27, 2017, President Trump announced the establishment of the Office of American Innovation to "make recommendations to the President on policies and plans that improve Government operations and services, improve the quality of life for Americans now and in the future, and spur job creation. These recommendations will be developed in collaboration with career staff along with private-sector and other external thought leaders."[2]

KPMG breaks the spectrum of intelligent automation into three distinct categories, or classes, to help better differentiate the types of intelligent automation and the applicability and benefits for government. The three classes, which will be discussed in "The spectrum of intelligent automation" section of the guide, are (1) RPA, (2) enhanced process automation, and (3) cognitive automation.

This layman's guide puts some of the terminology aside for a minute and describes the field of intelligent automation in general—a very broad spectrum of capabilities that encompasses the more commonly used term RPA, all the way to cognitive automation, such as IBM's Watson. We will provide insight as to why harnessing intelligent automation will be increasingly essential to the business of government in an era of budget constraint and increasing citizen expectations. And, we will hopefully tone down the hype and debunk some of the myths along the way.

[1.] This layman's guide was adapted for government from KPMP's "Demystifying Digital Labor – The layman's guide to the spectrum of robotics and automation," authored for business by David Kirk, PhD, Managing Director, Advisory, http://www.kpmg-institutes.com/content/dam/kpmg/advisory-institute/pdf/2016/demistifying-digital-labor.pdf.

[2.] https://www.whitehouse.gov/the-press-office/2017/03/27/president-donald-j-trump-announces-white-house-office-american

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Why is intelligent automation so important for government?

The short answer is that government cannot afford to do otherwise. While not in law or regulation, think of intelligent automation as a mandate. It is no longer about "if," but about "where, when, and how fast." Government faces urgent challenges that intelligent automation can help address, including:

Ever-tightening administrative operations budgets

Federal outlays for fiscal year 2016 were 4.3 times higher than in 1966 in constant 2016 dollars.[3] In announcing the January 2017 issuance of the U.S. Government Accountability Office's (GAO) report, "The Nation's Fiscal Health: Action Is Needed to Address the Federal Government's Fiscal Future," the Comptroller General of the United States stated: "The Congress and the Trump Administration face serious economic, security, and social challenges that will require difficult policy choices in the short term about the level of federal spending and investments as well as ways to obtain needed resources. They also face a government heavily leveraged in debt by historic norms and on an unsustainable long-term path."[4] Significant state and local fiscal sustainability issues exist as well.[5]

Declining workforces

Public sector employment, as a share of the population, continues to decline, and the federal government civilian personnel footprint is expected to further shrink.[6]

Increasing demands and citizen expectations

Government workloads continue to grow, with more participants in major means-tested federal programs each month.[7] There have been steady increases in call center volumes, such as the Social Security Administration, which experienced an 8.5 percent increase in 2016 and faces the continued retirement of the baby boomers. In 2016, public customer satisfaction with the quality of federal products and services rose to 68 percent from 63.9 in 2015, with local government satisfaction rising to 72.5 percent.[8] However, comparable national rates across all nongovernment sectors stood at 75.4 percent.

[3.] The Budget and Economic Outlook: 2016 to 2026, Congressional Budget Office, January 2016.

[4.] GAO-17-237SP, January 17, 2017.

[5.] "State and Local Governments' Fiscal Outlook: 2016 Update," GAO-17-213SP, December 8, 2016.

[6.] Presidential Executive Order 13781, Comprehensive Plan for Reorganizing the Executive Branch, March 13, 2017; Presidential Memorandum Regarding the Hiring Freeze, January 23, 2017; and Office of Management and Budget (OMB) Memorandum (M)-17-22, April 12, 2017.

[7.] "21.3 Percent of U.S. Population Participates in Government Assistance Programs Each Month," U.S. Census Bureau, May 28, 2015.

[8.] Federal Government Report 2016, American Customer Satisfaction Index, January 31, 2017.

What are the potential benefits for government?

Let's be clear—intelligent automation is not the latest wrench for tightening the next dime out of government operations—there are more than dollars at stake. The compelling case for intelligent automation is multifaceted and includes a number of interrelated benefits. They fall into the following seven areas—all of which point to enhanced government performance, accountability, and reduced cost.

