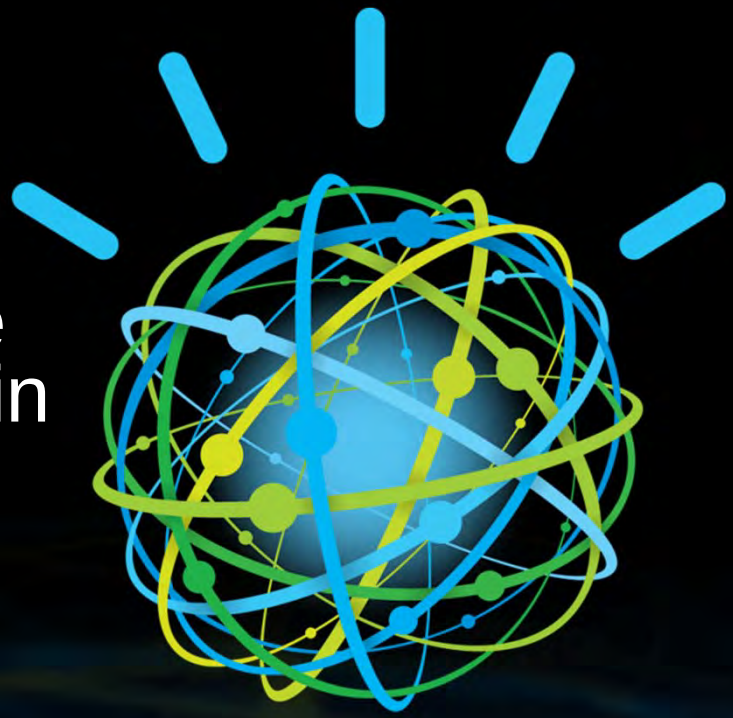
IBM

WATSON

Manuela Mueller-Gerndt

IBM Watson: Eine Technologie für evidenzbasierte Antworten in der medizinischen Versorgung



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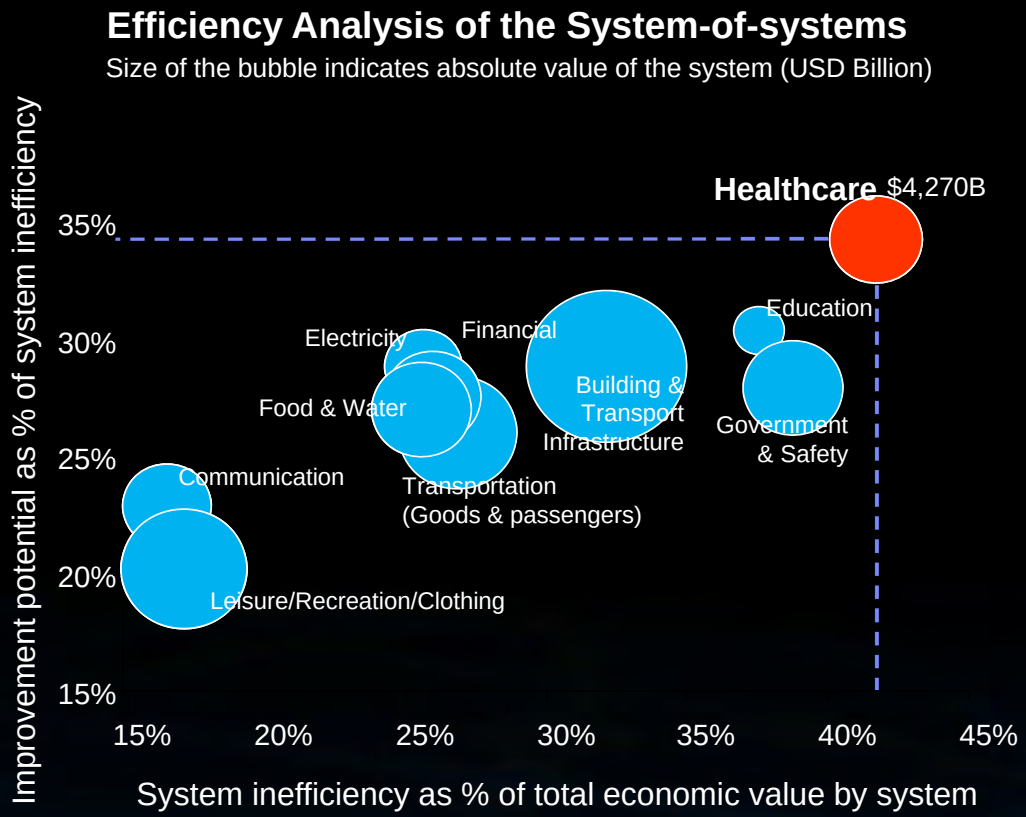
Evidence is mounting that the global healthcare system is increasingly challenged by entrenched inefficiencies

- **Healthcare** is the largest contributor to "system of systems" inefficiency, wasting over 2 trillion USD per year[1]
- Economists estimate that the current level of **healthcare inefficiency could be reduced by nearly 35%**
- The integration between the various systems extends and amplifies the impact of idiosyncratic **inefficiencies**
- These inefficiencies were attributed to several factors, including the **ineffective gathering, sharing, and use of information**



"The problem lies not in technology, but in a lack of common objectives and an incomplete understanding of the importance of efficiencies in the planet's system, a united long-term view and a system for global optimization." – Economist, Asia Pacific

Sources: IBM Institute for Business Value "The world's 4 trillion dollar challenge", January 2010

1) IBM Institute for Business Value analysis based on 2009 survey of 518 economists.

Agenda

What is IBM Watson and why is it important?

