

Disruption ahead

Deloitte's point of view on IBM Watson



Meet Watson

Cognitive computing is a rapidly evolving technology that holds the potential to reshape how work gets done, how businesses grow, and how markets and industries evolve.

While many technology players—large and small—are investing in developing cognitive computing or artificial intelligence (AI) solutions, as of March 2015, IBM is the only company marketing a cognitive computing platform that’s specifically designed to support the development of a broad range of enterprise solutions. Deloitte has joined IBM in investing time, money, and people toward applying Watson technologies to help solve our client’s business problems.

IBM Watson combines natural language processing, machine learning, and real-time computing power to sift through massive amounts of unstructured data—documents, emails, journals, social posts, and more—to answer questions fast. Like humans, Watson learns from experience and instruction.

Cognitive computing is still in its infancy. However, it’s not too soon to imagine how your business and industry could be positively disrupted by this new technology. Our goal for publishing this white paper is not to provide definitive answers—the technology is changing too fast—but to help you understand the fundamentals of Watson and cognitive computing and to inspire you to begin planning how you can take advantage of these new technologies.

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Let’s talk

Smart machines and cognitive computing

Cognitive computing enters the enterprise

Developing machines capable of exhibiting human-like intelligence has been a goal of artificial intelligence (AI) since its inception as a research field in the mid-1950s. Natural language processing and machine learning are two of the subfields of AI. While AI has matured considerably over the decades, advances in processing power and data storage make using AI more feasible for solving enterprise problems.

Today's smart machines with AI capabilities are already changing how humans work. Here are three examples:

- Machines that enhance human capabilities, such as an employee using a wearable computing device to answer almost any question.
- Machines replace humans, such as a cognitive virtual assistant used as an automated customer service representative.
- Humans and machines work side by side, such as a warehouse employee working with a mobile robot to move boxes.

Deloitte's Tech Trends 2015 points out that the first example--augmenting human capabilities and knowledge--could hold more promise for business by amplifying our intelligence for more effective decision making.

Cognitive computing is a relatively new term, often used as a synonym for artificial intelligence. Unlike traditional computer systems, which are programmed by people to perform certain tasks, cognitive systems have the ability to learn through their interactions with both data and humans. They can even adapt and get smarter over time.

Cognitive computing is part of an even larger trend, broadly referred to as "big data." IBM estimated that 80% of data today is unstructured (i.e., in the form of natural language), with the remaining 20% being structured data (i.e., in the form of rows and columns). Cognitive computing is primarily focused on unstructured data.

As with any new technological development, early adoption accompanied by smart strategies and effective execution can position businesses for competitive advantages that can last for years. At Deloitte, we share Gartner's view that "the risk of investing too late in smart machines is likely greater than the risk of investing too soon."

"For Gartner clients, the risk of investing too late in smart machines is likely greater than the risk of investing too soon."

IBM Bets on New Watson Unit to Ignite Smart Machine Era Growth
Gartner Inc., January 14, 2014

Our take: the disruptive power of cognitive computing



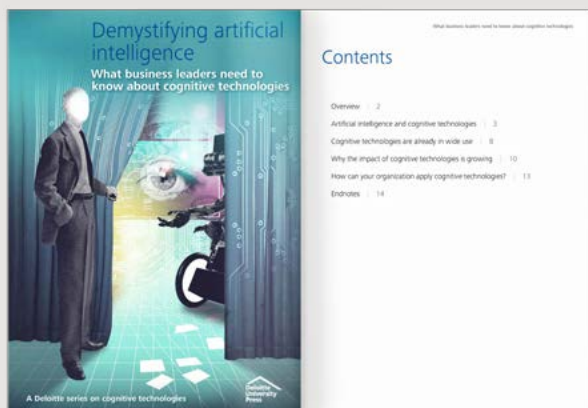
Cognitive computing is starting to emerge as a real opportunity and threat for many businesses. It is a component of the broader trend around big data, but it is particularly important because cognitive computing focuses on the realm of unstructured data, which is clearly dominant in volume over that of structured data. If we embrace and harness the power of cognitive computing, we can help our clients positively disrupt their businesses and industries. It may even hold transformative potential for Deloitte's businesses.

Deloitte's Tech Trends 2014 specifically called out **Cognitive Analytics™** as a potential business disruptor. Deloitte coined the term "Cognitive Analytics" to describe the application of analytics and cognitive computing technologies to enhance human decisions.

In November 2014, Deloitte University Press published the article, **Demystifying artificial intelligence: What business leaders need to know about cognitive technologies**, clarifying the distinction between the field of artificial intelligence (AI) and the technologies emanating from it, which we call cognitive technologies. The article provides an overview of some of the key cognitive technologies. And it argues that, driven by billions of dollars of investment in commercialization and ongoing improvement in performance, cognitive technologies are destined to have a growing impact on business over the next three to five years and beyond.

In January 2015, **Cognitive Technologies: The real opportunities for business** was published based on an analysis of over 100 recent applications and pilots of cognitive technologies across 17 sectors. The report identifies the three main categories of application of cognitive technologies: product, process, and insight. And it offers a framework organizations can use to guide decisions about investing these categories in technologies.

In Deloitte's Tech Trends 2015, **Amplified Intelligence** suggests that AI's more promising application is to augment workers' capabilities, rather than replace them.



Here comes Watson

You've probably heard about Watson's *Jeopardy!* victory in 2011 against two human contestants. Winning the TV game show required Watson to demonstrate encyclopedic knowledge, to decipher convoluted statements, and to deliver lightning-fast responses. Watson's performance was not flawless, but it still won by a large margin. In addition to being an ingenious PR stunt, the event was seen as a new milestone in the development of AI—and possibly even the beginning of a new era in computing.

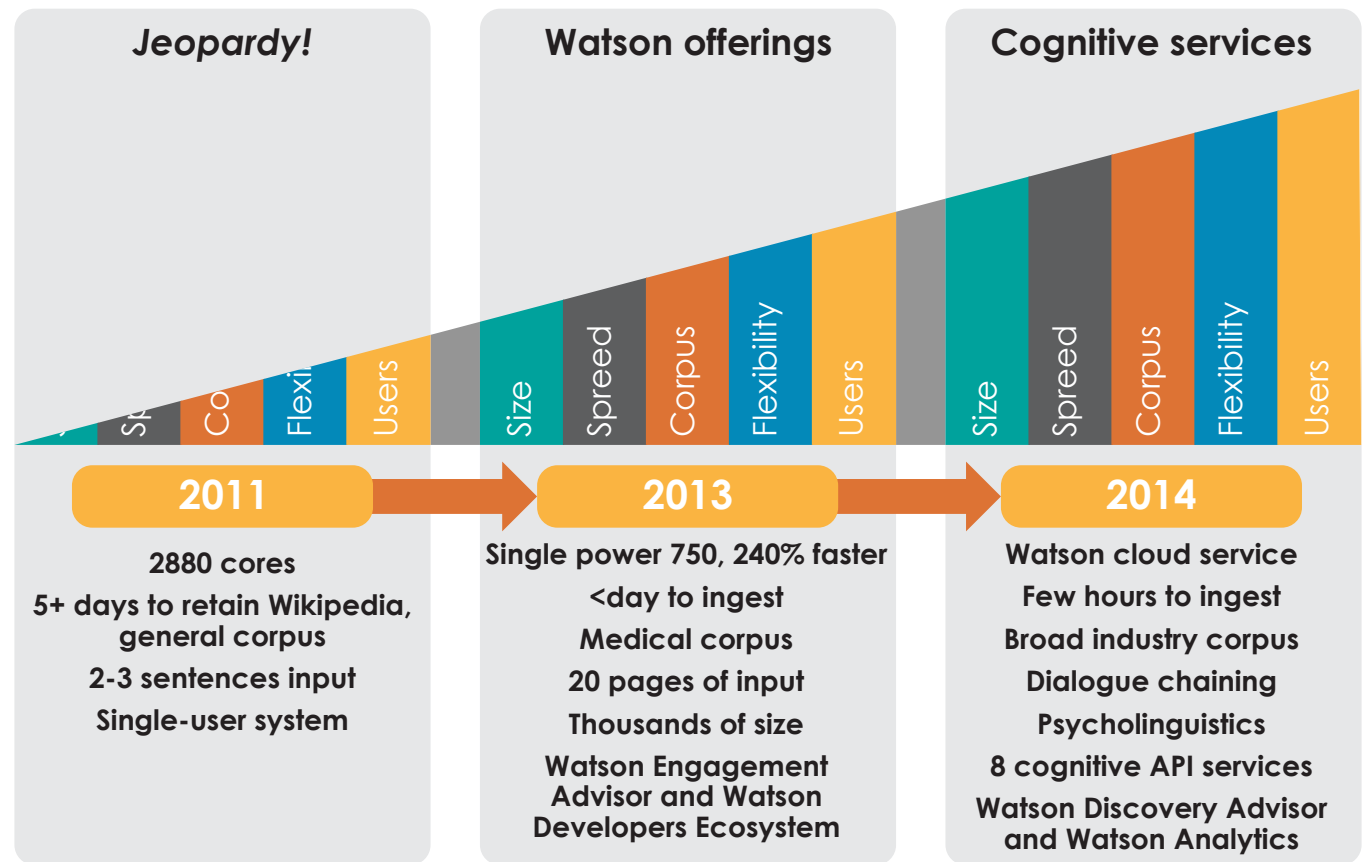
IBM sees cognitive computing as the third major technological wave that could transform our world:

- **Tabulating Systems Era (late 1800s to 1940s).** Mechanical devices were invented that helped people organize data and make calculations.
- **Programmable Systems Era (1940s to 2010s).** Scientists have built electronic programmable computers, which humans program to perform specific tasks. This era has led to huge technological leaps—space exploration, creation of the Internet, and more.
- **Cognitive Systems Era (2010s).** Cognitive systems are fundamentally different from traditional computers; cognitive systems learn from their interactions with data and humans—essentially continuously reprogramming themselves.

The changes that are coming over the next 10 to 20 years—building on IBM's Watson technology—could transform how we live, work, and learn.

Figure 1 illustrates IBM's progress with Watson.

