

Putting Watson to Work

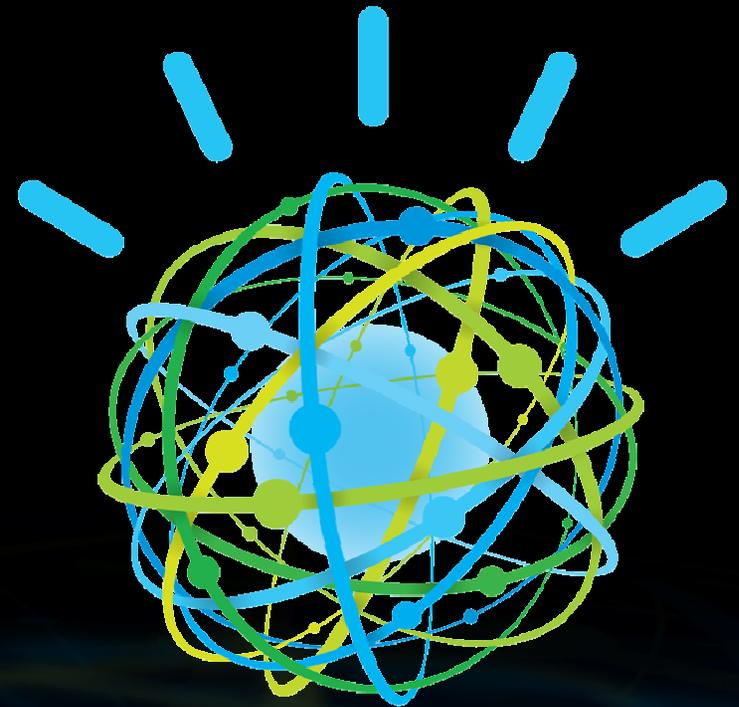
September 9, 2013

Richard Talbot

Director, PLM

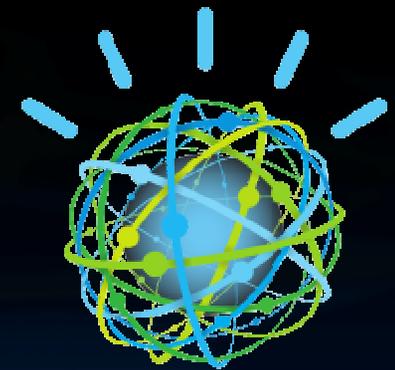
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Topics

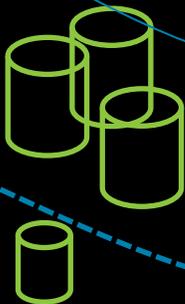
- What is Big Data and why does Analytics matter?
- Who is IBM Watson?
- Why is Big Data / Analytics relevant in Healthcare?
- What's next?



We're "dying of thirst in an ocean of data"

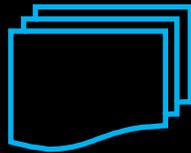
90%

of the world's data was created in the last two years



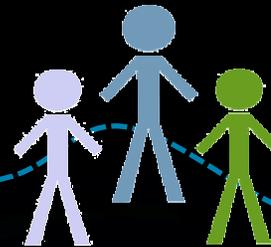
80%

of the world's data today is unstructured



20%

amount of data traditional systems leverage today



1 in 2

business leaders don't have access to data they need

83%

of CIOs cited BI and analytics as part of their visionary plan

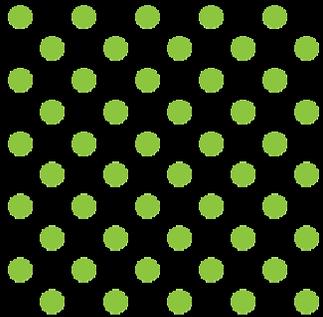
2.2X

more likely that top performers use business analytics

Big Data: Characterized by the 'Four Vs'

In February 2011, Watson became the avatar for all things analytics, but ...