How is IBM putting Watson to work?

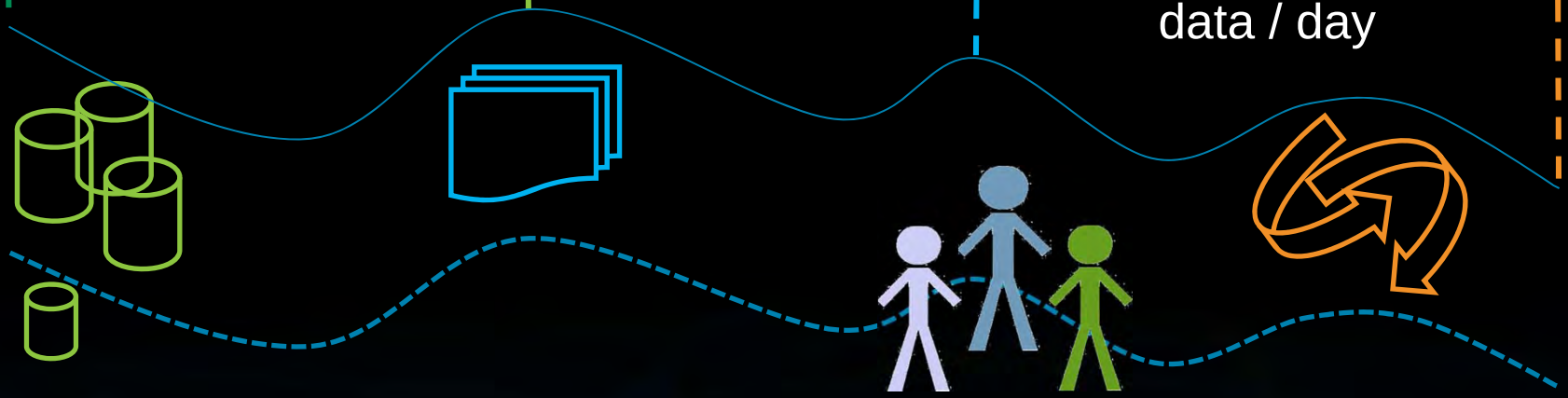
What can we expect in the future?