Figure 1
IBM has consistently improved Watson since its 2011 *Jeopardy!* debut



IBM's billion-dollar baby

IBM investments in Watson

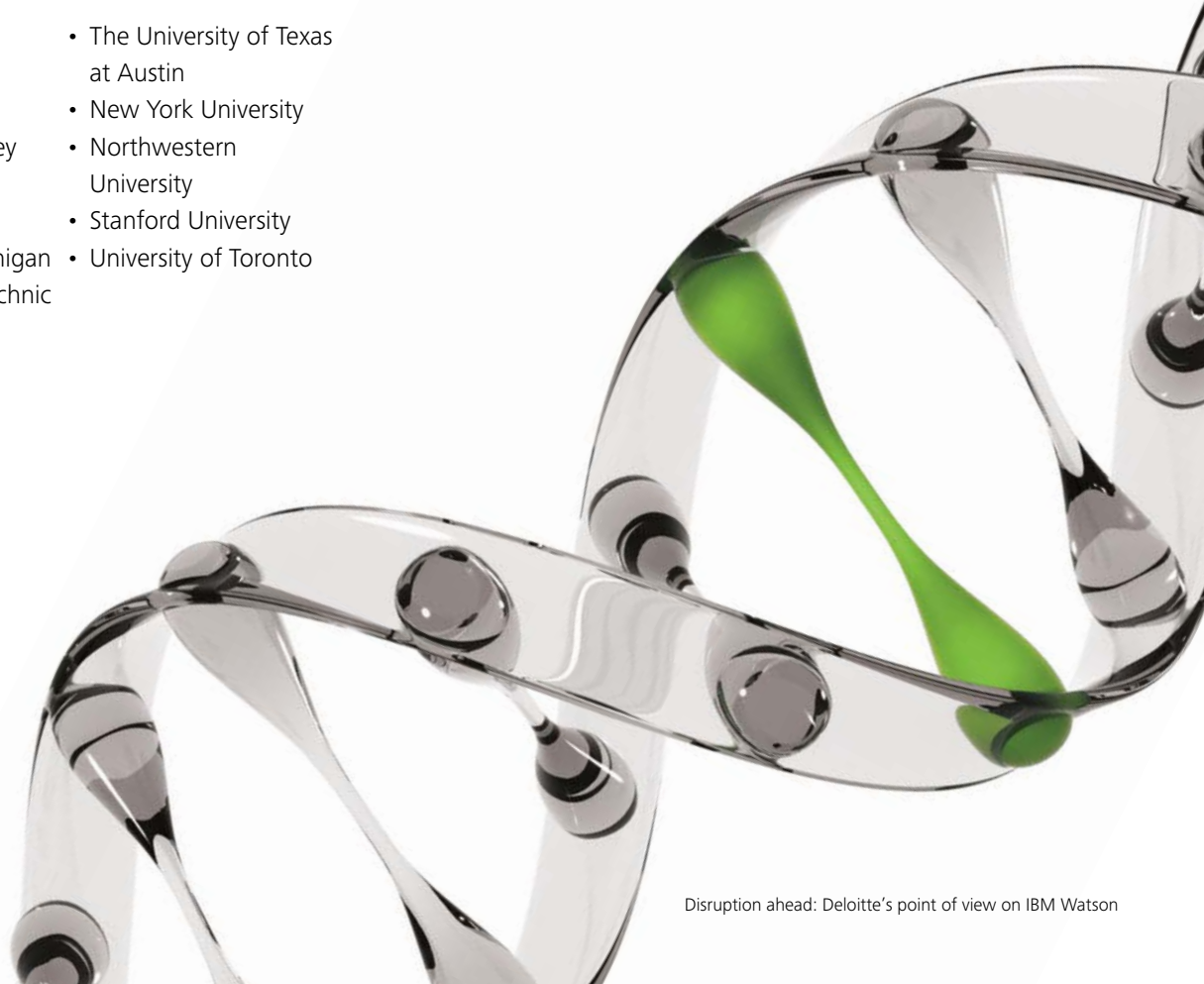
In January 2014, IBM announced the formation of the IBM Watson Group, headed by Senior Vice President Michael Rhodin. IBM is committing \$1 billion to the initiative, creating a 2,000-person business unit focused on building, marketing, and delivering cognitive computing solutions. Approximately one-third of IBM's research resources will be dedicated to Watson.

IBM is investing \$100 million in a venture fund to support the development of Watson-enabled apps such as Welltok, which answers personalized health questions, and the Fluid Expert Personal Shopper (XPS), an e-commerce application that aims to replicate the best of in-store experiences and assist customers with purchases.

IBM is also committing resources and support to universities to encourage students to develop Watson-enabled apps and to prepare them to become the next generation of cognitive technologists. Ten leading technology institutions, listed below, are currently participating:

- Carnegie Mellon University
- University of California, Berkeley
- The Ohio State University
- University of Michigan
- Rensselaer Polytechnic Institute
- The University of Texas at Austin
- New York University
- Northwestern University
- Stanford University
- University of Toronto

In the fall of 2014, these universities introduced cognitive computing courses using a cloud-based version of Watson. Additional universities will join the initiative in 2015. It's interesting to note that all of the currently participating universities, except Rensselaer, are part of Deloitte's own university relations program.



Sizing up Watson's competition

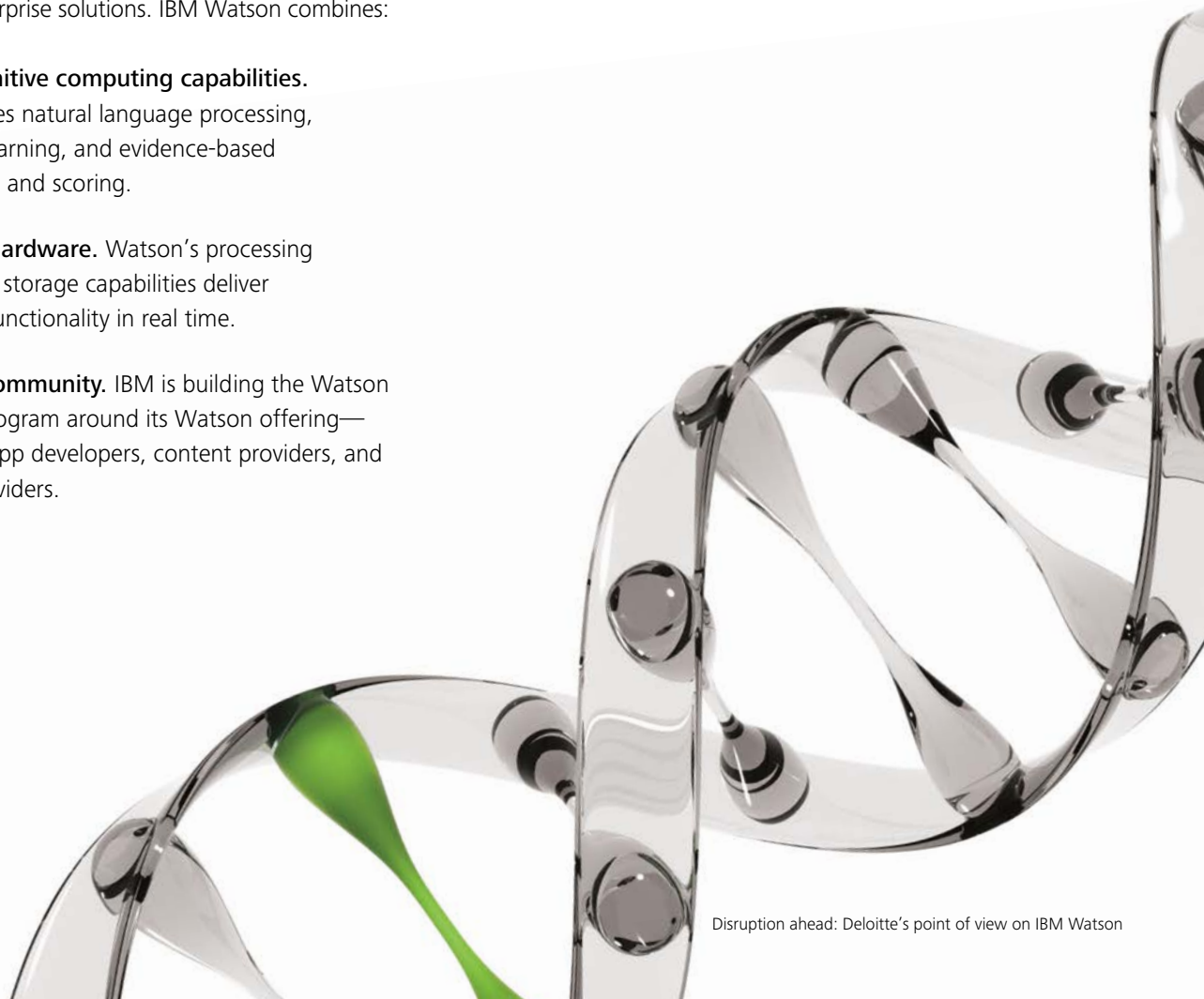
It's difficult to draw strict boundaries around what represents Watson's competition. For this comparison, we've focused on products on the market that possess the defining elements of cognitive computing: natural language processing (NLP), humanlike understanding learning capabilities, real-time processing, and artificial intelligence.

Many large technology players are investing in cognitive computing or AI. Digital personal assistants, such as the Siri® voice recognition software by Apple Inc., Google Now, and Microsoft's Cortana respond to natural language requests and understand context. Apple has extended these capabilities to integrate Siri voice recognition with the Apple CarPlay™ software system. Google has purchased DeepMind, which uses AI for e-commerce and games. In 2014, Microsoft announced the addition of Delve to its Office 365 family. Delve proactively identifies relevant enterprise content based on how the user interacts with others through Microsoft Office products and documents.

There are also a growing number of cognitive computing niche players that offer applications ranging from sentiment analysis to conversion of graphs into words. However, none of these rivals are prone to making Watson obsolete. As of March 2015, IBM is the only company marketing a cognitive computing platform that's specifically designed to support the development of a broad range of enterprise solutions. IBM Watson combines:

- **Deep cognitive computing capabilities.** Watson uses natural language processing, machine learning, and evidence-based hypotheses and scoring.
- **Enabling hardware.** Watson's processing power and storage capabilities deliver cognitive functionality in real time.
- **Support community.** IBM is building the Watson Partners Program around its Watson offering—including app developers, content providers, and service providers.

As of March 2015, IBM is the only company marketing a cognitive computing platform that's specifically designed to support the development of a broad range of enterprise solutions.



Cognitive computing offerings by niche players

To learn more about niche players, read Gartner's reports, "Cool Vendors in Smart Machines, 2014" and "Predicts 2015: Sourcing Strategies Shift From 'Built to Last' to 'Built to Adapt'".