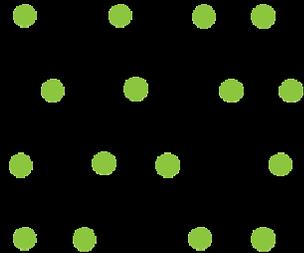
Volume



Data at Rest

Terabytes to Exabyte's of existing data to process

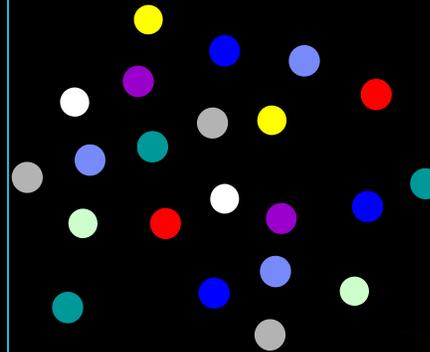
Velocity



Data in Motion

Streaming data, milliseconds to seconds to respond

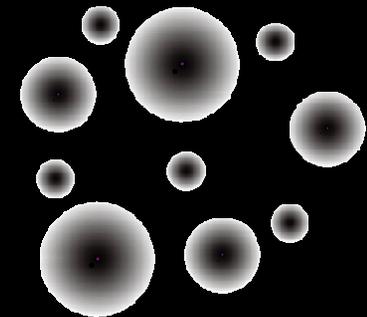
Variety



Data in Many Forms

Structured, unstructured, text, multimedia

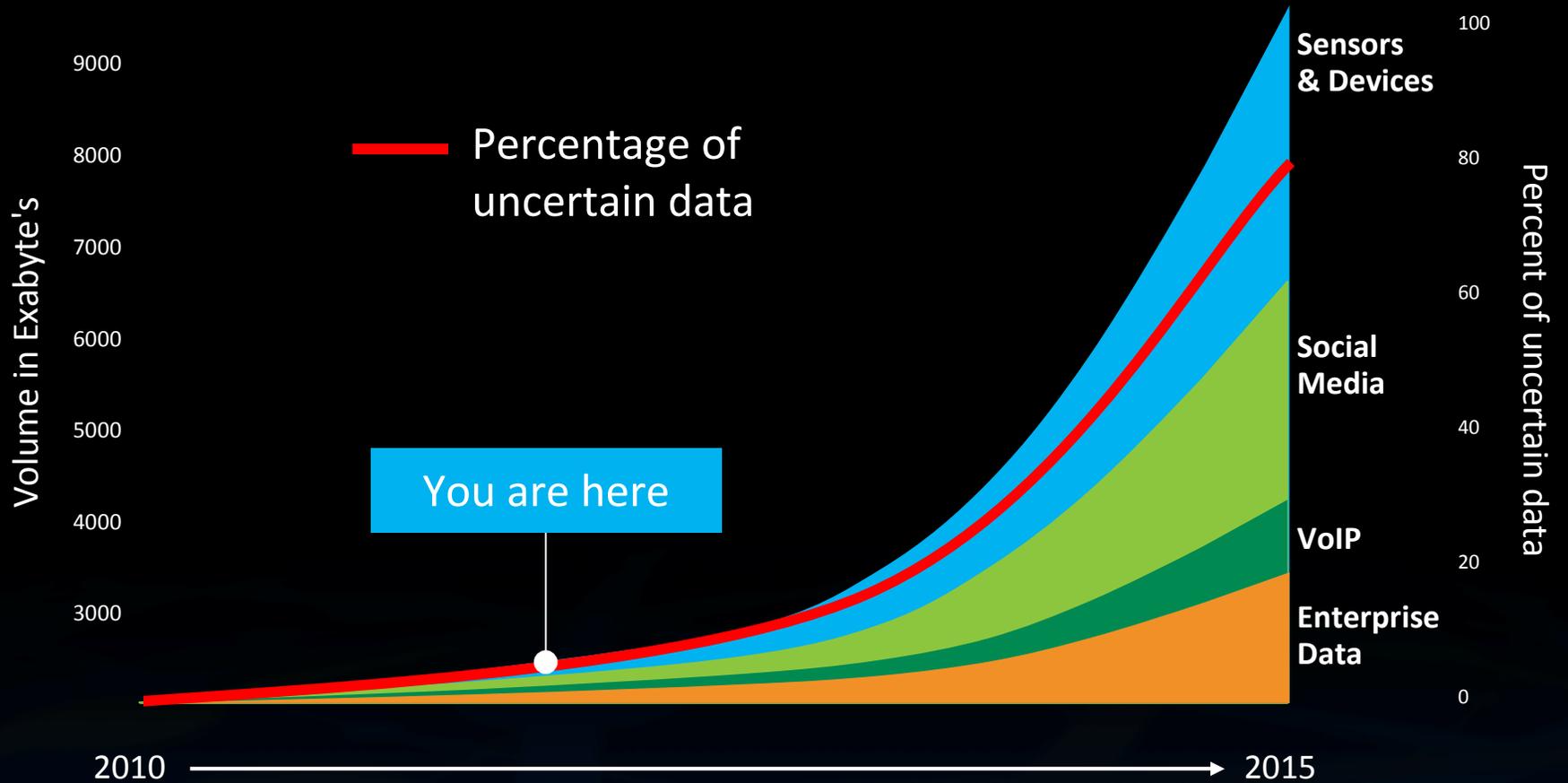
Veracity



Data in Doubt

Data inconsistency & incompleteness, ambiguities, latency, deception

Big Data: This is just the beginning



Source: IBM Global Technology Outlook - 2012

Big Data: Creates more opportunities for making better decisions

Using information and analytics in new and exciting ways

Gain more complete answers

Extend existing analytics to provide additional insights

Create new perspectives

Extend analytics to communities and processes not reached before

Reduce Costs

Rethink existing approaches to how data and content is managed, stored and analyzed to reduce infrastructure costs

Uncover new business opportunities

Identify new offerings and new business models that create value



Web & Social Interaction Data



Multimedia Data



Text, Content, & Documents



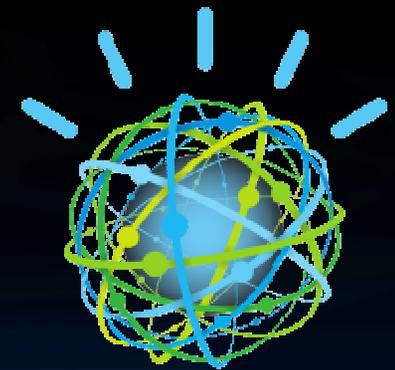
Storage & Network Data



Transactional Data

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IBM's Commitment to Research and tradition of Grand Challenges