Businesses are "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

1 Trillion
connected devices generate 2.5 quintillion bytes data / day

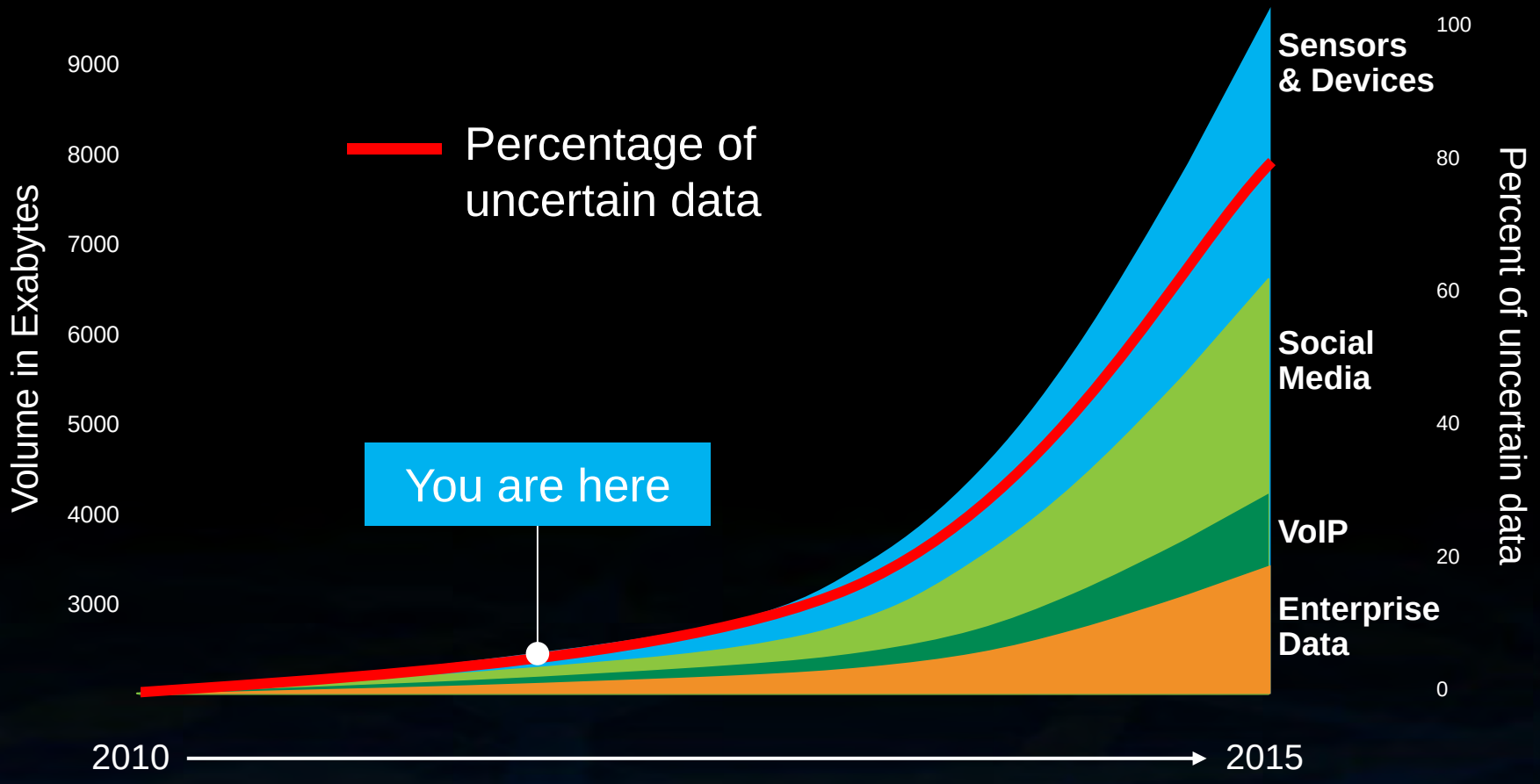


1 in 2
business leaders don't have access to data they need

83%
of CIOs cited BI and analytics as part of their visionary plan

2.2X
more likely that top performers use business analytics

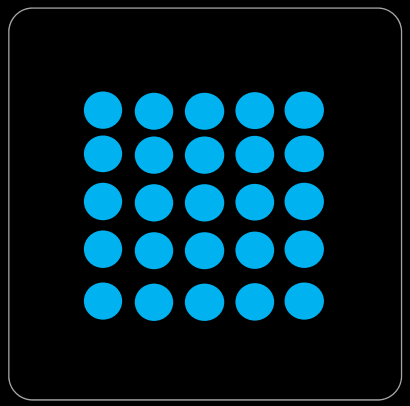
Big Data: this is just the beginning



Source: IBM Global Technology Outlook - 2012

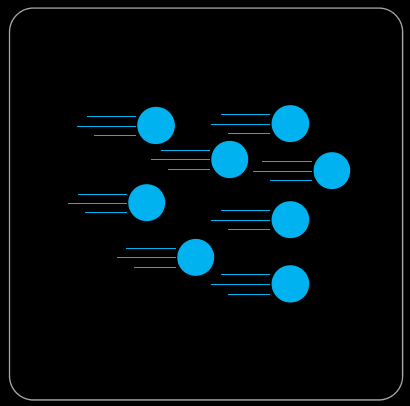
Big Data is more than just volume

Volume



Terabytes to exabytes of existing data to process

Velocity

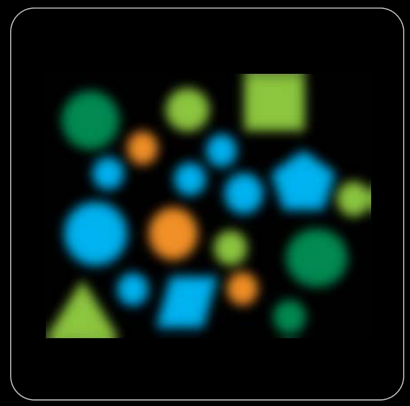


Streaming data, milliseconds to seconds to respond

Variety

Structured, unstructured, text and multimedia

Veracity



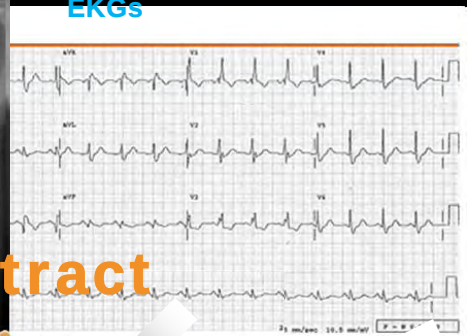
Uncertainty from inconsistency, ambiguities, etc.