Company	Summary of cognitive functions	Use cases
Luminoso	Luminoso Insight Engine: Uses NLP to identify patterns in text and perform sentiment analysis	Analyze customer feedback to proposed product design changes; review how consumers feel about food items or grocery store experience
AlchemyAPI	AlchemyAPI: Uses NLP to process textual information, applies deep learning techniques to image recognition, and performs sentiment analysis	Assist claims management (insurance and warranty), technical support, product returns (complaint management), brand and product intelligence, retention management, and complex question answering
Digital Reasoning	Synthesys: Uses NLP and machine learning to analyze all formats of data to perform "semantic relationship analysis" in order "to mitigate risk or expand an opportunity"	Scan up to billions of communications from thousands of traders to spot language patterns and identify potentially fraudulent activity
Highspot	Highspot: Uses machine-learning techniques to perform enterprise search	Assist users in finding content within the enterprise and within cloud-based applications
Lumiata	Lumiata: Applies "graph analysis" to patient data but does not use cognitive techniques	Enable medical professional to interrogate the underlying "clinical model of [the] patient"
Sentient Technologies	Sentient: Millions of AI processing nodes enables powerful predictive modeling for lending institutions	Helps improve loan origination decisions to achieve breakthrough outcomes
Enterra	Cognitive Reasoning Platform: Uses NLP, AI, and big data analytic techniques	Used in supply chain to reduce waste, etc., and assist in medical research ¹
IPsoft	Amelia: NLP (understands 20 languages), machine learning, and AI	Assist with service desk support, help field engineers troubleshoot, and support procurement ²
Next IT	Alme: Multilingual NLP and AI	Assists with customer service

¹ <http://www.enterrasolutions.com/big-data/analytics>

² http://www.ipsoft.com/wp-content/uploads/2014/09/Amelia_Brochure.pdf

What makes Watson unique

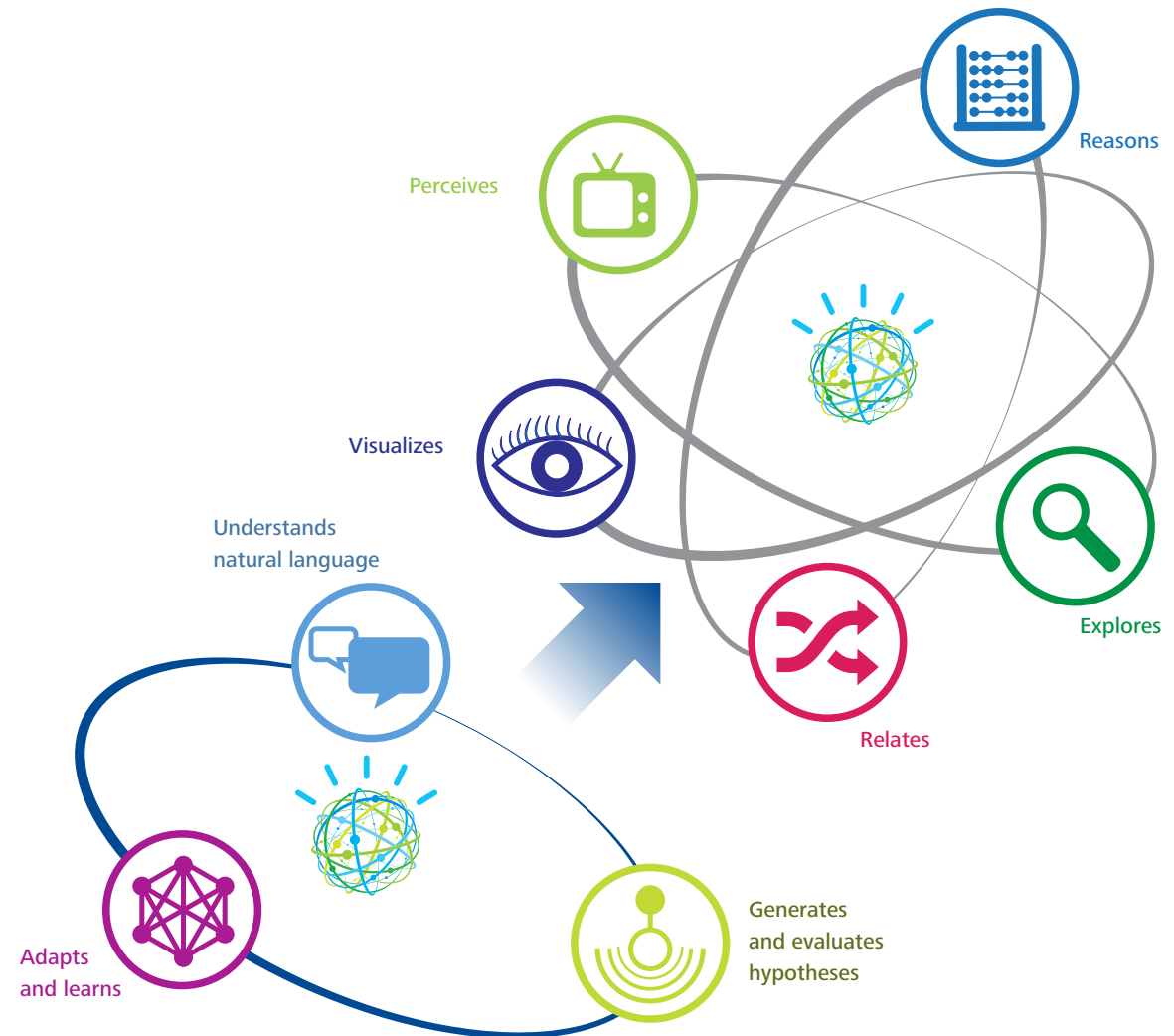
In technical terms, IBM Watson is an advanced open-domain question answering (QA) system with deep natural language processing (NLP) capabilities. At this point, the Watson Software as a Service (SaaS) platform is most effectively used to sift through massive amounts of text—documents, emails, social posts, and more—to answer questions in real time.

Watson accepts questions posed by the user in natural language and provides the user with a response (or a set of responses) by generating and evaluating various hypotheses around different interpretations of the question and possible answers to it. Unlike keyword-based search engines, which simply retrieve relevant documents, Watson gleans context from the question to provide the user with precise and relevant answers, along with confidence ratings and supporting evidence.

Its learning capabilities allow Watson to adapt and improve hypothesis generation and evaluation processes over time through interactions with users. Developers and other users can improve the accuracy of responses by “training” Watson.

IBM is also continuing to expand Watson’s capabilities to incorporate visualization, reasoning, ability to relate to users, and deeper exploration to gain a broader understanding of the information content. Watson recently launched a new platform service that has the ability to ingest and interpret still and video images, which is another significant type of unstructured data. (See **Figure 2**.)

Figure 2
Watson will continue to evolve



The Watson Ecosystem

Today, the Watson technology is commercialized as a Software as a Service (SaaS) platform. However, Watson has also created a separate business model—The Watson Ecosystem—which serves as a marketplace where Watson-related products and services can be sold, with IBM likely taking a share of the revenue generated.

The Watson Partners Program is a distinctive element of the Watson Ecosystem targeted on partnering with third-party developers. The Watson Ecosystem works with this global community to develop Watson apps, facilitate access to content, and provide specialized skills to assist in app development. (See **Figure 3**.)

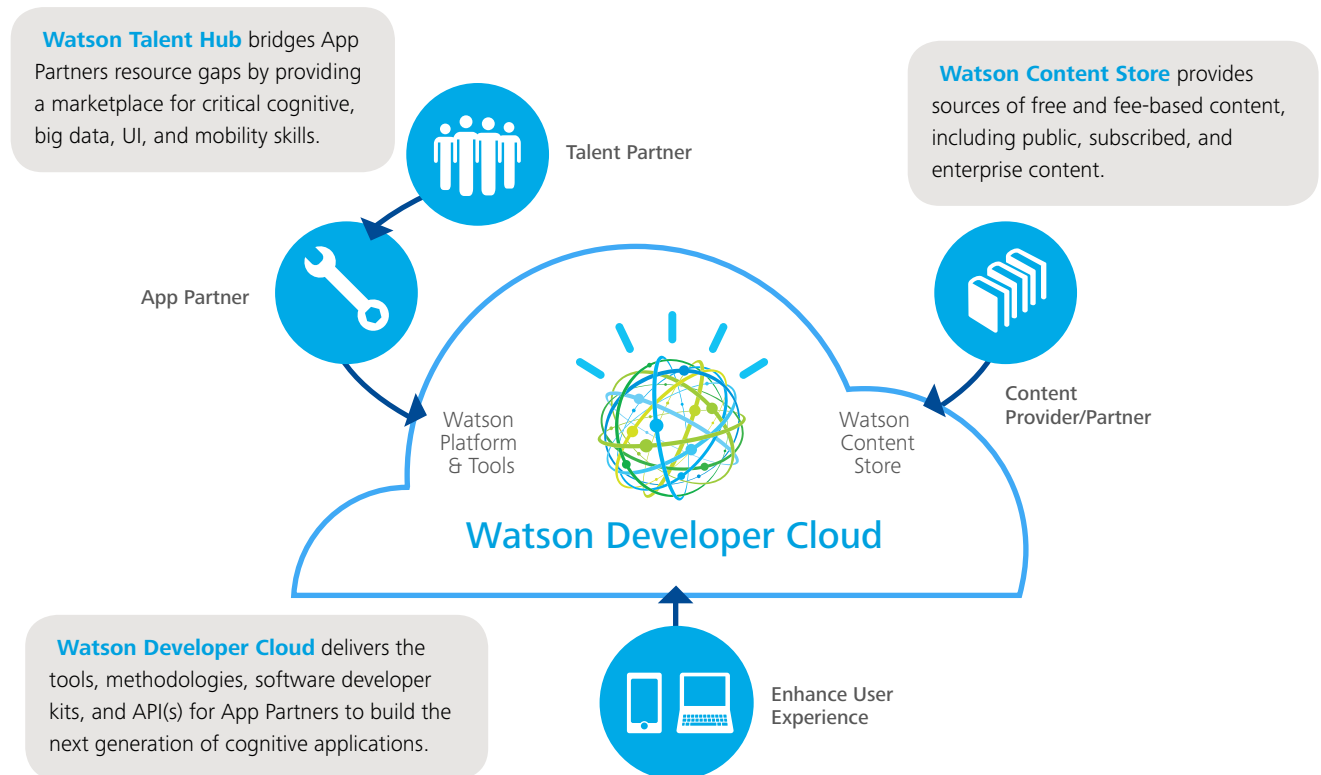
IBM has approximately 150 ecosystem partners signed up to develop “Powered by Watson” cognitive solutions. When approved to join the partner program, members have access to the following:

- **Watson Developer Cloud.** Provides application tools, methodologies, software developer kits (SDK), and application programming interfaces (APIs) needed to build cognitive applications. All released APIs are available to developers. (See **page 16**.)

- **Watson Content Store.** Provides developers access to content partners who sell their data or provide it for free.
- **Watson Talent Hub.** Allows developers to find certified talent partners to fill skill gaps such as linguistics, natural language processing, machine learning, user experience design, and analytics.

Deloitte is one of the first global systems integrators to become a member of the Watson Partner Program. Under this program, our teams will have access to a Watson instance, including Watson Experience Manager, for experimentation and learning. We have teams who have already begun exploring the possibility of creating cognitive applications through the Watson Developer Cloud. As Watson’s technologies continue to mature, Deloitte intends to join the Watson Talent Hub as both a systems integrator and an advisor.