- In 2004, several IBM Researchers noticed the restaurant had fallen silent. They soon discovered the cause: Ken Jennings, who was then in the middle of his 74-game winning streak on Jeopardy!
- Can we design a computing system that rivals a human's ability to ...
 - Retrieve, analyze and interpret vast amounts of information?
 - Understand and master the complexity of natural language?
 - Respond with speed, accuracy and a high level of confidence?
- After 4+ years of development, IBM Research challenged Ken Jennings and Brad Rutter, the two most renowned *Jeopardy!* World Champions, to an exhibition match in February, 2011



America's Favorite Quiz Show



Jeopardy! features trivia in history, literature, culture, science, sports, geography, ... and lot's more

- U.S. TV quiz show – 9M daily viewers
- Questions cover broad range of topics
 - History, literature, politics, art, science ...
 - Word plays, subtle meaning, ironies, riddles
- Strategies for selection of topics, searching for Daily Doubles, complex wagering on Final Jeopardy! ...
- Fast responses, with accuracy and confidence



David Ferrucci

IBM Fellow and Principle Investigator
for IBM Watson/DeepQA

Ancient Times

This city didn't exist at the time of the Trojan War, so Paris couldn't have abducted Helen from there.

IBM Watson combines transformational technologies

1 Understands natural language and human communication

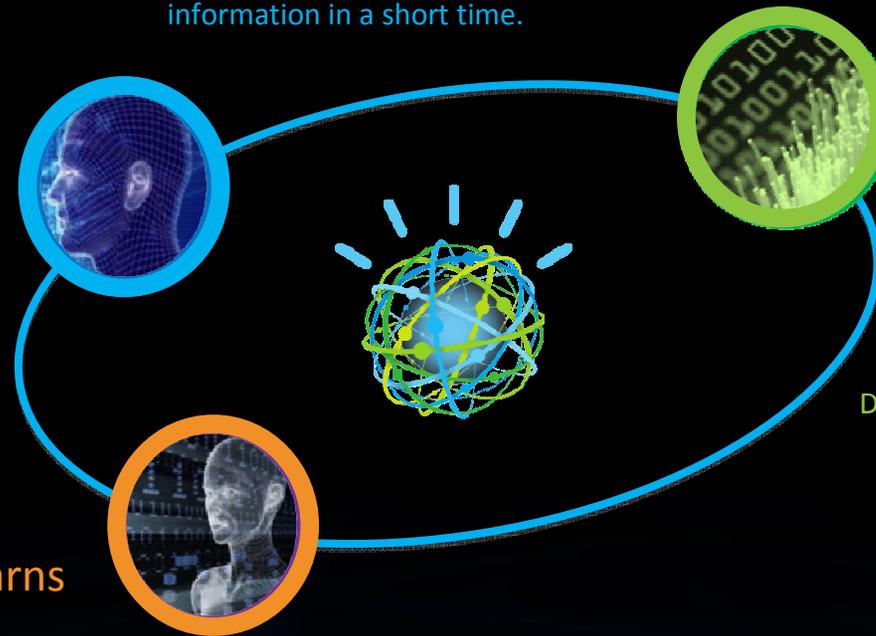
Consumes and analyzes a massive amount of information in a short time.