Data in context unlocks insights

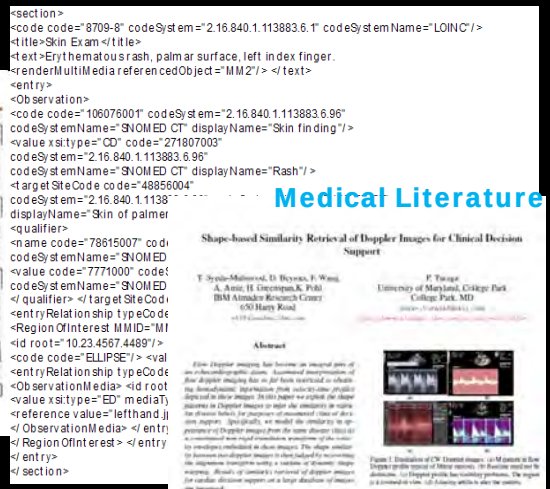
Radiology

Lab Reports

EKGs



Medical Records

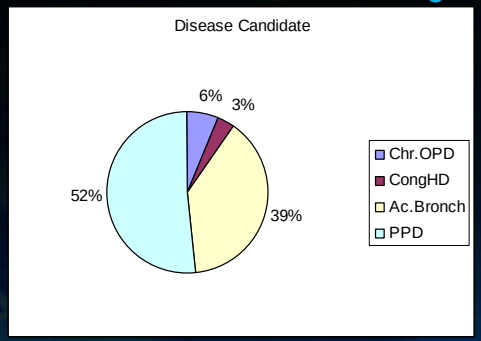


Medical Literature

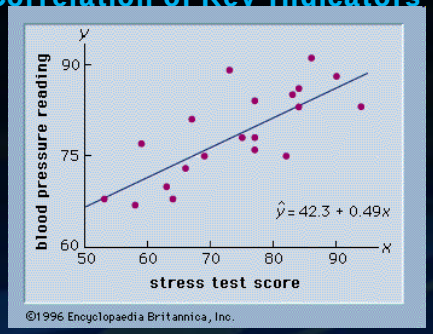
Extract

Integrate

Statistical Validation of Diagnoses



Correlation of Key Indicators

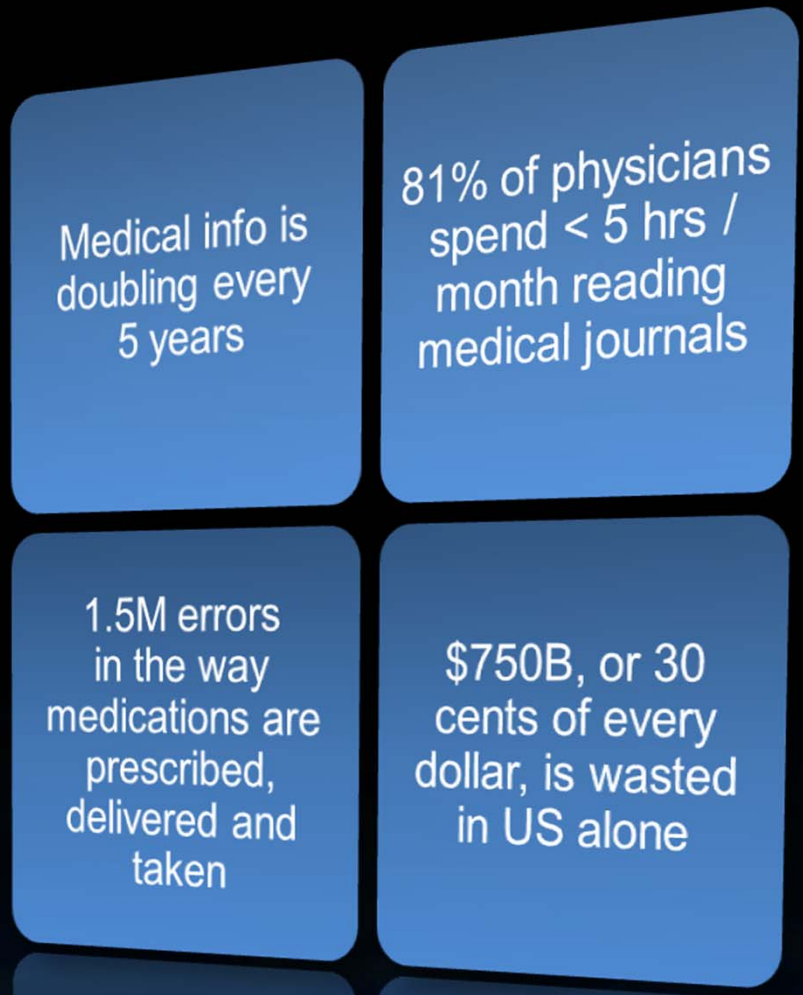


Optimized Treatments

Healthcare is “dying of thirst in an ocean of data”

“Medicine has become too complex. Only about 20% of the knowledge clinicians use today is evidence-based.”

Steven Shapiro
Chief Medical & Scientific Officer
University Pittsburgh Medical Center



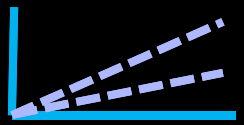
Cancer is an insidious disease

1 in 4

individuals will die from cancer

3X

rate cancer cost climbs vs. std. health costs or 15-18% / yr.



20%

of cancer cases receive the wrong diagnosis initially with some as high as 44%

$263.8B

overall costs of cancer in the US in 2010

$$$$$$$$$$$
$$$$$$$$$$$
$$$$$$$$$$$
$$$$$$$$$$$

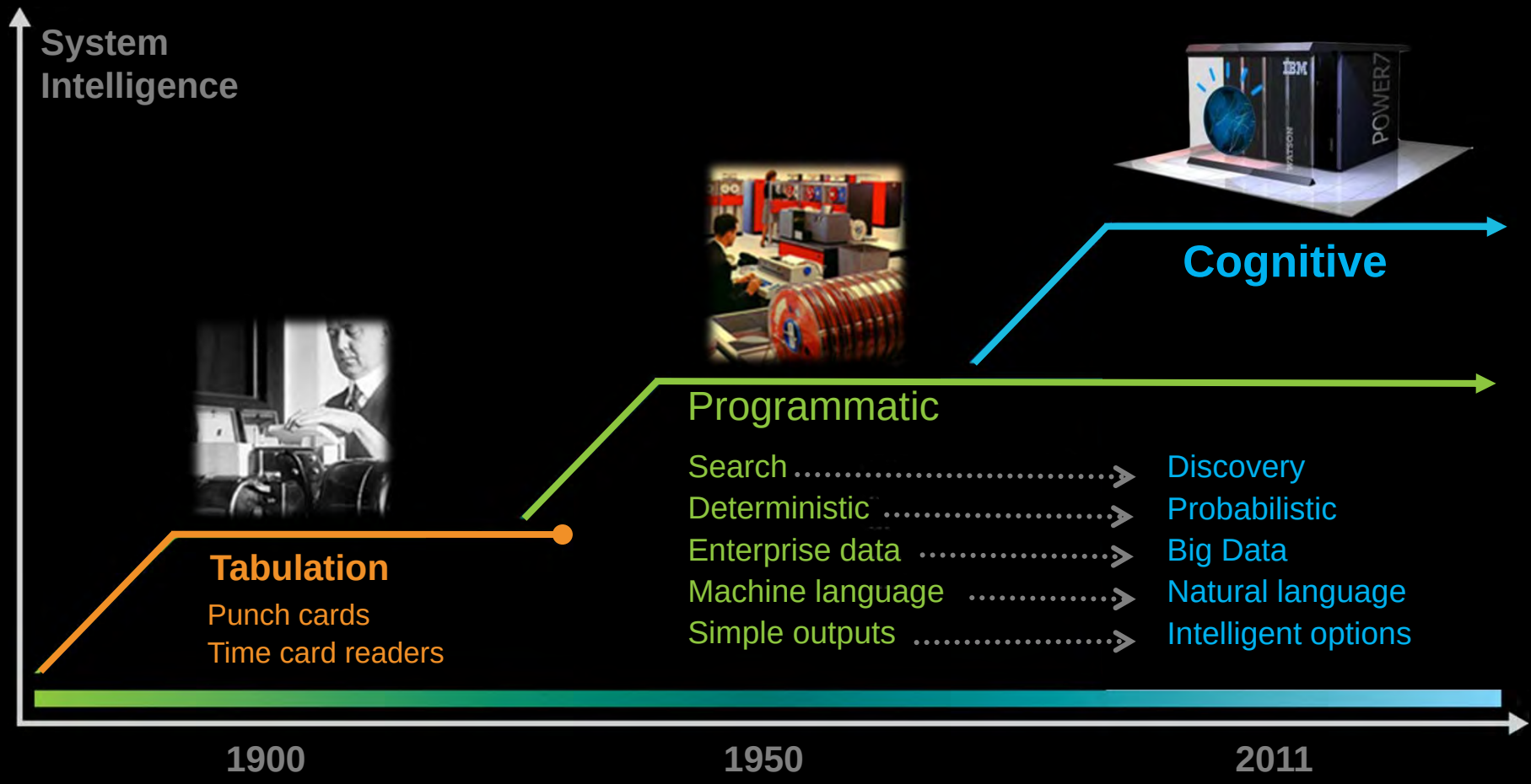
Cancer (US ONLY)	2011 New Cases (est.)	2011 Deaths	%
Respiratory	239320	161250	28%
Digestive	277570	139250	24%
Genital	338620	63980	11%
Breast	232620	39970	7%
Urinary	132900	28970	5%
Lymphoma	75190	20620	4%
Leukemia	44600	21780	4%
Oral	39400	7900	1%
Other	216450	88230	16%
TOTAL	1,596,670	571,950	100%