Figure 3
IBM Watson Ecosystem



Building blocks of the Watson architecture

Architecture overview

Figure 4, on the following page, illustrates the five types of technologies that augment and support Watson's cognitive capabilities:

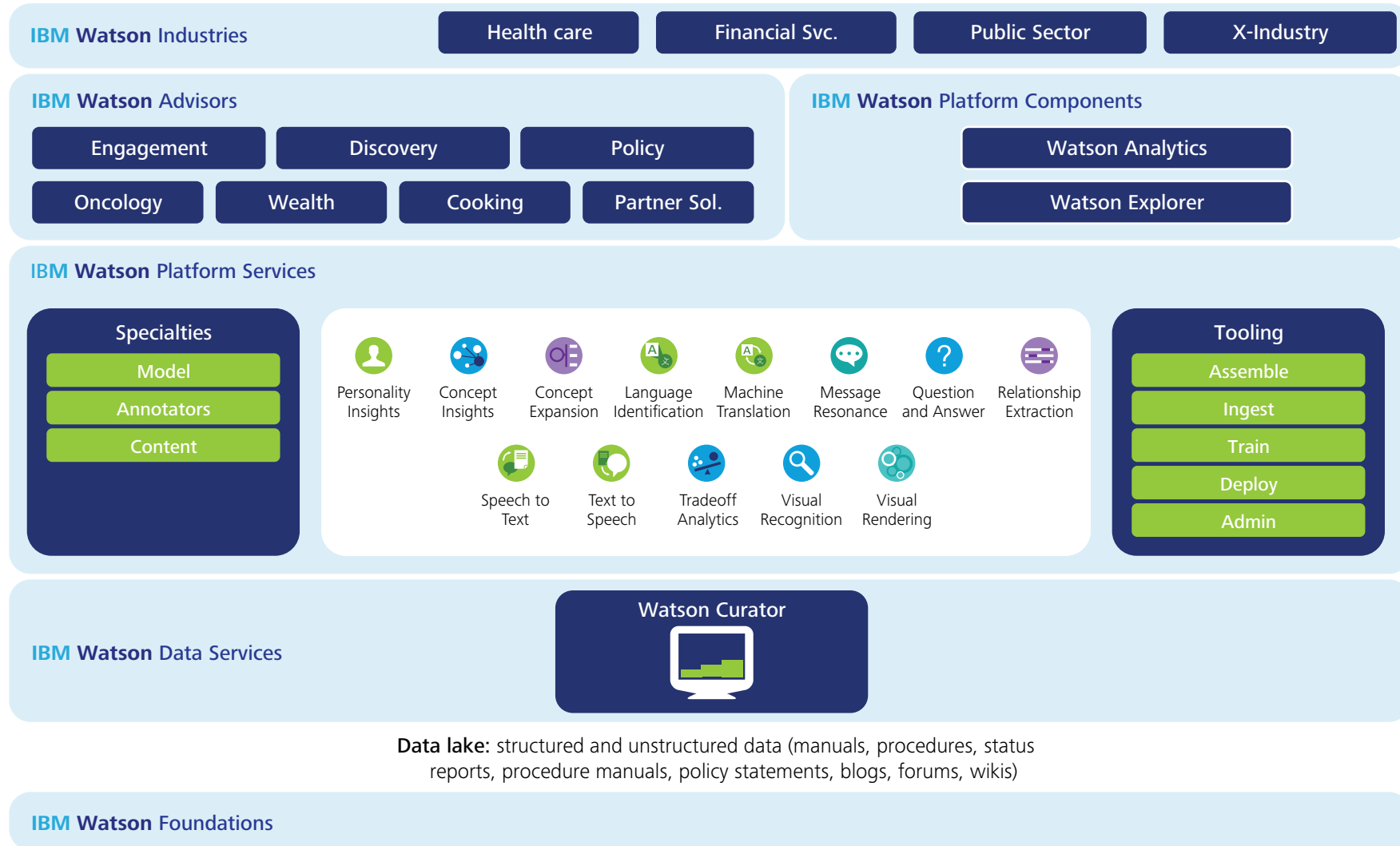
- **Watson Advisors.** These IBM-designed solutions target a multi-industry or industry-specific task. Examples include answering customer or agent questions (Engagement Advisor), conducting document research (Discovery Advisor), or processing and advising on compliance requests (Policy Advisor). Industry-specific offerings include Watson for Oncology, Watson for Wealth Management, and Chef Advisor. Other one-of-a-kind advisor solutions are likely to be developed in the future.
- **Watson Platform Components.** Watson Explorer, now available, and Watson Analytics, currently in beta, expand Watson's capabilities to more effectively mine structured data, including the integration of existing databases. IBM intends to move toward a hybrid environment, which leverages insights from both unstructured and structured data—all calibrated to the specific business situation.
- **Watson Platform Services.** Watson was introduced with only the Question Answer application program interface (API). One year later, Watson now has a total of 13 APIs and SDKs, with more coming soon and throughout the year. (See page 16.)
- **Watson Data Services.** In October 2014, the Watson Curator was introduced to help clients efficiently assess and gather relevant information across multiple sources. This service helps subject matter experts create higher-quality information collections.
- **Watson Foundations.** IBM is branding many of its existing information management and analytics software products under the Watson umbrella as a bridge to cognitive computing.

The following pages provide an overview of each of these major architectural components.



Figure 4

Building blocks of the Watson architecture



Watson Advisors

Watson is developing three solutions that apply cognitive computing capabilities to address multi-industry tasks: Engagement Advisor, Discovery Advisor, and Policy Advisor. In 2015, Watson is expected to launch three Industry Advisors: Watson for Oncology, Watson for Wealth Management, and the Chef Advisor.

As of March 2015, only the Engagement and Discovery Advisors are available for app development. The other Advisors are available through IBM's Beta Program; they are expected to be released for commercial use at the end of 2015.

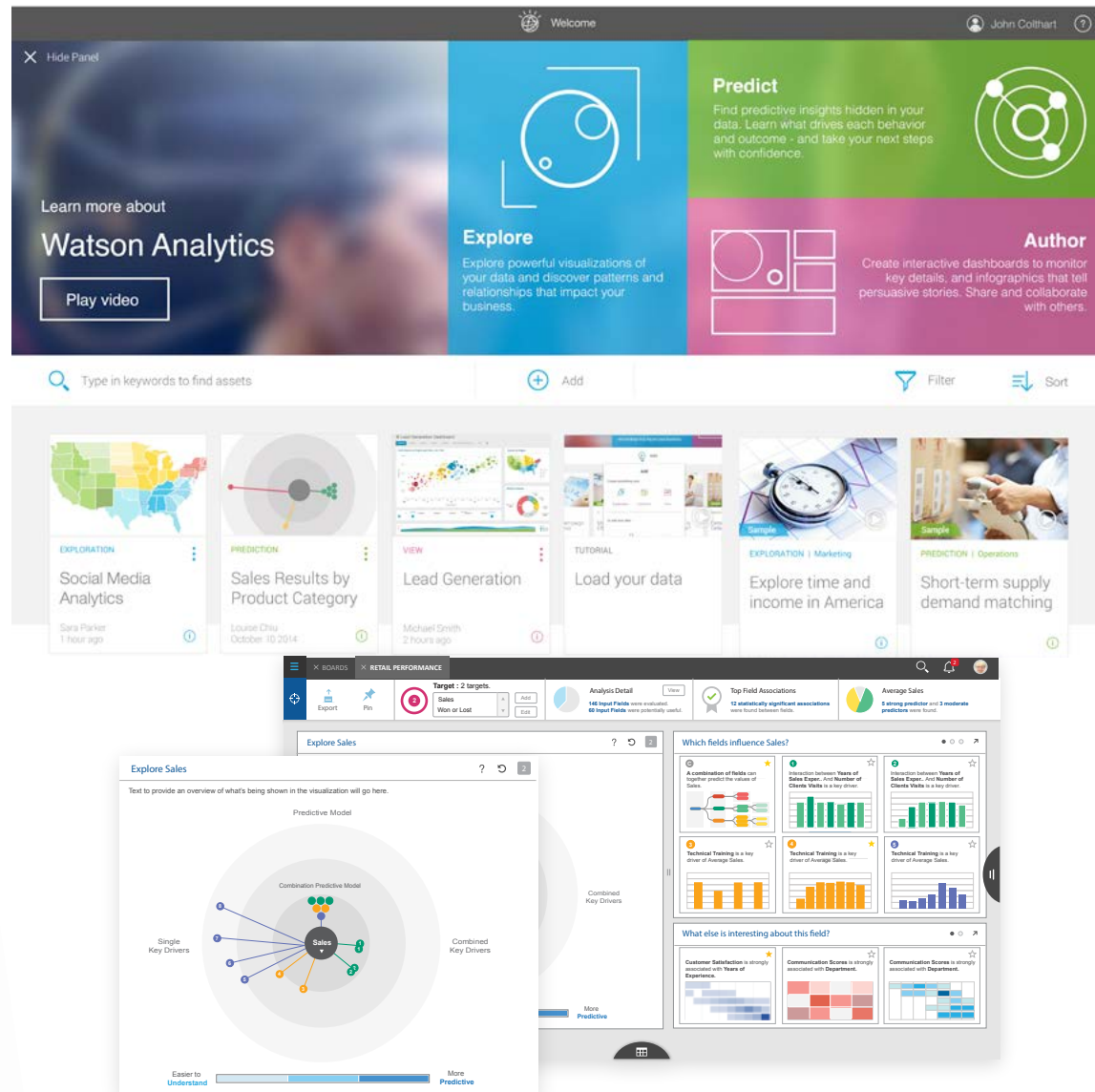
<p>IBM Watson Engagement Advisor <i>Now available for app development; version 2.0 expected in 2015</i></p>	<p>The Engagement Advisor helps businesses deliver more personalized interactions with their customers. Customers can ask questions in plain English, such as through customer self-service or an agent, and receive tailored answers along with supporting evidence. For example, customers may ask: How do I apply for a savings account? What are my benefits? Which is the best product based on my requirements?</p> <p>In 2015, Engagement Advisor 2.0 will be integrated with Cognea, a new IBM acquisition. This integration will expand the Engagement Advisor's capabilities by adding virtual assistants with distinct "personalities" that can communicate with people through conversation.</p>
<p>IBM Watson Discovery Advisor <i>Now available for app development</i></p>	<p>The Discovery Advisor acts as a research assistant to clients engaged in R&D activities, such as the pharmaceutical industry. It allows the researchers to focus on the most relevant information and quickly connect pieces of supporting evidence spread over millions of documents. For example, researchers can ask: Which cancer therapies inhibit the FLT3 mutation?</p>
<p>IBM Watson Policy Advisor <i>Now in beta; commercial release expected late 2015</i></p>	<p>The Policy Advisor assists clients with compliance or policy-related decisions. For example, the advisor can automatically process applications, such as those filed for Social Security benefits, against related policies. For example, clients can ask: Can this procedure be approved based on NY state guidelines?</p>
<p>Industry-specific Advisors <i>Now in beta; commercial release expected late 2015</i></p>	<ul style="list-style-type: none">• Watson for Oncology. Searches medical journals, texts, guidelines, and leading practices to help physicians make more informed treatment decisions for cancer patients.• Watson for Wealth Management. Captures the investment knowledge of leading wealth management managers and other resources to help individuals meet their financial goals.• Chef Watson. Sifts through quintillions of possible combinations of ingredients, flavors, and individual preferences to help cooks discover new recipes.