Productivity/Performance – Intelligent automation tools work 24/7, 365 days a year, and perform tasks at digital speeds. They can do more and do it continuously while appreciably driving down costs.[9]

Employee satisfaction – Eliminating mundane repetitive tasks allows employees to focus on strategic initiatives, thereby impacting the organization in a more profound way, resulting in greater job satisfaction. A common misperception is that intelligent automation simply replaces the human workforce as opposed to enabling the workforce and/or changing what they do. For example, finance organizations should expect to see marked declines in routine backroom transaction processing and reconciliation activities and, at the same time, a need for staff with broad and deep analytical capabilities.

Scalability – Intelligent automation tools scale instantaneously at digital speeds to respond to fluctuating and large workloads. These tools are noninvasive and can work with the existing, even legacy, information technology (IT) infrastructure.

Consistency/Predictability – Intelligent automation tools do not make inconsistent decisions, such as electing to turn right one day and left the next. They are configured to solve a problem the same way every time.

Quality/Reliability – Intelligent automation tools always do what you tell them to do. When properly configured they do not make mistakes and thereby eliminate human error. Having said that, when not properly configured and/or maintained, a robot will fail—and fail at digital speeds.

Auditability – Intelligent automation tools keep the perfect audit trail—the software log—a file built by the software that documents every action it took and the corresponding resulting outcome.

Citizen engagement – Intelligent automation can greatly improve citizens' experience with government services through reduced wait times and more accurate and prompt assistance and responses.

[9.] Bank of America Merrill Lynch estimates that the global market for robots and artificial intelligence will reach $152.7 billion by 2020, with improved productivity gains of 30 percent in some industries. (See "Robotics Revolution – Global Robot and AI Primer," December 16, 2015.) Productivity gains of this magnitude in government backroom operations equates to significant cost savings.

The spectrum of intelligent automation

From a strategic perspective, as well as to simplify the terminology challenge, as shown in Figure 1, we have divided the spectrum of intelligent automation into three classes: (1) RPA, (2) enhanced process automation, and (3) cognitive automation. Categorization is not a perfect science, and as such, an automation tool may very well have characteristics in multiple classes and/or sit on the boundary between two classes. It is important to understand that the spectrum is wide and ever-expanding.

As shown in Figure 1, the first class of intelligent automation, RPA, encompasses fundamental thinking tasks, such as workflow and process mapping. RPA is what you may most commonly see in organizations today. The second class, enhanced process automation, involves more sophisticated tasks, such as an ability to work with unstructured data and pattern recognition. The third class, cognitive automation, includes artificial intelligence, digestion of super-data sets, and predictive analytics. Again, think of IBM's Watson.

Before further exploring each of these three classes, categorization into classes is not to be confused with a maturity model since tools in each class have specific capabilities that address a specific type of automation opportunity. Each class is intended to address real-world issues and provide the appropriate level of capabilities for solving those specific issues at the right cost/performance trade-off. For example, you really do not want to use a cognitive platform to perform routine workflow activities that may simply entail extracting information from one system and pasting the data to another system. Let's now look at each of the three classes in more detail to describe the differences between the three classes.