MEMORIAL SLOAN-KETTERING CANCER CENTER ESTABLISHED 1884 + IBM + WELLPOINT

Working Together to Beat Cancer

Source: American Cancer Society, National Health Institute

Watson is ushering in a new era of computing . . .



. . .enabling new opportunities and outcomes

Brief History of IBM Watson

IBM Research Project *(2006 –)*

R&D

Jeopardy! Grand Challenge *(Feb 2011)*

Demonstration

Watson for Healthcare *(Aug 2011 –)*

Commercialization

Watson for Financial Services *(Mar 2012 –)*

Expansion

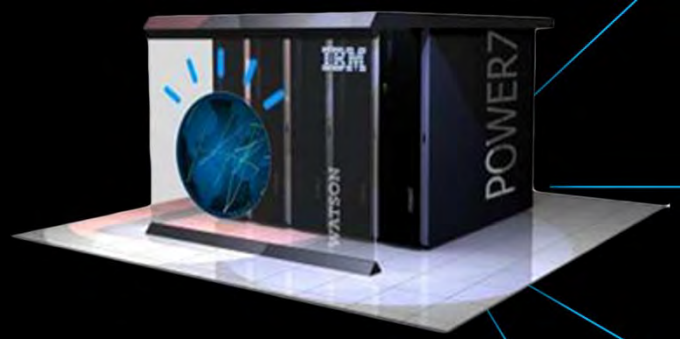
Watson Industry Solutions *(2012 –)*

Cross-industry Applications

A look behind the scenes

System Specifications

- 2880 Processing Cores
- 90 IBM P750 Servers
- 16 Terabytes Memory (RAM) – 20TB Disk
- 80 Teraflops (80 trillion operations per second)
- Workload Optimized Systems



IBM Technology Depth

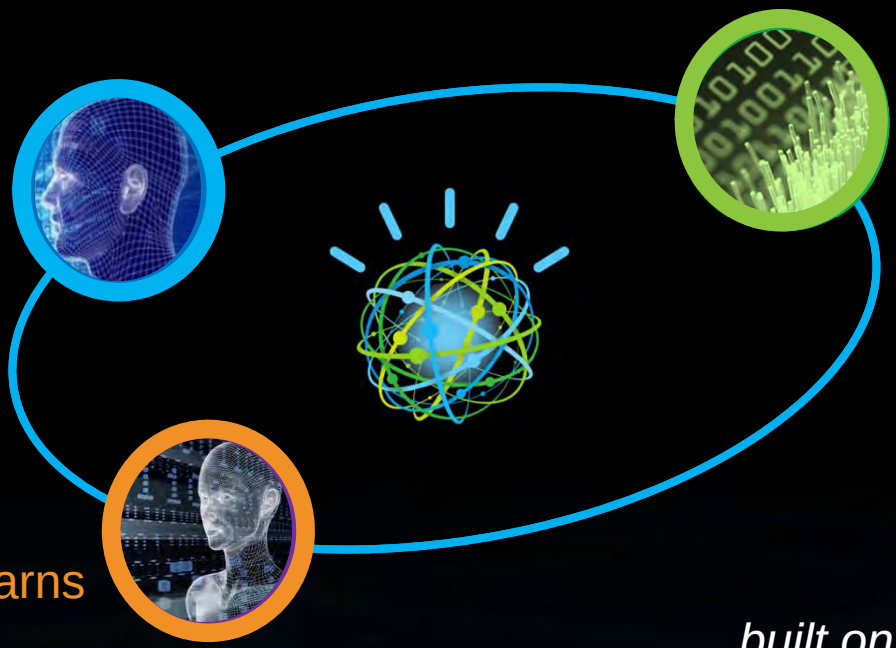
- Content Analytics
- Business Analytics
- Big Data
- Databases / Data Warehouses