Watson Platform Components

IBM Watson Analytics

Watson Analytics supports analysis and visualization of structured data with a natural language interface. Its interactive, mobile-compatible dashboard allows users to ask questions about their data in natural language. This allows anyone to independently discover patterns or insights hidden in their data to inform better decisions. For example, this platform can provide easy access to information that can support customized sales presentations or help financial advisors select appropriate investments for their clients. (See Figure 5.)

Figure 5
IBM Watson Analytics



IBM Watson Explorer

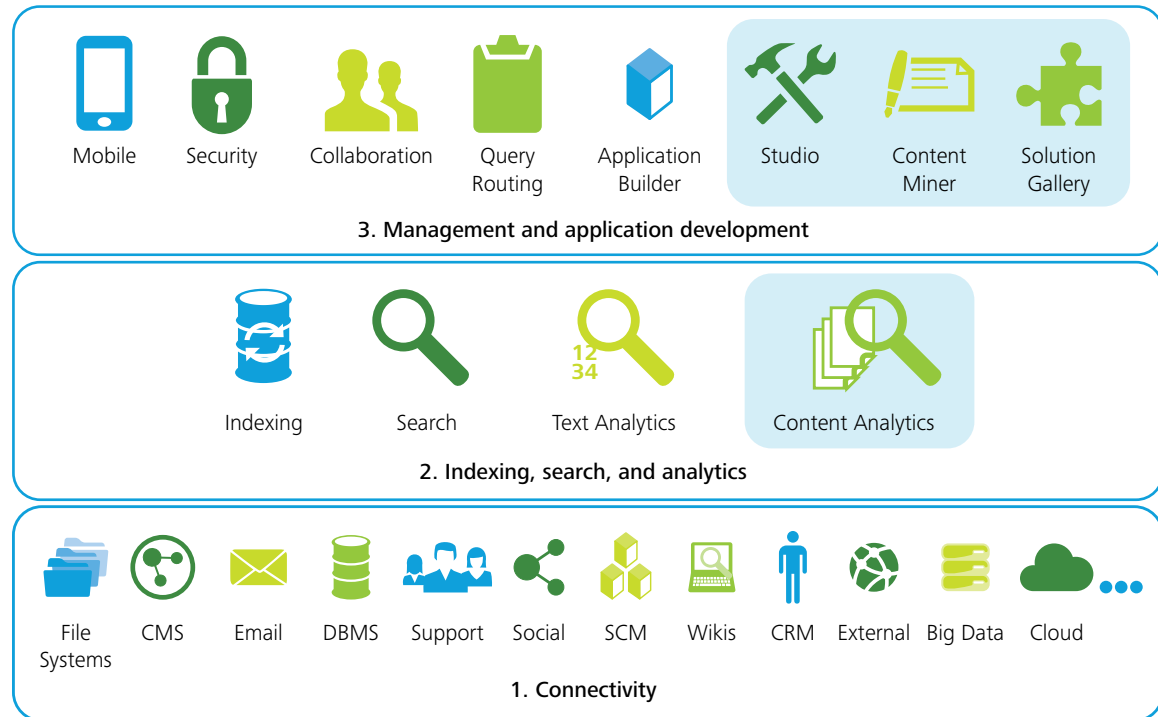
Currently available; previously called
"IBM InfoSphere Data Explorer"

Watson Explorer combines content and data from many different systems throughout the enterprise and presents them to users in a single view, dramatically reducing the amount of time users spend looking for information.



Explorer can search structured and unstructured data pulled from a wide range of sources—digital file systems, email, logs, social networks, wikis, CRM, and more—to deliver data, analytics, and cognitive insights customized for the user's role, context, and current activities. It also incorporates Watson's cognitive question-and-answer exploration capabilities on top of the 360-degree view to provide users quick context to their questions and activities.

Figure 6
Watson Explorer platform



Watson Platform Services

Question Answer

Uses natural language processing to understand user questions and provide ranked answers supported by evidence and confidence levels.

Example: Helps call center representatives find quick answers to customer questions to improve customer satisfaction.

User Modeling

Uses linguistic analytics to construct a personality profile of an individual by analyzing his or her social media activities and other online text.

Example: Helps marketers target offers by analyzing the customer's online activity to understand shopping behaviors.

Message Resonance

Analyzes message content and scores how it is likely to be received by a target audience. Also suggests words that are highly likely to receive a desired response.

Example: Enables organizations to mitigate negative press during a crisis or engage consumers during a new product launch.

Machine Translation

Translates text between languages: English, Spanish, Brazilian Portuguese, French, and Arabic.

Example: Customer service representatives for global companies can quickly search a database for answers that are translated into their native language.

Relationship Extraction

Analyzes text to find relationships between sentence components (nouns, verbs, subjects, etc.)

Example: Provides related information, such as the city's best restaurants, when a user asks "What can I do tonight in London?"

Language Identification

Identifies the language in which text is written.

Example: Determines a travel app user's language to provide quick recommendations.

Visualization Rendering

Allows users to easily generate customized charts and graphs from their data.

Example: Users can quickly transform answers to a business question into an intuitive dashboard or visual report in seconds.

Concept Expansion

Maps euphemisms or colloquial terms to more commonly understood phrases.

Example: Interprets phrases so that they can be analyzed; "The Big Apple" would be interpreted as "New York City."

Concept Insights (new)

Explores information based on the concepts behind your input, rather than limiting investigation to findings based on traditional keyword searches.

Example: Can be used to improve search queries with results that are more conceptually related.

Speech to Text (new)

Transcribes the human voice into written word, currently in English only.

Example: Enables voice control over apps and devices.

Text to Speech (new)

Understands natural language to generate synthesized audio output with appropriate cadence and intonations, currently in English and Spanish.

Example: Assists vision impaired people or enable audio reading of texts and emails to drivers.

Visual Recognition (new)

Analyzes the visual content of images and video frames to understand the content directly without the need for a textual description.

Example: Could be used to organize and ingest large collections of digital images or understand consumer shopping preferences based on image queries.

Tradeoff Analytics (new)

Helps users make better choices to best meet multiple conflicting objectives, by finding optimal alternatives across multiple criteria.

Example: Could be used to help customers make buying decisions by analyzing the pros and cons of products based on the customer's personal needs and requirements.

Personality Insights (new)

Enables deeper understanding of people's personality characteristics, needs, and values to help engage users on their own terms.

Example: Can analyze text from a customer's twitter stream to help a travel agency decide between leading with a budget or luxury trip offer.

Additional Watson APIs

The following APIs are expected to be released in 2015 or beyond: Semantic Expansion, Policy Knowledge, Policy Evaluation, Dialogue, Sentiment Extraction, Sentiment Analysis, Industry Accelerators, Question Generation, Medical Information Extraction, Ontology Creation.

Watson Data Services

Watson Curator

Watson Curator helps users assess and gather relevant text documents across multiple sources using a guided and intuitive review process. It helps subject matter experts create higher-quality information collections much quicker and automatically manages superseded and contested information. The Watson Curator is hosted as a Software as a Service (SaaS) on SoftLayer, an IBM company.

Watson Foundations

Watson Foundations Products

IBM's preexisting products, in the IBM Analytics Unit, and also included in the Watson brand

Data and information management

Includes Information Server; MDM Server; Federation Server; Optim; Guardium; DB2 with BLU; IMS; Informix; Industry Models; PureData; BigInsights; Streams; Sensemaking; FileNet/ECM family of products

Business and advanced analytics

Includes Cognos BI, TM1; SPSS Statistics, Modeler, Analytic Catalyst, and Data Collection; Decision Manager; Content Analytics



Let's pick Watson's brain

How Watson works

According to Watson's developers, advanced hypothesis generation and scoring combined with deep natural language processing and machine-learning capabilities are what make Watson unique.

Here's how it works:

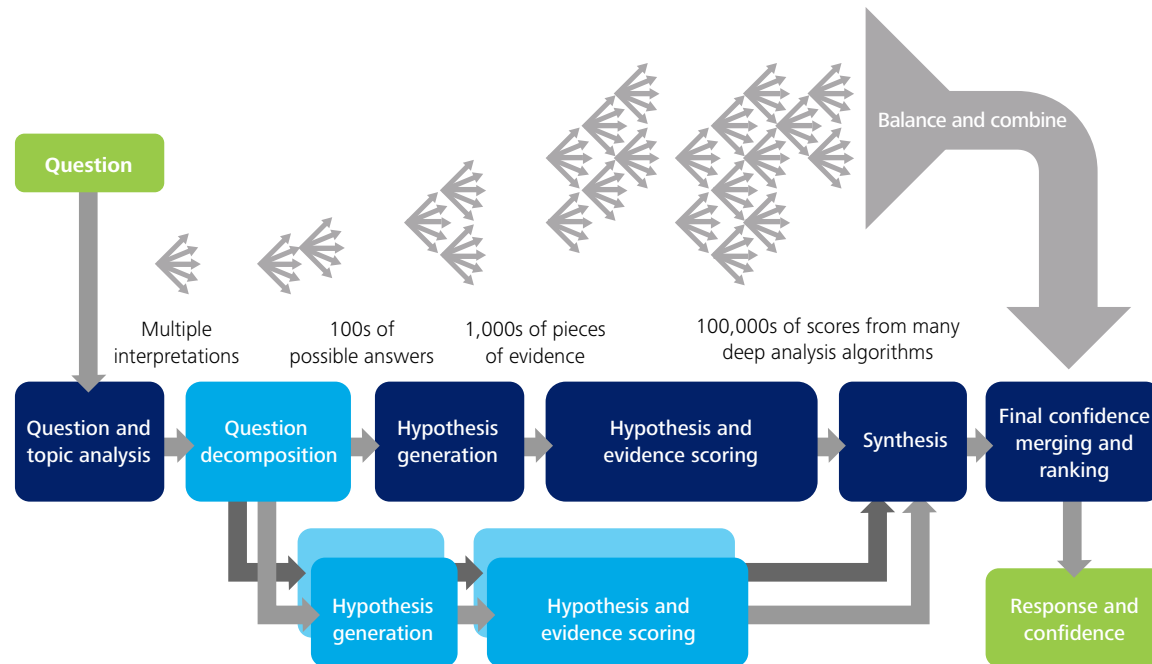
- When presented with a question, Watson analyzes the question to determine what type of information is needed (such as a person's name or geographical location) as well as various possible interpretations of the question (hypotheses) and the evidence supporting them.
- Watson searches across its knowledge repository for possible answers to the question and various interpretations. It forms many hypotheses around the answer—possibly hundreds or even thousands—and gathers evidence supporting them.
- Watson then performs deep comparisons between the language of the question and the response using reasoning algorithms to score the hypotheses it generated.