2 Generates and evaluates evidence-based hypothesis

Develops and validates a broad range of hypotheses, assigns levels of confidence to all possible answers.

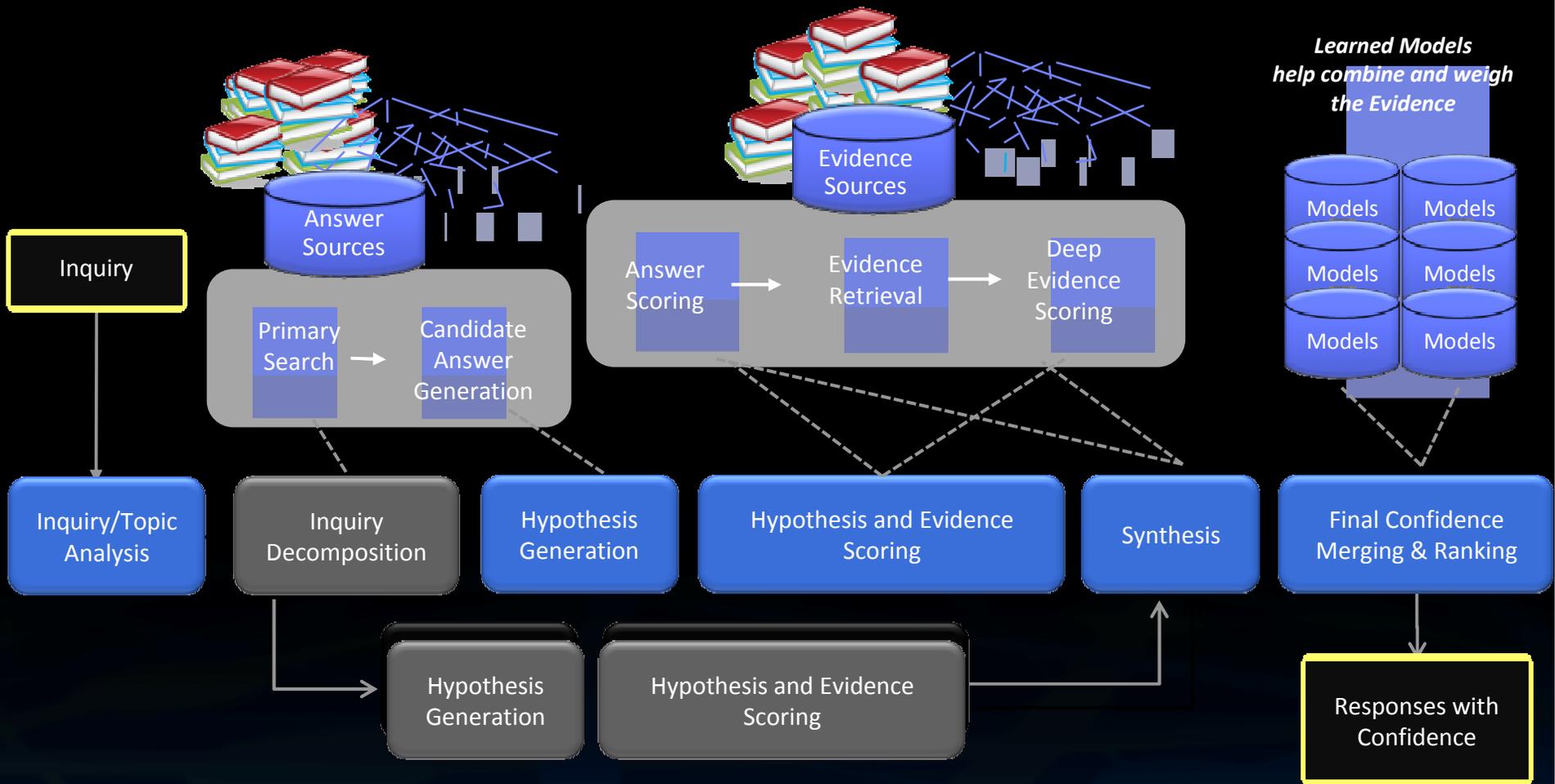
3 Adapts and learns from user selections and responses

Learns from missteps and adapts to changing environments quickly.