In the past 5 years IBM has spent over $14B in analytical acquisitions and $6B in R&D annually

IBM Watson combines transformational technologies

1 Understands natural language and human communication

2 Generates and evaluates evidence-based hypothesis



3 Adapts and learns from user selections and responses

…built on a massively parallel architecture optimized for IBM POWER7

Watson enables three classes of cognitive services

Ask

- Leverage vast amounts of data
- Ask questions for greater insights
- Natural language inquiries
- e.g. - Next generation Chat

Discover

- Find the rationale for given answers
- Prompt for inputs to yield improved responses
- Inspire considerations of new ideas
- e.g. - Next generation Search → Discovery

Decide

- Ingest and analyze domain sources, info models
- Generate evidence based decisions with confidence
- Learn with new outcomes and actions
- e.g. - Next generation Apps → Probabilistic Apps

Watson for Healthcare solutions are build on repeatable assets

Solutions

Watson for Healthcare

TEACH
Enable new methods for teaching & medical training
Ex. Watson Oncology Research Advisor

PRACTICE
Enable research and delivery of evidence based medicine
Ex. Watson Oncology Diagnosis and Treatment Advisor

PAY
Enable the rapid evaluation and pre-auth. of medical treatment
Ex. Watson Utilization Management Advisor

ASK Services | **DISCOVER Services** | **DECISION Services**

Capabilities

NLP & Machine Learning
- Medical annotation
- Clinical feedback
- Medical based insights

Data
- Medical Journals / Articles / Text Books
- Research
- Clinical Trials
- Govt. / Industry guidelines

Analytics
- Data mining
- Optimized Algorithms
- Business Intelligence
- Text analytics

Cloud
- Public Cloud
- Private Cloud
- Hybrid Cloud
- Scalable
- Secure (e.g. HIPAA)

Mobile
- Healthcare Applet
- Smartphone/ Tablet based UI for clinicians

Workload Optimized Systems
- Massive parallel processing
- Tuned to unique Healthcare requirements

Platform

Content | Tooling | Methods | Algorithms | APIs

IBM Oncology Diagnosis and Treatment Advisor Demonstration

Shows how Watson can assist an Oncologist by:

- Synthesizing disparate data – patient records, clinician notes, test results, pathology reports, etc.
- Identifying missing pieces of data recommending tests with complete transparency
- Suggesting personalized, confidence-weighted, evidence-based options to improve quality of care and patient experience

Main Characters

Dr. Mark Norton:
Head of Thoracic Oncology

The Watson Oncology Treatment Advisor assists Dr. Norton in:

- Gaining insights into Mrs. Yamato's case and possible treatment options
- Reviewing suggested medical tests and supporting evidence
- Investigating new factors as they arise
- Advancing treatment considerations to conclusion
- Obtaining timely pre-authorization for the selected treatment plan

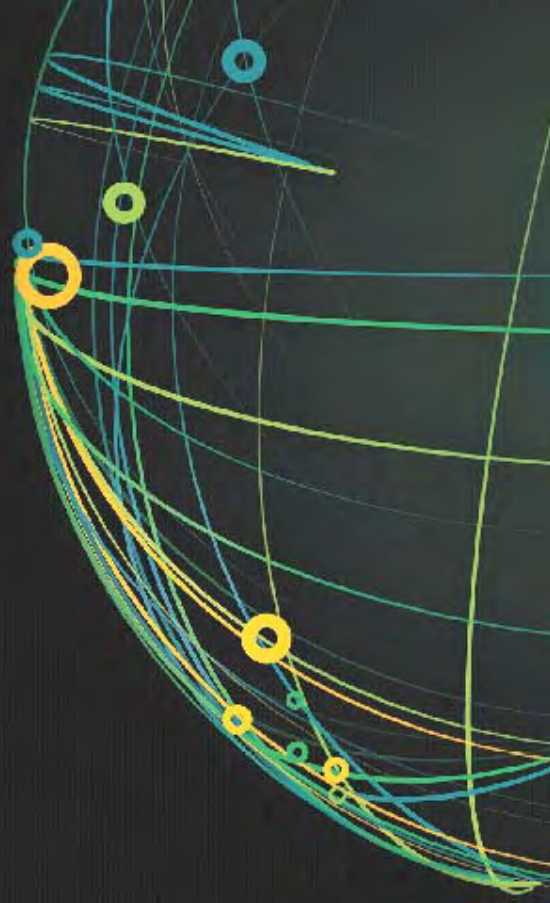
Lin J. Yamato:
Patient

Lin J. Yamato, a 37 year old Japanese woman who has never smoked, has been diagnosed with Lung Adenocarcinoma. She is consulting Dr. Norton to determine her treatment options.