Figure 1: Classes of intelligent automation
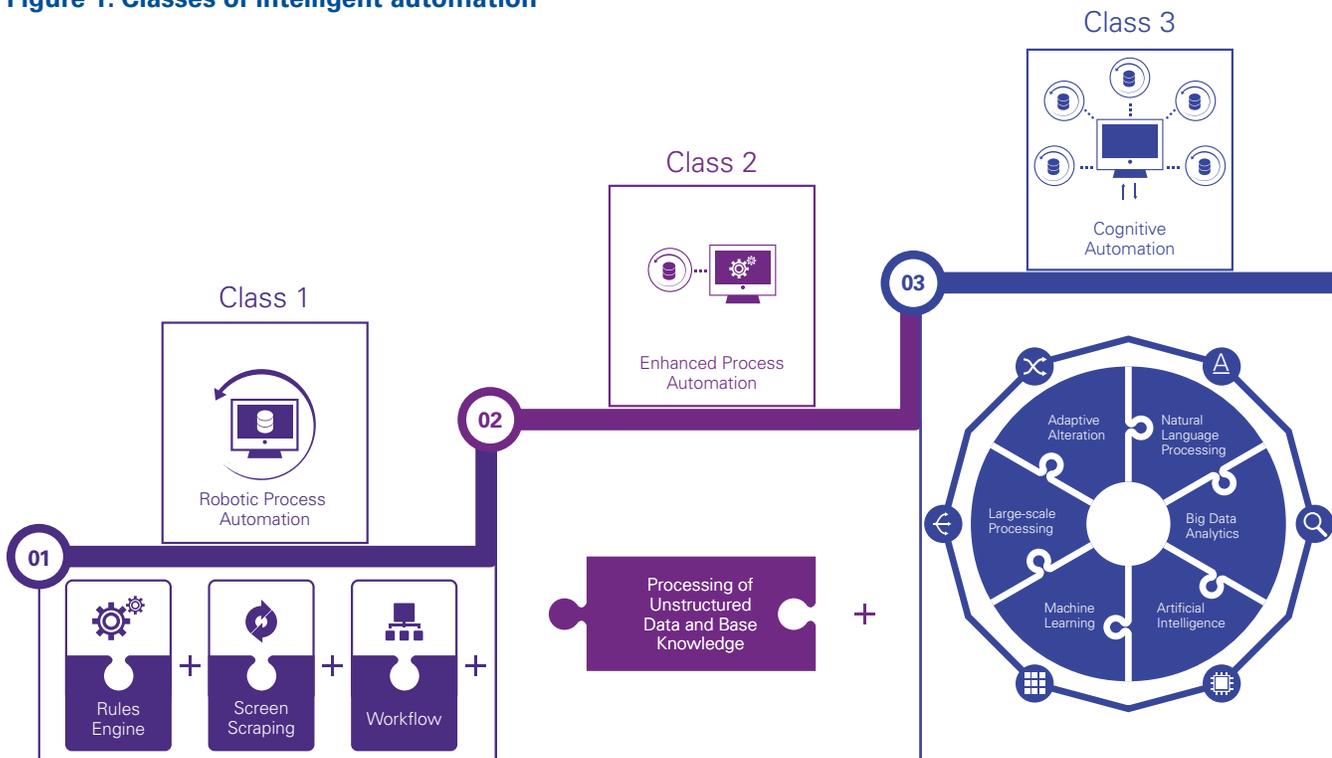
Class 1: Robotic process automation

In Class 1, RPA leverages tried and true technologies to automate very rudimentary processes and thinking tasks. Found in almost all government organizations today in some form, these processes and tasks are typically repetitive in nature, involve multiple systems, and follow very explicit steps.