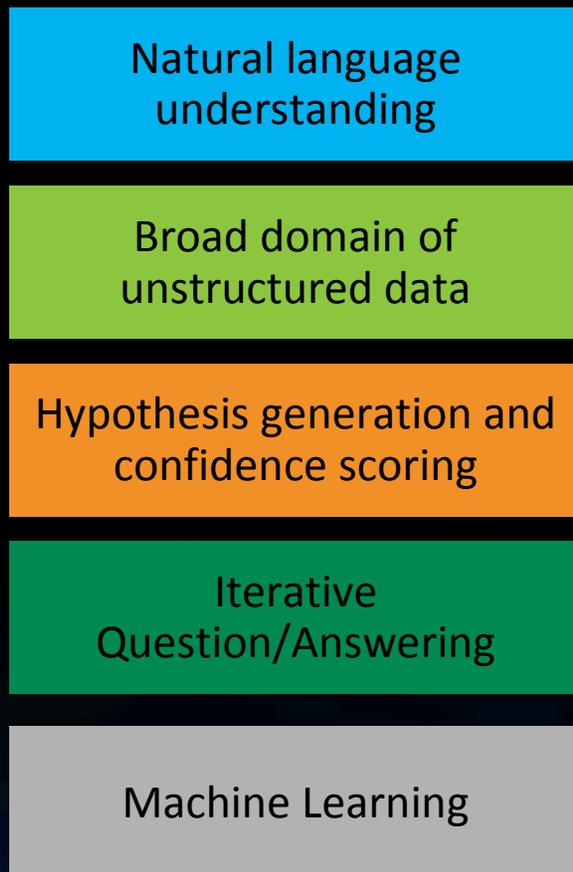
*...built on massively parallel
IBM POWER7 technology and system architecture*

How Watson Works: DeepQA Architecture



Where to put Watson to work

Watson Capabilities



Best Fit for Watson

- Problems that require the analysis of unstructured data
- Critical questions that require decision support with prioritized recommendations and evidence
- High value in decision support
- Leverage scale to maximize machine learning and improve outcomes over time

Moving beyond Jeopardy! was a non-trivial challenge

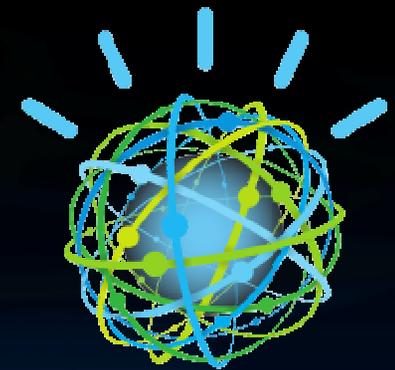
Watson at Play

Watson at Work

1 User	➔	10s of thousands concurrent users
Max. input was two sentences	➔	Pages of input (e.g. medical record)
5+ days to retrain	➔	Dynamic content ingestion
Evidence not present	➔	Supporting evidence integral
Text-only input	➔	Text, tables, images ...
Q&A model	➔	Simple Q&A + Conversation
Basic security	➔	High security (e.g. HIPAA)

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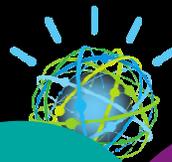
Why Watson for Healthcare?

- Diagnosis and treatment errors
- Shortage of MDs
- Demand for remote medicine

Complexity

- Shift from Fee-for-Service to ACOs
- Focus on Wellness and Prevention
- Universal coverage

Policy Changes



Clinical Outcomes

Operational Outcomes

- Costs are 18% of US GDP
- 34% of \$2.3T US spend is waste
- Costs can vary up to 10x

Costs

Info Overload

- Medical data doubles every 5 years
- Detailed patient biomedical markers
- Targeted therapies

Personalized Medicine

The Question

Evidence based

“What happened to the last 100 patients ... with similar characteristics, ... in similar circumstances, ... who were given a similar diagnosis, and ... prescribed a similar treatment plan that the clinician is recommending for me?”

Translational

Confidence



Context Sensitive

Healthcare industry is beset with some of the most complex information challenges we collectively face

Modern biology little resembles the subject taught in high school: rat dissections, dizzying wafts of formaldehyde and eyeing cells under microscopes.

As much or perhaps more than any other field, the information age has deluged biology in data as scientists seek to characterize the inner workings of the body cell-by-cell and gene-by-gene.

All of this information is collected, stored and analyzed not in lab notebooks, but on computers.

So the biologists who learned their trade in dissections and magnifying cells are finding themselves in something of a mid-career crisis as they discover that their skills with computers are more important than their ability to resolve a microscope.