- Using its advanced analytics algorithms, Watson aggregates the individual comparison scores to derive a final confidence score to each possible answer and ranks them accordingly, providing the user with the highest-rated answers. This final aggregation is domain (industry) specific and is tuned by examining the relevance of each comparison algorithm.

- Watson's confidence scoring can improve over time through interactions with the users, who "train" the system.

As **Figure 7** shows, Watson's parallel processing capabilities allow it to evaluate thousands of hypotheses and tens of thousands of pieces of evidence in response to a single inquiry and consolidate the results—all in almost real time.

Figure 7
How Watson processes a question



Problems suitable for Watson

According to IBM, 90 percent of the world’s data was generated just in the past two years, and 80 percent of the data is in an unstructured format—emails, social posts, articles, and more, including Word, HTML, or PDF documents. In today’s world of big data, we have a growing need to manage content that spans the “four V’s”: huge data size (volume), high-speed data accumulation (velocity), great diversity of data formats and sources (variety), and increasing need of data assurance (veracity). (See **Figure 8**.)

IBM Watson was designed to help businesses mine massive amounts of data to solve certain types of business problems. A good candidate for Watson has one or more of these characteristics:

- **Requires posing questions in natural language.** People who need fast answers to questions they pose in natural language can benefit from Watson. Typical examples in retail include consumers looking for online product recommendations or, in financial services, investors researching financial instruments. Watson also can provide decision support in areas such as compliance, customer service, and enterprise knowledge management.

Figure 8
What makes a good Watson use case?

Volume	Velocity	Variety	Veracity
<ul style="list-style-type: none"> • Needs ability to sift through large amounts of data, such as all Wikipedia content • Transforms the user experience with contextual relevance and active dialogue 	<ul style="list-style-type: none"> • Needs responses to be available in real time or near real time 	<ul style="list-style-type: none"> • Needs deep natural language processing • Leverages different sources of unstructured information • Requires ability to load different file formats (PDF,HTML, etc.) 	<ul style="list-style-type: none"> • Leverages evidence-based insights with weighted confidence • Benefits from a continuous learning capability

- **Requires context-based search.** Watson can help researchers quickly locate relevant information within huge amounts of text from various sources. For example, Watson can help health care researchers by precisely sifting relevant information from thousands of journals, genomic information databases, and patient records. One difference between Watson and Google is that Google is primarily driven by keyword search, while Watson can understand the context—the semantic relations among the keywords—to retrieve far more precise results.
- **Requires inference chaining.** Watson can support decisions that require inference chaining (A infers B, B infers C, and so on). Analysts or researchers can build an inference graph based on an inference chain to observe a broad spectrum of downstream considerations. Convergence in the inference graph with high confidence scores may reveal hidden insights and more important inferences.
- **Allows active learning and decision support.** Watson is not a plug-and-play solution; the system must be trained to identify appropriate answers. Watson is built on active learning technologies that can adapt to changes in data and user requirements. By routinely interacting with subject-matter experts, Watson can be trained or retrained based on feedback from users. In this way, Watson gets smarter over time as a result of this feedback loop, and users can gain more accurate results from Watson.

Guidelines for an effective Watson knowledge database

A problem suitable for Watson is one that requires searching through huge volumes of text and images, which have been added to the Watson knowledge base, called the "corpus." Each corpus is virtually partitioned into secure hosting environments, separating one client's data from another. An effective corpus must be:

- **Comprehensive.** The corpus must contain the information required to formulate correct answers.
- **Easily retrievable.** Content must be ingested into Watson so that correct segments of information can be quickly located.
- **Physically available.** Content can come from a variety of sources, but it must be legally available (licensed) and ingested by Watson.
- **Clean.** Content must be cleansed and curated for Watson to be effective.
- **Secure and private.** Content should not include individual user information, such as financial transaction information or identifiable patient records. Typically, this type of data is best handled on traditional customer or provider platforms designed to address security and privacy concerns.

As of March 2015, only text documents can be added to the Watson corpus for cognitive computing. Watson currently has trouble ingesting and interpreting certain types of PDF documents, but IBM is working to resolve this issue.



Data sources usable by Watson

The following types of data sources are not directly usable by Watson's cognitive computing functions at this time:

- Spreadsheets and nested tabular data
- Report data, such as call data records, sensor logs, meter data

However, IBM offers a vast array of Business Analytics and Information Management technologies that effectively process structured data, including Watson Analytics and Watson Foundation Products. We expect to see the unstructured and structured aspects of Watson to become more compatible and synergistic over time.

Figure 9
Data sources usable by Watson as of March 2015

Client Content	Public Content	Third-Party Content	Customer Question Sets
<p>Unstructured Data</p> <ul style="list-style-type: none"> • Product literature • Manuals/ Specifications • Guidelines • Procedures/Policies • Journals • Best practices • FAQs • Certification tests • Brochures • Call logs • Images <p>Structured Data</p> <ul style="list-style-type: none"> • Client profiles • Product/Part lists • Company directory 	<p>Unstructured Data</p> <ul style="list-style-type: none"> • Wikipedia • Industry definitions • Open source content • Regulatory guidelines • Images <p>Structured Data</p> <ul style="list-style-type: none"> • Type systems 	<p>Unstructured Data</p> <ul style="list-style-type: none"> • Subject matter domain content • News feeds • Market data • Business reports • Industry intelligence • Risk analysis assessments • Industry definitions • Images <p>Structured Data</p> <ul style="list-style-type: none"> • Taxonomy/ Ontology • Type systems • Market data 	<p>Unstructured Data</p> <ul style="list-style-type: none"> • Sets of questions with known answers relating to key concepts

Problems not suitable for Watson

Watson is not a silver bullet capable of answering every question. For example, it is not able to execute complex numeric calculations, summarize information, or conduct inductive reasoning. In general, the following problems are not appropriate for Watson:

- **Complex mathematical computation.** Watson can perform only very simple number calculations and comparisons. For example, it would know that “20 years before 1988” has the same meaning as “in 1968.” However, Watson should not be expected to perform complex numeric calculations like bill payment analysis and complex logic reasoning like gaming. Watson cannot answer questions such as “What is the standard deviation of today’s hourly temperatures?” unless the value has been calculated by someone and added to Watson’s corpus.
- **Predictive analysis.** Watson Advisors cannot perform predictive analysis or predict the future, because it is designed to extract existing knowledge instead of creating new knowledge. It can only find candidate answers by comparing huge amounts of data and considering their statistical strength. For example, users should not expect Watson to answer such questions as “What will be the stock price of XYZ Company tomorrow?” or “When will the next earthquake occur in Los Angeles?” However, Watson
- **Inductive reasoning.** Watson is not able to make a judgment or assimilation from various sources. It can provide supporting information for users to make better decisions, but Watson itself cannot replace users in making judgments or decisions. For example, Watson is not good at answering “What is the best insurance policy for me?” because the answer requires evaluating information about the user and various insurance plans. In addition, Watson cannot yet combine information from various documents or create an answer that is a deduction from multiple passages it finds, such as providing a critical summary of an article that has been placed in its corpus.

Analytics leverages IBM SPSS to enable predictive analytics using very sophisticated models and algorithms; these predictive analytics capabilities do not incorporate Watson’s cognitive computing capabilities, NLP, hypothesis generation, and adaptive learning capabilities at this time.



Our take: Watson's limitations as of March 2015

IBM is still in the early days of developing and deploying cognitive computing capabilities, but we expect them to evolve rapidly, thanks to IBM's strong commitment supported by a \$1 billion investment. By teaming with IBM early in the Watson development cycle, Deloitte should be well positioned to help shape Watson-related offerings to our clients' business needs.

Consider the following potential limitations as you explore how Watson may help your organization.

- **Watson mainly searches text.** Watson does a good job of searching massive amounts of unstructured data, such as text in journals, emails, and social posts, including Word, HTML, and some PDF documents. Traditional analytics tools are better suited for structured and semi-structured data. However, a new platform service, Visual Recognition, analyzes visual content of images and video frames to understand the content without a text description.
 - **Watson understands only English.** Currently all materials added to the corpus must be in English, and at this time, questions should be asked in English. Watson is trained to understand nuance and correlation, and even sarcasm; adding additional languages will be a challenge. However, IBM has announced a partnership with CaixaBank to develop Watson in Spanish, a partnership with SoftBank to develop Watson in Japanese, as well as plans to accelerate their own
- efforts to develop Watson in Brazilian Portuguese. In addition, Watson API services, such as Machine Translation, can currently translate text between languages: English, Spanish, Brazilian Portuguese, French, and Arabic. We don't expect today's language capabilities to be a significant limitation, since most international business is conducted in English.
 - **Some Watson technologies may not be integrated.** Some of the technologies added to the Watson "brand" may not be fully integrated with Watson's cognitive capabilities. We expect that this will be resolved over time.
 - **Only Watson Engagement Advisor and Watson Discovery Advisor have been released.** So far, we have seen new use cases based on only the Engagement and Discovery Advisors. IBM expects to release Watson Policy Advisor later in 2015, followed by the Industry Advisors.
 - **App development requires IBM involvement.** Developers must rely on IBM to help resolve back-end problems and train the system. Watson Lab Services (similar to other IBM Software Brand lab services) typically will provide deep subject matter expertise. Deloitte regularly subcontracts with IBM lab services for this type of assistance.



Watson in action

Watson use cases

IBM Watson is designed to support business uses across a broad range of industries and functional areas. IBM is initially focused on developing solutions in areas such as customer engagement, health care, finance, retail, and travel/hospitality. A few use cases are highlighted below, and more are accessible on the IBM Watson portal on Deloitte Resources.

Watson explores the great outdoors

IBM collaborated with Fluid, Inc., and The North Face to build the Fluid Expert Personal Shopper (XPS), a Watson-enabled shopping tool. XPS provides a personalized shopping experience that replicates a conversation a customer may have with a salesperson at a brick-and-mortar store. For example, if a customer asks about camping gear for a winter hiking trip to Patagonia, XPS would answer the question by pulling information from a wide variety of sources, such as product descriptions, customer loyalty information, sales histories, customer reviews, outdoors blogs, and travel magazines.

Watson goes to medical school

The IBM Watson team has collaborated with highly regarded health care providers and a health insurance company to help medical professionals diagnose illnesses and identify treatment options. Memorial Sloan Kettering Cancer Center worked with IBM to develop a Watson-enabled diagnosis tool to provide physicians with evidence-based diagnosis and treatment suggestions for cancer patients. The tool includes supporting evidence and the data source with every suggestion to aid the doctor's decision-making process. The tool points out areas where more information is needed and updates suggestions as new data is added. The solution's corpus combines patient data with massive volumes of medical literature, which will be enhanced as new oncology techniques, treatments, and evidence are added to the corpus.