A question we often hear is: Why call it "robotic" if the automation isn't actually using physical robots? The short answer is to first consider the term robotic as a descriptor to the underlying process and not to the automation. An organization is automating a process that is robotic by its very nature—meaning it is done the exact same way over and over. An example is copying a dollar value out of a legacy mainframe IT system, pasting it into an Excel spreadsheet running on a server, and doing that repetitively. Since through RPA, an organization is automating a very manual, robotic process by applying automation technologies, the resulting automation solution is thought of as a software robot, or a bot. While not a physical robot, virtual bots can be configured to perform tasks across IT applications and systems.
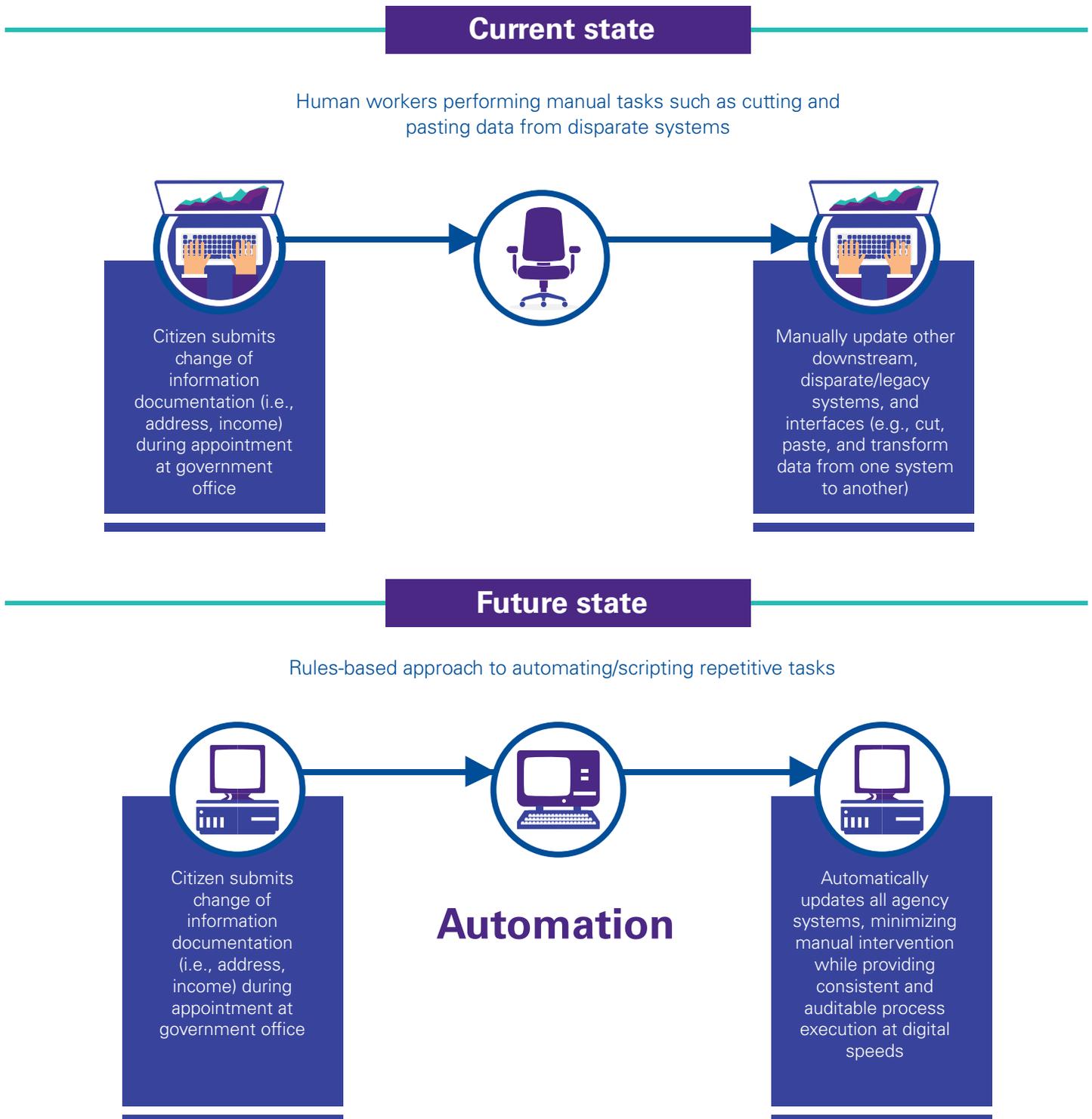
RPA tools leverage capabilities, such as workflow, rules engines, and automated event data collection (known as screen scraping) to automate existing manual processes. The tools often sit on the computer desktop and run at the user level. To the technology environment, the tools look just like a human user and have credentials to log on to systems as a user would.

In general, these tools can be thought of as quick-hit technologies that essentially only allow for a very piecemeal approach to intelligent automation. They often return immediate benefits upon implementation of the very first process automation.

They also can deliver incremental benefits with every subsequent process or subprocess an organization automates. Organizations can see meaningful benefits in a matter of weeks, but more typically in a couple of months.

Let's now look at Figure 2 for the current and future state through the application of RPA to the manual task of copying and pasting data from different systems.

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Figure 2: Robotic process automation before and after

Current state

Human workers performing manual tasks such as cutting and pasting data from disparate systems

Citizen submits change of information documentation (i.e., address, income) during appointment at government office

Manually update other downstream, disparate/legacy systems, and interfaces (e.g., cut, paste, and transform data from one system to another)

Future state

Rules-based approach to automating/scripting repetitive tasks

Citizen submits change of information documentation (i.e., address, income) during appointment at government office

Automation

Automatically updates all agency systems, minimizing manual intervention while providing consistent and auditable process execution at digital speeds

Class 2: Enhanced process automation

Moving to Class 2—enhanced process automation—the tools/platforms have additional capabilities beyond basic RPA. Included are the ability to:

— Solve problems and/or perform work activities (often referred to as out-of-the-box knowledge)

— Understand natural language (Natural Language Processing or NLP) and, thereby, interpret unstructured data, such as the unbounded wealth of information on the Internet, e-mails, and social media content

— Learn new knowledge by either watching a human solve problems or by consuming additional data.