Medical info is doubling every 5 years

81% of physicians spend < 5 hrs / month reading medical journals

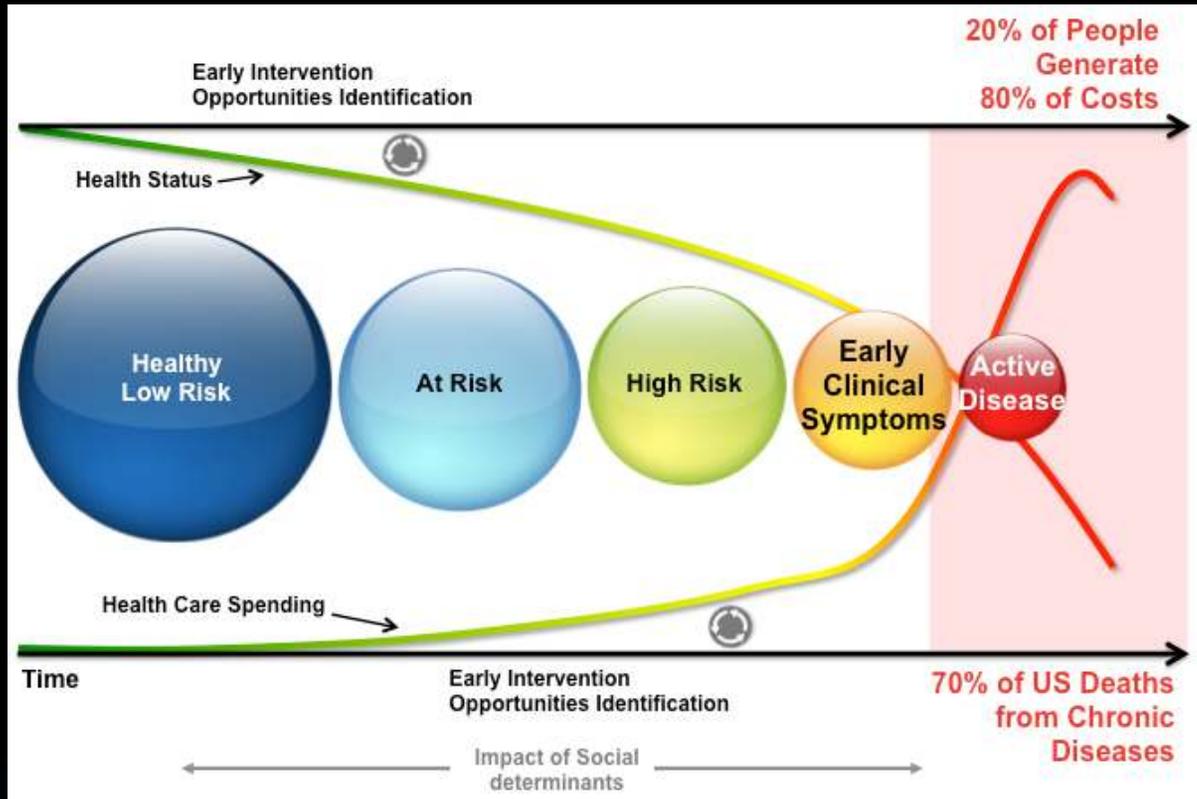
1.5M errors in the way medications are prescribed, delivered and taken

\$750B, or 30 cents of every dollar, is wasted in US alone

Eric Berger

Business and Technology Editor
Houston Chronicle - March 1, 2010

Why Cancer?



Leading Causes of Death¹

- Heart disease
- Cancer
- Chronic lower respiratory
- Stroke
- Accidents

\$263.8B

cost of cancer in the US in 2010

3x

cancer cost climbs vs. standard health costs (~18% / yr)

20-44%

cancer cases receive the wrong diagnosis initially

NEJM medical concept annotations

Diseases

Symptoms

Relations
causeOf
modifierOf
negationOf
partOf
remedyOf
resultOf

- 1 Chamarthi, Bindu; Morris, Charles A.; Kaiser, Ursula B.; Katz, Joel T.; Loscalzo, Joseph
- 2 Stalking the Diagnosis
- 3 362/9/834
- 4 http://content.nejm.org/cgi/content/full/362/9/834</citation_fulltext_html_url>