IBM Watson Oncology Treatment Advisor

Putting IBM Watson to Work in Healthcare

IBM Watson Oncology Treatment Advisor



IBM WATSON

Lin J. Yamato

Gender: Female

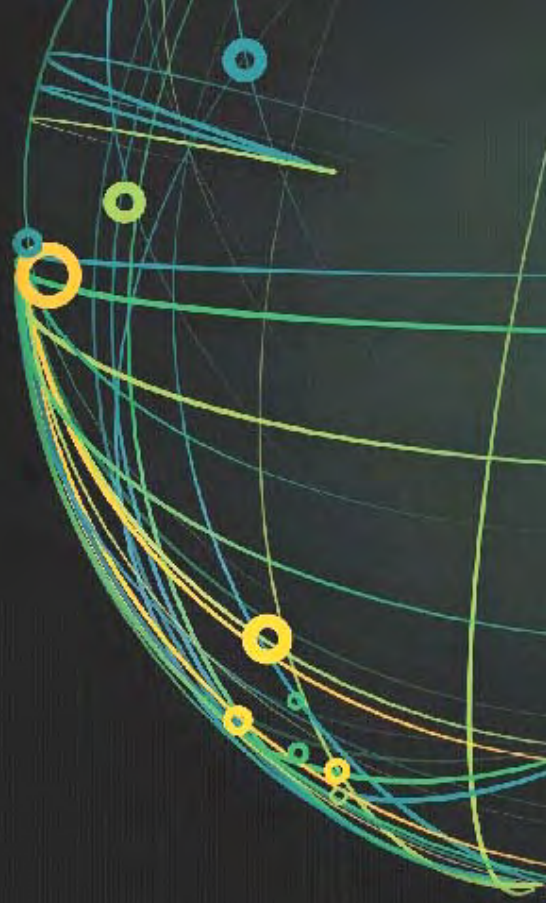
DOB: January 15, 1975 (37)

Place of Birth: Osaka, Japan

Current Condition

DX: Lung Adenocarcinoma

Smoking History: Never smoker



Case Information

The IBM Watson case information does not obviate the need to review the EMR record in detail

PATIENT	DEMOGRAPHICS	CURRENT CONDITION
Lin J. Yamato	**Gender:** Female	**DX:** Lung Adenocarcinoma
Patient ID: 000-0000	**DOB:** Jan 15, 1975 (37)	**Smoking History:** Never smoker
Provider ID: 00-0000-0	**Place of Birth:** Osaka, Japan	

Key Points

2/16/12 – Pathology report from CT biopsy of right adrenal gland: Metastatic adenocarcinoma; morphologically consistent with specimen 312-647 — EMR EVIDENCE

2/07/12 – CT chest/abdomen/pelvis with contrast: 1.7 cm lesion right adrenal gland suspicious for a metastatic deposit — EMR EVIDENCE

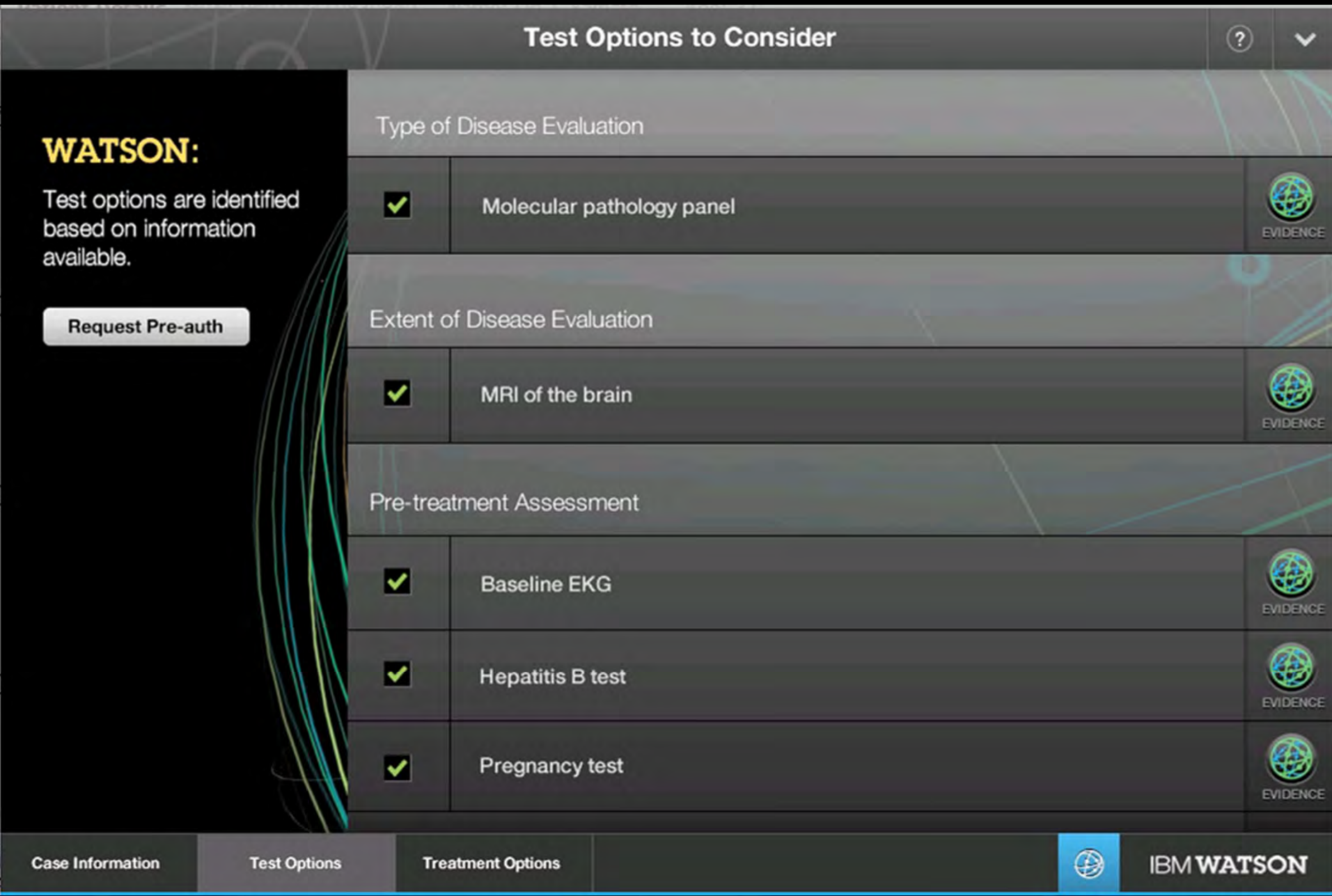
2/05/12 – CT chest without contrast: 3.1 cm lesion right upper lobe of lung suspicious for neoplasm — EMR EVIDENCE