Tools in Class 2 are able to deal with processes that may involve a high number of complex transactions and require a deeper level of analytics, involving both structured (e.g., a database) and unstructured (e.g., Internet) data. These tools leverage years of experience gained across multiple organizations all exercising the same or very similar processes and captured in the out-of-the-box knowledge. An example would be standard finance processes driven by Department of the Treasury reporting requirements.
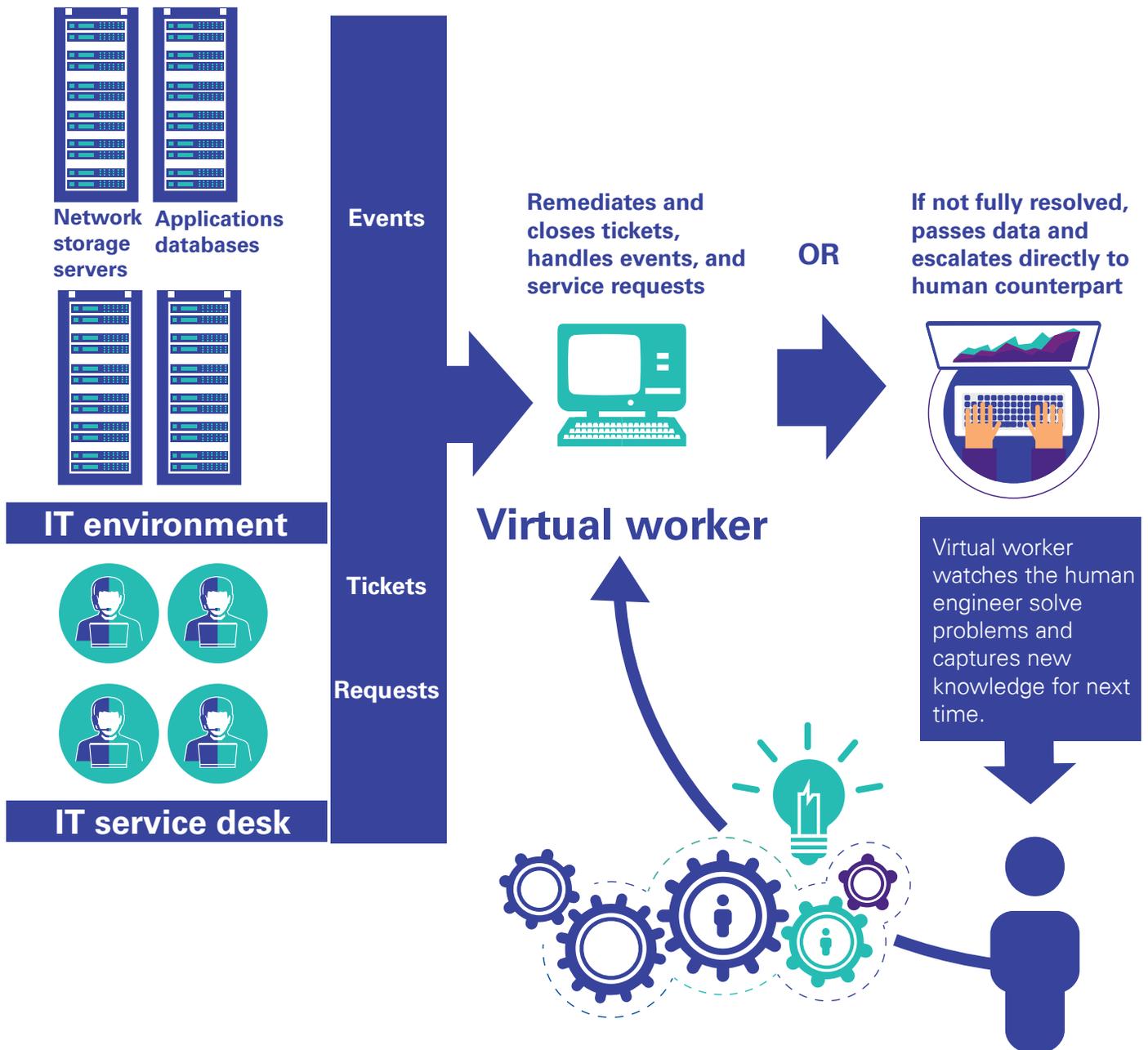
In general, these tools are not quite the quick-hit basic RPA tools defined in Class 1. They typically require a longer period of time for integration into the environment, do not sit on the desktop, and may require connections to most or all of an organization's existing IT infrastructure to gain the maximum benefits. Results in this category are often seen in months and the costs of implementation can be considerably higher.