Watson as the doctor's advisor

View this video to see how a doctor may interact with Watson to better inform diagnosis and treatment decisions. While Watson may not currently have all the capabilities demonstrated, IBM is actively pursuing research, acquisitions, and partnerships to enhance Watson. For example, IBM's acquisition of Cognea in May 2014 will likely accelerate development of Watson's voice recognition capabilities.

Short version
(2 minutes)

Full version
(8 minutes)



Figure 10
Selected IBM Watson case studies

Company <i>Solution Area</i> <i>Product</i>	Description	Data Sources
The North Face and Fluid, Inc. <i>Customer engagement</i> Fluid's Expert Personal Shopper (XPS)	Provides a highly personalized shopping experience	Product information, customer loyalty data, sales histories, user reviews, blogs, and relevant magazines, publications, and travel documents
Memorial Sloan Kettering Cancer Center <i>Health insurance</i> Utilization Management Advisor	Provides benefit approval suggestions to nursing staff based on recommended treatments for patients	Patient data, historical use cases, medical literature, clinical guidelines, and best practices
Memorial Sloan Kettering Cancer Center <i>Health care diagnostic tool</i> MSK Care System	Provides physicians with evidence-based diagnosis and treatment suggestions for cancer patients	Patient data, medical literature, journal articles, physicians' notes, and National Comprehensive Cancer Network (NCCN) guidelines and best practices
Welltok <i>Health care</i> CaféWell Concierge	Provides patients with highly personalized suggestions for improving health	Location-based data; user activities such as sleeping, exercising, and eating; preventive service benefits; and health- and wellness-related data
MD Anderson Cancer Center <i>Health care</i> Oncology Expert Advisor	Fine-tunes treatment plans by providing alerts to adverse events and suggesting evidence-based treatment and management options for patients	Patient profile, institutional clinician and research knowledge, and medical literature guidelines
Genesys <i>Contact Center Solutions and Customer Experience Provider</i> Agent Advisor and Virtual Agent	Helps customer service agents provide fast, data-driven answers. Can also be used directly by customers via mobile device, chat session, or online interaction	Product information, user reviews, troubleshooting guidelines and best practices, and customer profile



Case study: changing the world of health care

Note: This case study was originally published in Deloitte's Tech Trends 2014

In 2011, WellPoint, one of the nation's largest health benefits companies, set out to design a world-class, integrated health care ecosystem that would link data on physical, financial, worksite, behavioral, and community health. By establishing a singular platform, WellPoint could enhance its ability to collaborate, share information, automate processes, and manage analytics. To do this, WellPoint needed an advanced solution and therefore teamed with IBM to use the capabilities of Watson—IBM's cognitive computing system.

"We decided to integrate our health care ecosystem to help our care management associates administer member benefits, while providing a seamless member experience and working to reduce costs," said Gail Borgatti Croall, SVP of Care Management at WellPoint.

Today, WellPoint uses cognitive analytics as a tool for utilization management, specifically, in reviewing pre-authorization treatment requests—decisions that require knowledge of medical science, patient history, and the prescribing doctor's rationale, among other factors. With its ability to read free-form textual information, Watson can synthesize huge amounts of data and create hypotheses on how to respond to case requests. In fact, WellPoint already has "taught" its cognitive engine to recognize medical policies and guidelines representing 54 percent of outpatient requests.

"It took us about a year to train our solution on our business, and the more we taught the faster the Watson cognitive platform learned," said Croall. "Now it's familiar with a huge volume of clinical information and professional literature."

For each case reviewed, the system provides nurses with a recommendation and an overall confidence and accuracy rating for that recommendation. In some outpatient cases, the system already can auto-approve requests, reducing the timeframe for patient treatment recommendations from 72 hours to near real-time. Furthermore, nurses have experienced a 20 percent improvement in efficiency in specific workflows due to the one-stop-shop nature of the integrated platform.

WellPoint's use of cognitive analytics for utilization management represents the tip of the iceberg. "We'd like to see how our system can support a more holistic, longitudinal patient record—for example, integrating electronic medical record (EMR) data with claims, lab, and pharmacy data," said Croall. "We've barely scratched the surface with our cognitive analytics capabilities. It truly will change the way we perform utilization management and case management services."

Realizing business value with Watson

Steps to a Watson solution

Cognitive computing is beginning to emerge as an opportunity and a threat for many businesses, especially information-intensive industries, such as insurance, health care, telecom, and banking. But others may also benefit from being early movers.

Figure 11 outlines the basic steps toward generating value from Watson and other cognitive technologies.

The following two pages provide examples of potential business usage patterns for IBM Watson and identifies areas of your organization that may benefit from a Watson solution.

Figure 11

Steps to realizing value with Watson cognitive computing



Figure 12
Watson usage pattern examples












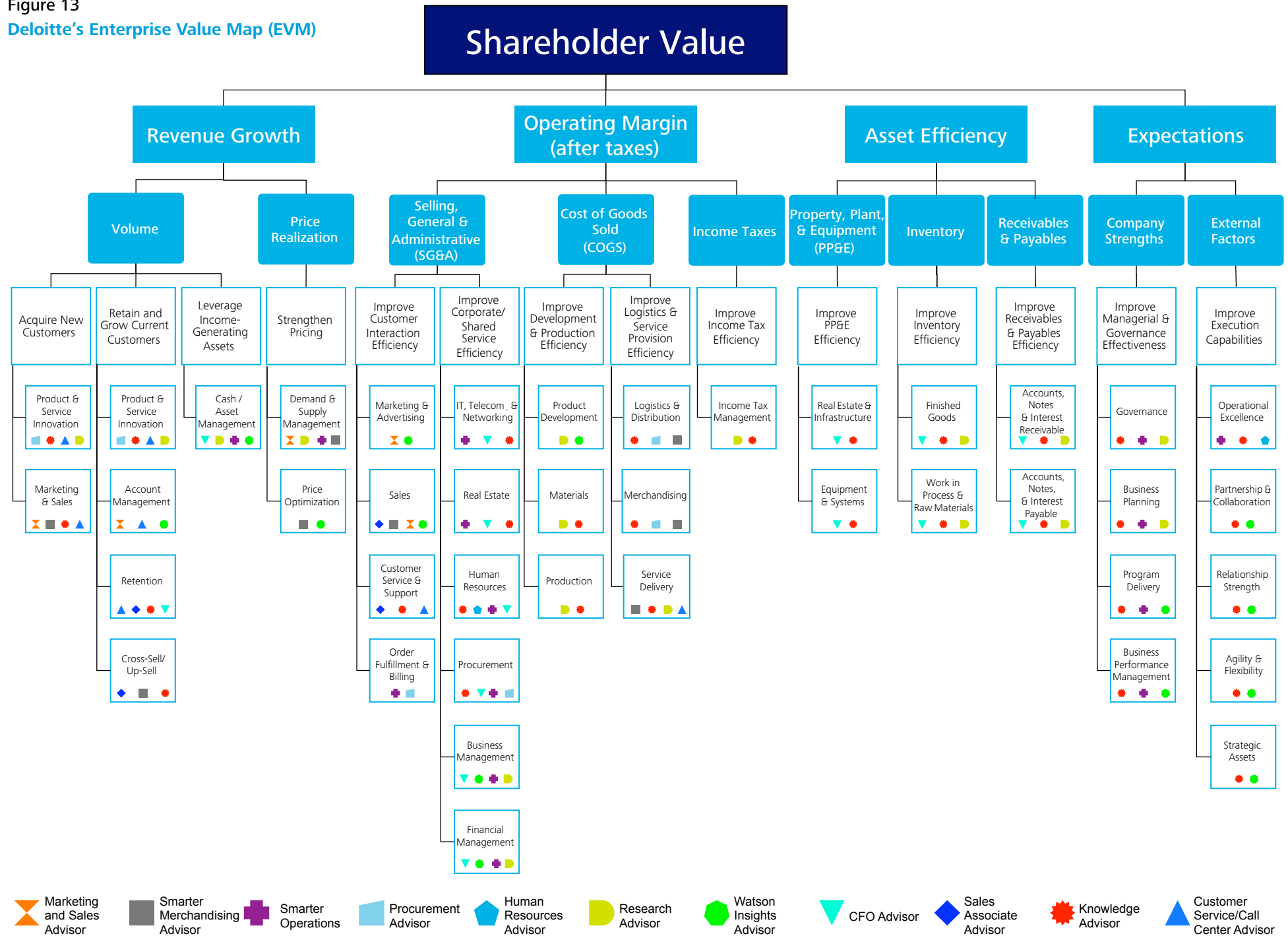
		Patterns	Value Proposition	Industry
Cross-Enterprise Examples	Operational Efficiency Advisors	 Marketing and Sales Advisor	Creating the most effective targeted marketing campaigns and effective sales strategy by leveraging multiple sources of data from analyst reports, social data, blogs, reviews, and market research, and leveraging Watson’s user profiling, message resonance, and psycholinguistic capabilities	Cross-Industry
		 Smarter Merchandising Advisor	Leveraging forward-looking structured and unstructured data to enhance intelligent merchandising and management decisions related to product, pricing, and inventory management	Cross-Industry
		 Smarter Operations Advisor	Streamlining business processes and compliance in relation to services, policies, procedures, and benefits through an employee-facing quick natural language Q&A self-service interface	Cross-Industry
		 Procurement Advisor	Empowering employees in the support, visibility, and strategic-sourcing process (In the medical industry, professionals tasked with fulfilling procurement needs struggle to navigate clinical evidence, research, analysis, and price data, which is scarce, highly decentralized, and biased. The supply chain decision-making process is complicated by competing priorities and inefficient collaboration within hospitals. In procuring implantable devices alone, an estimated \$5 billion is wasted annually due to these inefficiencies.)	Cross-Industry
		 Human Resources Advisor	Streamlining HR processes by leveraging procedures, benefits, policies, and other intellectual property in a quick natural-language interface	Cross-Industry
		 Research Advisor	Enabling analysts and researchers to gain new insights through correlation of large amounts of unstructured data. Whether in health care/life sciences, M&A, accounting and compliance, wealth management, or market competitive analysis—there is a vast corpus of information to provide a professional opinion based on a set of facts. Watson could help enable the understanding of new relationships in a much shorter timeframe.	Cross-Industry
		 Watson Insights Advisor	By curating information in a 360-view of nearly real-time information, Watson’s semantics understanding analyzes concepts within data that matches a user’s questions, without having to leverage advanced analytics, prepare or model key information. This enables business users to quickly access insights and expand relationship concepts through visualizations, across business functions or shared services (i.e., account management, business performance management), or helping to improve executional capabilities for an enterprise.	Cross-Industry
	 CFO Advisor	Visualizing, integration, and retrieval of structured and unstructured data for better decisions in an intuitive natural language user interface	Cross-Industry	
	Knowledge Advisors	 Sales Associate Advisor	Enabling sales associates in obtaining product information, social content, blogs, product reviews, comparisons to maximize customer service and engagement for higher conversion rates	Cross-Industry
		 Knowledge Advisor	Empowering knowledge support and enablement of employees on all of client’s intellectual content and selected public information	Cross-Industry
 Customer Service/Call Center Advisor		Intelligence-enabled support to help agents quickly respond to client and employee inquires and issues	Cross-Industry	
Industry-Specific Examples	Knowledge Advisors	Wealth Advisor	Empowering wealth advisors with answers to important questions, portfolio management, recommendations asset allocation, and investment decisions based on the risk profile of clients and quick market analysis	Financial
		Insurance Advisor	Enabling insurance agents and underwriters with a comprehensive view of client needs/gaps and reducing subjectivity	Financial
		Underwriting Advisor	Assist analysts in risk/exposure analysis rapidly resourcing analyst reports and other relevant information on new guidelines, policies, weather and news, etc.	Financial
	Customer/Self-Service Advisors	Oil and Gas Advisor	Empowering oil and gas producers of mineral deposit discovery, drilling, and equipment troubleshooting to quickly sift through large amounts of information in the decision-making process of mineral deposit discovery and drilling equipment troubleshooting	Oil and Gas
		Health and Wellness Advisor	Assisting clients in a mobile self-service app to engage in better health decisions, or aiding drug store retailers with the most up-to-date information to match products and knowledge with consumer concerns and issues, and to drive better patient outcomes.	Health care/ Retail
		Shopping Advisor	Assisting clients in obtaining product information, social content, blogs, reviews, for better-informed purchase decisions, and increase customer engagement and conversion rates	Retail
Wine Advisor	The Wine Advisor helps suggest wines based on customer need, tastes, and food pairings, as well as reviews/awards, price, varietal, region, and promotion	Retail		