5 A 58-year-old woman presented to her primary care physician after several days of dizziness, anorexia, dry mouth, increased thirst, and frequent urination. She had also had a fever and reported that food would "get stuck" when she was swallowing. She reported no pain in her abdomen, back, or flank and no cough, shortness of breath, diarrhea, or dysuria. Her history was notable for cutaneous lupus, hyperlipidemia, osteoporosis, frequent urinary tract infections, three uncomplicated cesarean sections, a left oophorectomy for a benign cyst, and primary hypothyroidism, which had been diagnosed a year earlier. Her medications were levothyroxine, hydroxychloroquine, pravastatin, and alendronate. She lived with her husband and had three healthy adult children. She had a 20-pack-year history of smoking but had quit 3 weeks before presentation. She reported no alcohol or drug abuse and no exposure to tuberculosis. Her family history included oral and bladder cancer in her mother, Graves' disease in two sisters, hemochromatosis in one sister, and idiopathic thrombocytopenic purpura in one sister.

- Entity Types / Roles
- FAMILY-DISEASE
 - FAMILY-SUBSTANCE-ABUSE
 - FINDING-BLOODPRESSURE
 - FINDING-GENERIC
 - FINDING-HEARTRATE
 - FINDING-HEIGHT
 - FINDING-OXYGEN-SATURATIO
 - FINDING-RESPIRATORYRATE
 - FINDING-TEMPERATURE
 - FINDING-WEIGHT
 - MODIFIER-ANATOMY
 - MODIFIER-GENERIC
 - MODIFIER-NEGATION
 - MODIFIER-TIME
 - PATIENT-ACTIVITY-EVENT
 - PATIENT-AGE
 - PATIENT-ALLERGY
 - PATIENT-FEMALE
 - PATIENT-HAZARD-EXPOSURE
 - PATIENT-HEALTHSTATE
 - PATIENT-LOCATION
 - PATIENT-MALE
 - PATIENT-NAME
 - PATIENT-OCCUPATION

Medications

Modifiers

IBM Watson at work in Health Care

Product 1: Utilization Management

Streamlines the review processes between a patients' physician and their health plan:

- Speeds treatment approvals, reduces waste
- Enhances quality and consistency of patient care
- Moves patients toward treatment more quickly
- Trained on some of the highest volume medical policies



1600+ Providers



1500+ Practitioners

Product 2: Oncology Diagnosis and Treatment Advisor

Assists oncologists and researchers in identifying individual treatment options for patients diagnosed with cancer:

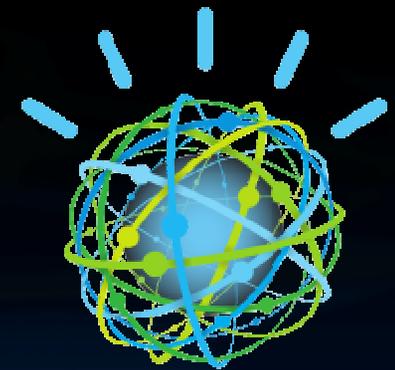
- Based on patient records, array of guidelines and published research
- Trained by industry experts at MSK, designed by oncologists
- Leverages 1.5M patient records and years of longitudinal data
- Synthesizes patient data with standard guidelines, best practices and medical insights

Early Adopters



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What's next for Watson?

10K

Baby boomers retire daily

6B

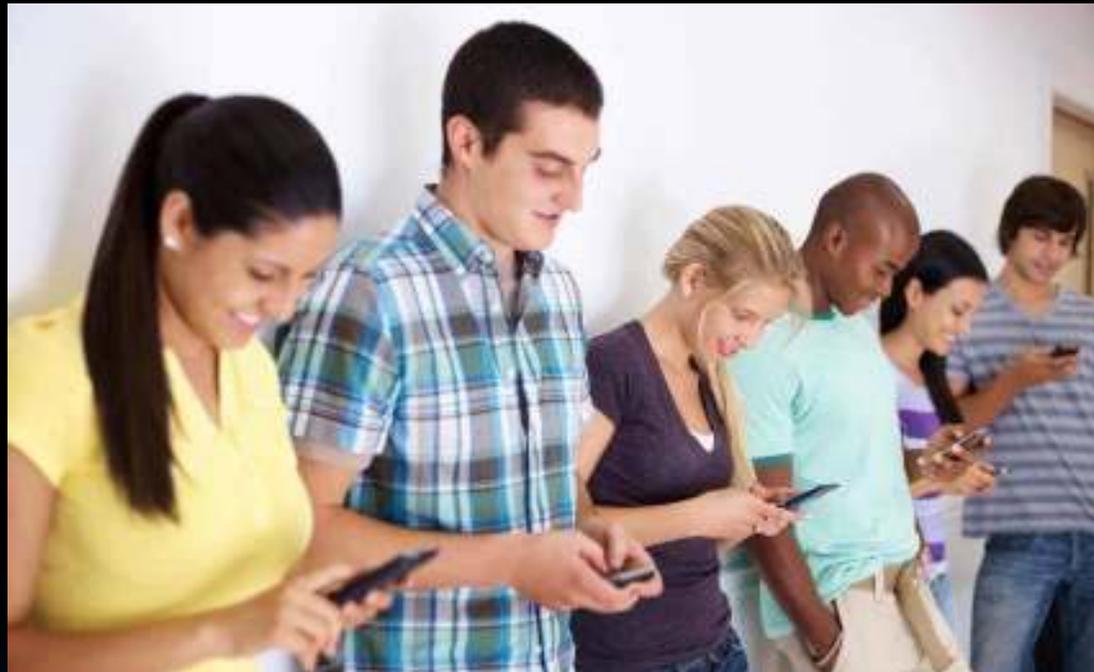
Mobile devices world-wide;
1B+ of them smartphones