However, unlike Class 1 tools, which are focused on executing the same explicit steps in an automated fashion, Class 2 tools have the potential to result in widespread back-office process evolution that will even more dramatically change the way government programs and operations are administered. They will be truly transformative, primarily due to their ability to deal with unstructured data and to automate the learning process itself—this is a game changer.

Figure 3 depicts a virtual worker augmenting the work of human help desk resolvers.

Figure 3: Enhanced process automation

Virtual worker supplements human resolvers

Network storage servers

Applications databases

IT environment

IT service desk

Events

Tickets

Requests

Remediates and closes tickets, handles events, and service requests

OR

If not fully resolved, passes data and escalates directly to human counterpart

Virtual worker

Virtual worker watches the human engineer solve problems and captures new knowledge for next time.

Class 3: **Cognitive automation**

The most advanced class of intelligent automation, cognitive automation probably has the most confusion and hype surrounding it. In addition, it requires the largest investment in time and money and is the least mature (and understood). Not unexpectedly, cognitive automation has the potential to drive transformation in government and the private sector far beyond anything we see today or what may be possible through the first two classes of intelligent automation.

Cognitive software mimics human activities such as perceiving, inferring, gathering evidence, hypothesizing, and reasoning. These software solutions are taught rather than the traditional approach of programming. While explicit steps, or commands, are programed into a traditional computer to solve a problem, in a cognitive solution, we would teach the computer the area of interest—call this the domain. Once the base domain knowledge is established, the solution typically continues to learn and solve problems within that domain—generally all on its own. The real power of cognitive computing is the ability to ingest massive amounts of data on which to quickly formulate hypotheses, which the human brain (or perhaps 100 human brains for that matter) could never handle.

For this reason, it is critical to have feedback loops (to help understand success or failure) and/or access to additional domain information. Combined with advanced automation, these systems can be trained to execute judgment-intensive tasks.

When early artificial intelligence (AI) systems were constructed, the challenge was making them smart. Expert knowledge bases were built through a very manual process of interviewing an expert and then capturing the resulting knowledge by manually building a knowledge system using languages designed especially for AI. This representation of knowledge was extremely hard to build and almost impossible to maintain. What resulted was static knowledge that quickly became outdated—and this is what has changed so significantly with cognitive software.

The dramatic advances in NLP and the ability of computers to read and extract meaningful information out of unstructured data are big drivers of what will be the explosion of computer-based cognitive intelligence.

As much as 80 percent of the world's data is unstructured,[10] and 90 percent of the world's data has been created in the last two years.[11] The ability to leverage this data, meaningfully consume it, and in an automated fashion build the associated knowledge ontology changes the game entirely.

Several highly visible demonstrations of cognitive automation, such as IBM's Watson winning Jeopardy against its two greatest champions and the Google car navigating city streets, have been great springboards for excitement and engagement. But we are in the early days of evolution, both in government and the private sector and much has to be learned, developed, and tested. Understandably, Class 3 tools require significant investments in time and dollars. The contextual learning stage alone can represent an investment measured in years, not months.

Figure 4 provides before and after scenarios using cognitive automation for a physician developing a patient treatment plan.[12] In both situations, the physician's human knowledge, experience, and intuition are used.