Figure 13
Deloitte's Enterprise Value Map (EVM)



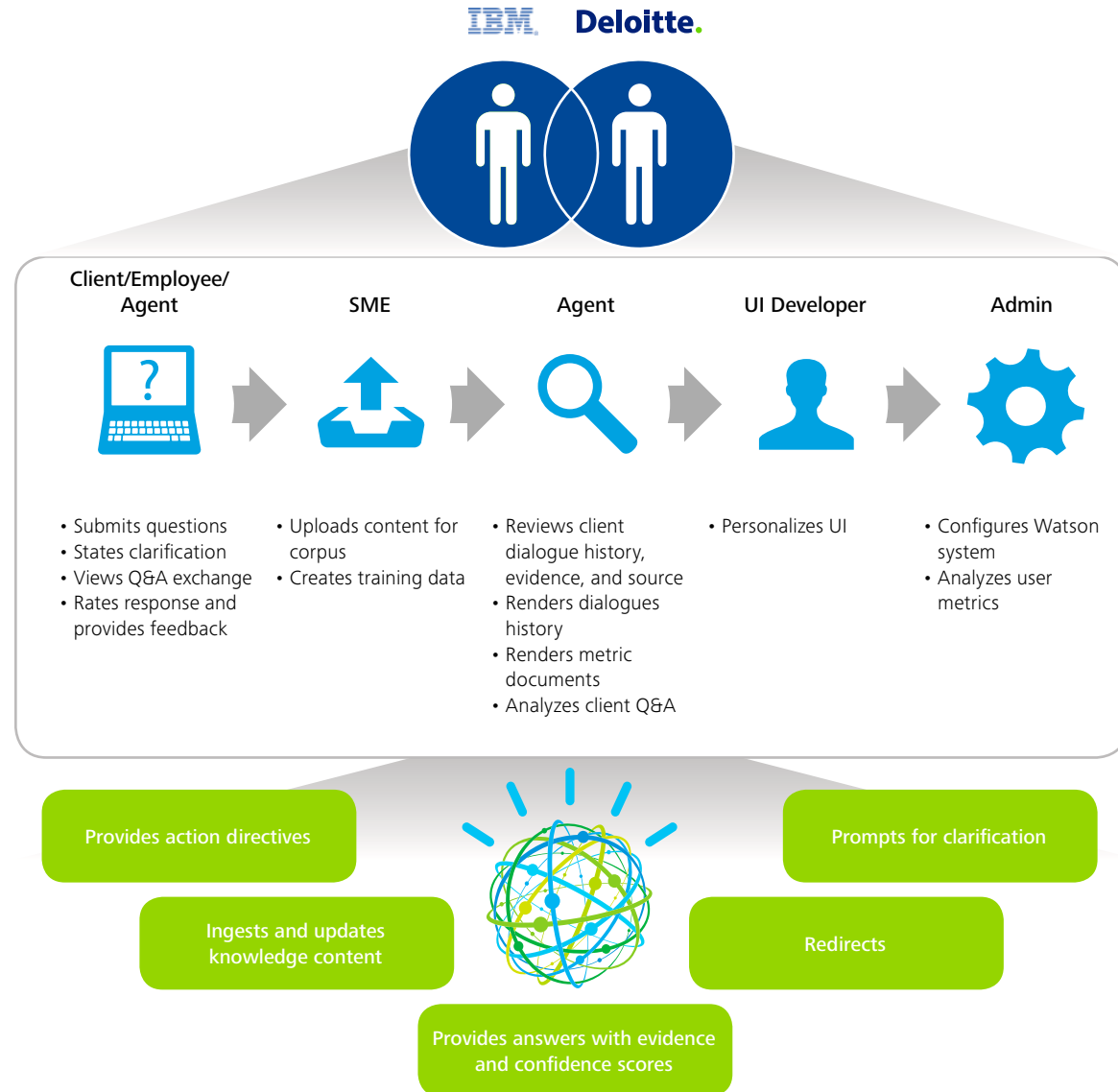
Deloitte is positioned to help

Extensive training and effort are required to expand business capabilities with Watson’s cognitive services or create a Watson-powered application. This is where Deloitte can help.

Deloitte’s cognitive computing offerings will use IBM Watson as a platform for providing the foundational capabilities in natural language processing and probabilistic reasoning. We are also working with other vendors with niche capabilities that complement and extend Watson’s cognitive abilities. Our goal is to provide holistic cognitive and advanced analytics solutions to help our clients make smarter decisions.

For more than a decade, Deloitte and IBM have had strong client and alliance relationships, and our collaboration around Watson is a natural extension of that. Our alliance offerings unite the depth and breadth of IBM’s technology portfolio with Deloitte’s leading methodologies and consulting experience. Through our “smarter teaming” approach, Deloitte and IBM can help our joint clients create and capture more value from cognitive computing.

Figure 14
Resources required to deploy and manage a Watson solution



Deloitte's cognitive computing offerings

Below are some of the ways that Deloitte can help you explore and execute cognitive computing solutions to add more potential value to your organization.

Ideation and advisory services

- Explore how Watson can positively transform your business during a Deloitte Greenhouse session tailored for your organization.
- Define your approach and strategies for leveraging cognitive computing capabilities.
- Develop internal and/or go-to-market strategies for industry or domain-specific cognitive solutions.

Implementation services: Watson enterprise offerings

- Customize and implement IBM's family of Watson Advisor cognitive computing offerings.
- Incorporate appropriate IBM technologies, such as: Watson Foundations, Watson advisors (Engagement, Discovery, Policy), and Watson industry advisors (Oncology, Wealth Management).

Implementation services: Watson Ecosystem partner solutions

- Customize and implement third-party powered-by-Watson cognitive solutions.
- Incorporate cognitive solutions that leverage Watson advisors and platform components, such as Fluid and MD Buyline.

Implementation services: Watson platform components

- Customize and implement IBM Watson tooling and API cognitive services.
- Incorporate appropriate IBM technologies, such as: Watson Content Analytics, Watson Explorer, Watson API services (Perceiving, Reasoning, Relating, etc.).

Implementation services: Watson foundations products

- Plan and implement IBM's Analytics portfolio of products as the foundation for building future cognitive computing capabilities.
- Incorporate appropriate IBM Analytics technologies, such as Information Server, Cognos BI/TM1, Watson Analytics, SPSS, BigInsights, Streams, DB2 Blu, PureData, etc.).

Deloitte cognitive transformation solutions

- Collaborate with a client or group of clients to develop and bring to market Watson-based cognitive computing solutions.
- Leverage Deloitte's industry and functional knowledge and IBM Watson technologies to create marketable solutions for clients.

Next steps

Learn about Watson applications

IBM has produced a series of videos that provides an overview of the process of creating an IBM Watson application. These include:

- [What is IBM Watson?](#)
- [What is the IBM Watson ecosystem?](#)
- [Roadmap for planning your IBM Watson cognitive application](#)
- [Building your Watson cognitive application](#)
- [Enrich your IBM Watson cognitive application with content](#)
- [Train your “Powered by Watson” cognitive application](#)
- [Test and deploy your “Powered by Watson” cognitive application](#)

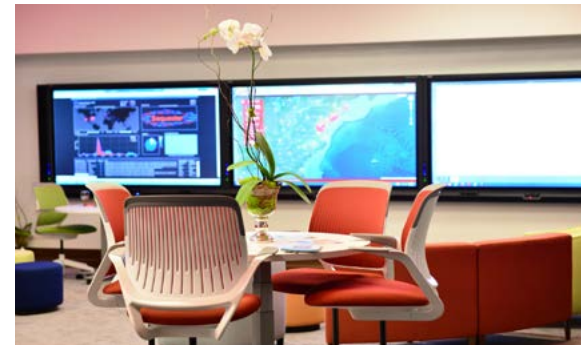
Explore what’s possible

Visit a Deloitte Greenhouse to explore the art of the possible for your business with Watson. Your company’s leaders can participate a one-day ideation session tailored to address your specific business challenges and opportunities. This interactive Watson Lab enables you to experiment with

Watson in a controlled environment, guided by ambitious objectives to uncover potential value that Watson may be able to generate for your company.

Pages 28-29 provide examples of business usage patterns for IBM Watson and areas of your organization that may benefit from a Watson solution.

Deloitte Greenhouse



About the Deloitte Greenhouse

The Deloitte Greenhouse is an advanced, immersive environment designed to accelerate breakthroughs. The Greenhouse combines behavioral methods, analytics, technology, and expert facilitation to create an experience that can propel clients to extraordinary results; it is a collaborative effort between the Deloitte Analytics Highly Immersive Visual Environment (HIVE), the Deloitte Client Experience (DCE) Labs and Deloitte Consulting Innovation (DCI).

Let's talk

We are in the early days of this new cognitive computing platform called Watson. The market will likely continue to grow as IBM's product matures and people find practical ways to apply cognitive computing to solve a myriad of business problems.

If you are ready to explore how Watson and cognitive computing may be able to positively disrupt your business to create more value, we should talk. You may contact us at watsoninfo@deloitte.com or reach out to any of the leadership listed here.

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