2.5B

Active Facebook, Twitter,
and YouTube accounts

84%

% top performers integrating
analytics for better insights



Traditional approaches to engaging with customers come up short



270B
Calls made
annually to call
center cost
\$600B



1 in 2
incoming calls
require
escalation or go
unresolved



61%
of calls could have
been resolved with
better access to
information



4.6%
Market value gain
from a single
point customer
sat gain

*Case studies based on Coremetrics, Sterling Commerce and Unica solutions

Customers expect personalization and control



“You don’t know me”

Intolerance of mass-market, impersonalized approaches

“You’re not connecting with me”

Demand for interaction on channel of choice

“You make it too hard”

Expectations for immediate results

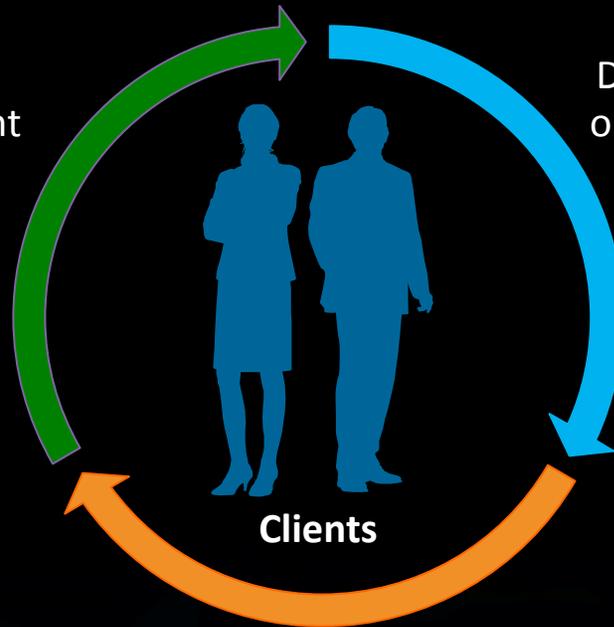
Watson transforms the way people interact

Know me

Leverage profile data for personalized insight into client wants and needs to contextualize experience

Engage me

Dynamic, evidence-based omni-channel experiences that adapt to client preferences



Empower Me

Interactive, informed natural language dialogue that enables insights at the point of action

IBM Watson Engagement Advisor

What it does:

- **Transforms client engagement** by knowing, engaging and empowering clients where they are
- **Develops client relationships** by reaching out to clients who do not leverage traditional channels
- **Empowers consumers and contact center agents** to take informed action with confidence

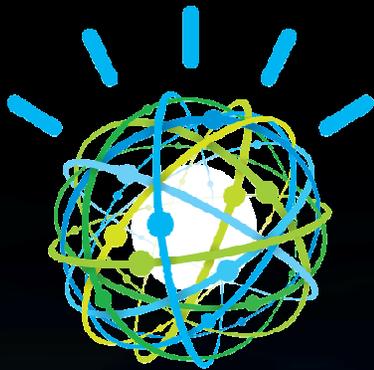
How it does it:

- **Answers questions and guides users** through processes with plain-English dialogue
- **Leverages natural language** to interact with users and build knowledge and expertise
- **Utilizes evidence evaluation and learning** to provide informed and effective responses to users



**Six Weeks to Deploy,
Six Months to ROI**

We have only just begun to build a new era of computing powered by cognitive systems ...



- Transform the way organizations think, make decisions, and operate
- Learn through interactions
- Deliver evidence-based responses driving better outcomes

Thank you!