Let's now consider a call center operation, with long wait times and staff trying to do their best but facing difficult questions for which a wealth of information is needed to handle the wide range of possible questions. Think of the complexities of some government program eligibility requirements or the almost 75,000-page federal tax code. Call center staff can become quickly inundated with citizens who are confused by complicated requirements and not at all happy about long wait times, conflicting advice, or simply the inability to answer.
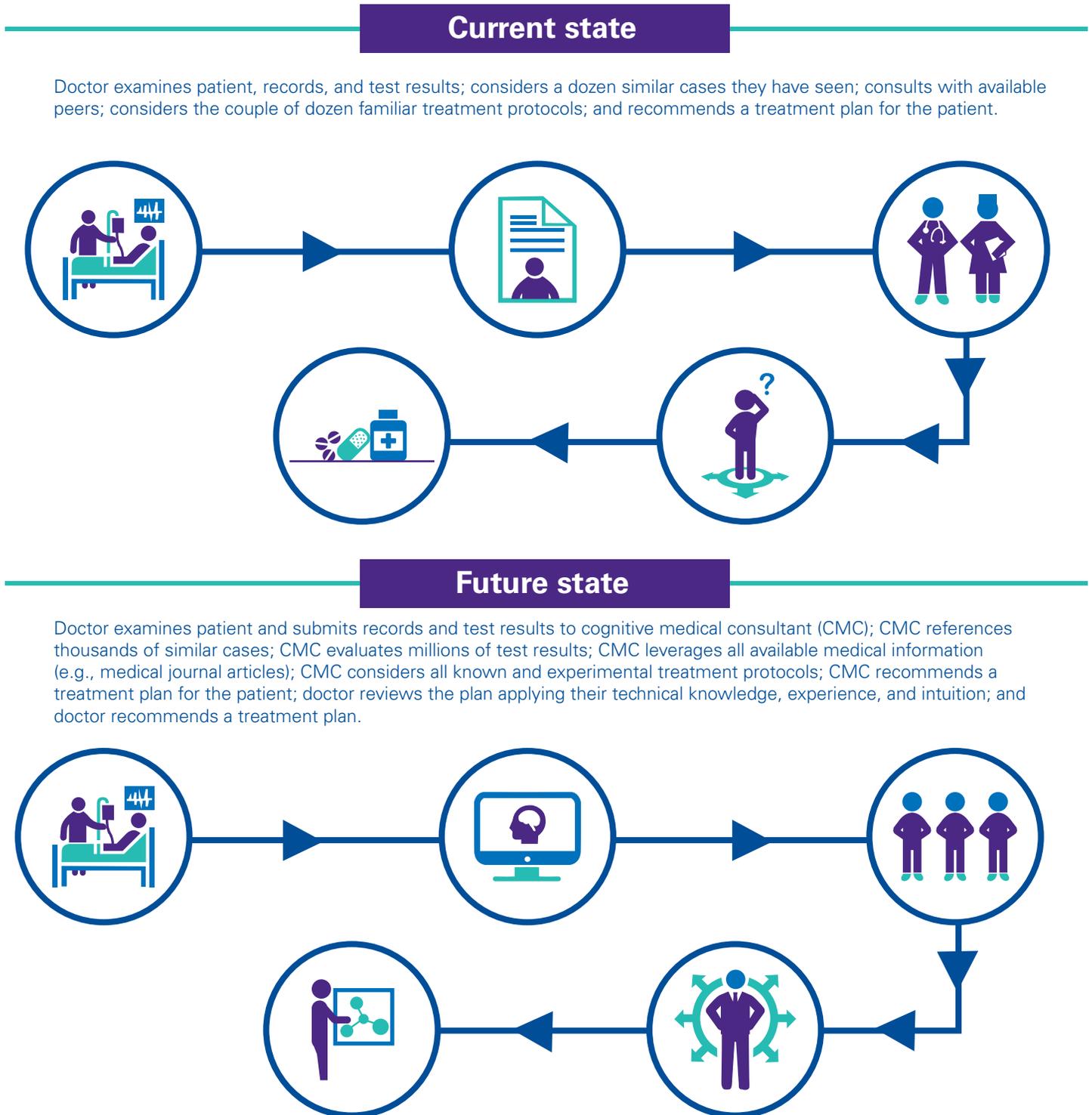
We have all experienced this, whether in reaching out to government or a private sector company. What if through cognitive technology, government could have thousands of virtual people with the world of knowledge at their fingertips 24/7, 365 days a year, and the ability to intelligently apply that knowledge and communicate with a citizen just as if the caller was speaking to a person. Perhaps not today, but this capability is certainly within the future realm of possibility and will dramatically change the citizen experience with government.

[10.] "Structure, Models and Meaning: Is "unstructured" data merely unmodeled?" – Intelligent Enterprise, March 1, 2005.

[11.] "Big Data, for better or worse: 90% of world's data generated over last two years" – Science Daily, May 22, 2013

[12.] "IBM's Watson computer can now do in a matter of minutes what it takes cancer doctors weeks to perform" – Business Insider, Lauren Friedman and Reuters, May 5, 2015.

Figure 4: Cognitive automation before and after

Current state

Doctor examines patient, records, and test results; considers a dozen similar cases they have seen; consults with available peers; considers the couple of dozen familiar treatment protocols; and recommends a treatment plan for the patient.

Future state

Doctor examines patient and submits records and test results to cognitive medical consultant (CMC); CMC references thousands of similar cases; CMC evaluates millions of test results; CMC leverages all available medical information (e.g., medical journal articles); CMC considers all known and experimental treatment protocols; CMC recommends a treatment plan for the patient; doctor reviews the plan applying their technical knowledge, experience, and intuition; and doctor recommends a treatment plan.

Final thoughts

There has been a lot of ground covered in this layman's guide on the broad spectrum of intelligent automation in government. We have talked a lot about the differentiation of the capabilities and applicability of the various classes of automation. While not meant as an attempt at a government or industry-standard taxonomy, it will hopefully enable a more meaningful conversation and keep people on the same page during that discussion.

These meaningful conversations are a must as these are exciting times with great opportunities right around the corner. Intelligent automation will likely dramatically change the landscape of your back-office functions over the next 5 to 10 years as well as your front-office functions, but like most technology-based evolutions, it is likely to happen in increments. It is also likely to happen in spurts as technology continues to advance, with progress that is likely to surprise you.

Be prepared to say at some point, "How did we get here and when did all of this happen?" It will be important to embrace it, understand it, get ahead of it, and be an early adopter. Those who do not may certainly be disadvantaged. To ignore intelligent automation as a transformation driver is to invite material adverse effects to the ability of government to meet citizen needs and carry out vital missions.

So where do you begin if you have not already done so? If you have already begun the journey, how can you continue to build on an existing intelligent automation program? With intelligent automation in general, you can start small and move toward more sophisticated toolsets—building upon success. The other key point is that much of this can be accomplished within program and operations organizations as part of mission execution without distracting core IT resources from enterprise-wide endeavors. This is especially applicable for Class 1 RPA investments, which can be relatively low cost while offering new ways to improve performance and reduce the burden of your back-office operations. On the other end, cognitive automation represents the prototypical quantum leap forward.

Be thoughtful and make sure that you engage the best and the brightest in your organization to carry the intelligent automation initiatives forward. In all likelihood, you will be amazed by what will be possible and the ability of your organization to up its game in serving the public while helping address the reality of the daunting budgetary decisions that await. Remember the words of President Theodore Roosevelt: "Believe you can and you're halfway there."

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How we can help

Choosing to adopt an intelligent automation model is the first step of a journey that can revolutionize an organization. Governments need a collaborator that can help them integrate the technology with existing business processes and systems in order to realize the many benefits that intelligent automation can provide.

KPMG is a recognized pioneer in providing intelligent automation solutions and has transformation projects in progress in the financial services, healthcare, technology, and telecommunications sectors. Our knowledge of use cases in functions such as finance, human resources, customer support, and procurement, among others, combined with our deep public sector experience enables us to advise clients at each stage of their intelligent automation journey, from discovery through implementation.

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Dave has spent the last 30 years helping companies and clients leverage technology to deliver enhanced business solutions. The more recent part of this 30-year road trip has utilized his early-career hands-on experiences to help clients better understand how best to leverage technology without being consumed by it. Dave, a managing director, is the Intelligent Automation leader for KPMG's Shared Services and Outsourcing Advisory practice. He is a thought leader and has spoken at multiple industry conferences on intelligent automation.

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