2/03/12 – PCP visit note: dry cough - labored breathing — EMR EVIDENCE

Information Needed

Has the patient experienced any hemoptysis? — EMR EVIDENCE

Does the patient have normal hearing? — EMR EVIDENCE


Test Options to Consider
WATSON:
Test options are identified based on information available.
Request Pre-auth
Type of Disease Evaluation
Molecular pathology panel
EVIDENCE
Extent of Disease Evaluation
MRI of the brain
EVIDENCE
Pre-treatment Assessment
Baseline EKG
EVIDENCE
Hepatitis B test
EVIDENCE
Pregnancy test
EVIDENCE
Case Information
Test Options
Treatment Options
IBM WATSON

WATSON

Test options a
based on info
available.

Request Pre-

Molecular pathology panel

Supporting Evidence

Due to frequent presence of driver mutations in patients with lung cancers, it is recommended that all patients are tested for EGFR, KRAS, ALK mutations.

References

NCCN Guidelines™ Version 3.2011 NSCL-13:
EGFR mutation testing (category 1)

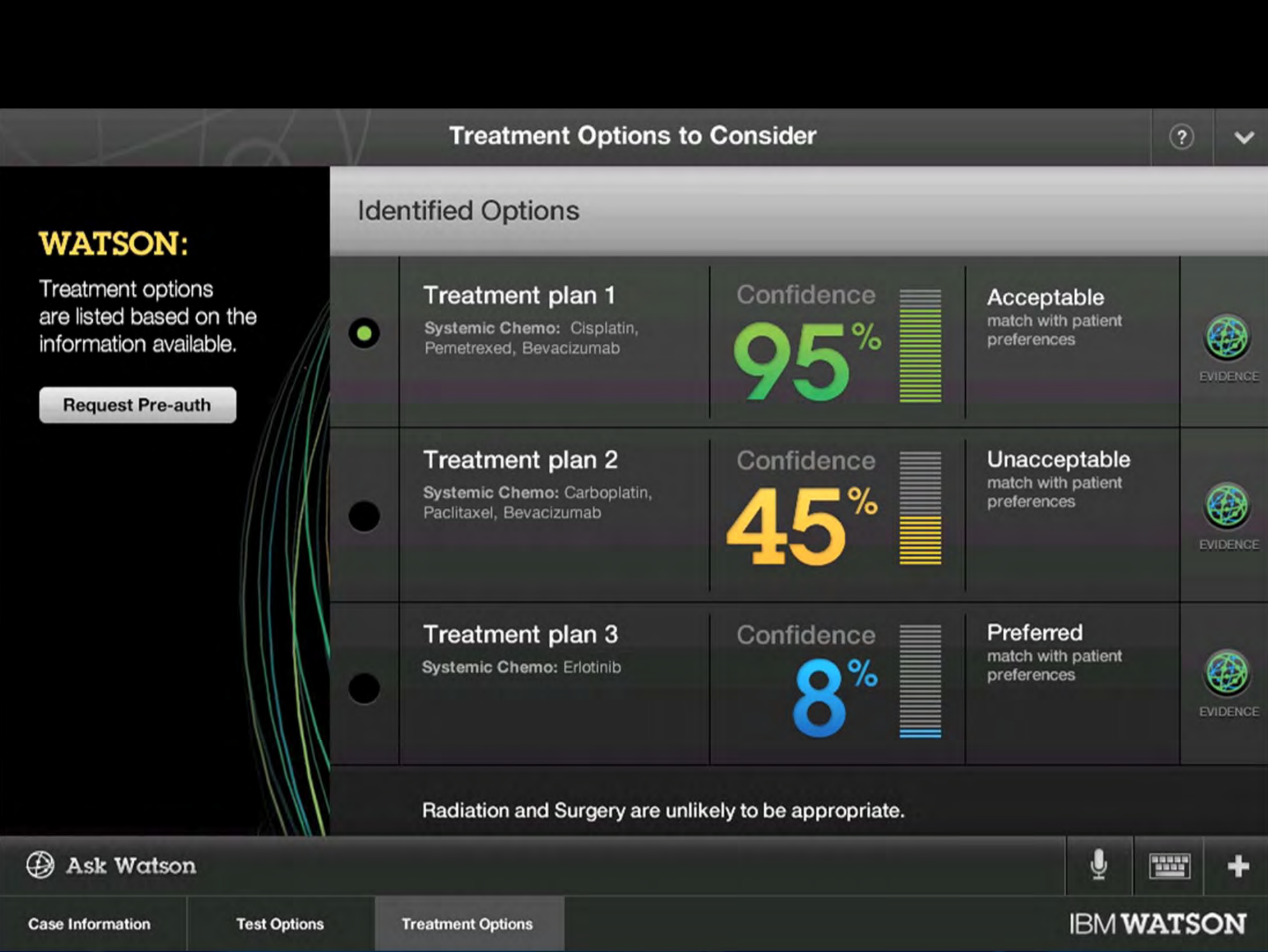
VIEW
REMOVE

Memorial Sloan-Kettering Cancer Center Best Practice:
Test for KRAS in addition to EGFR and ALK

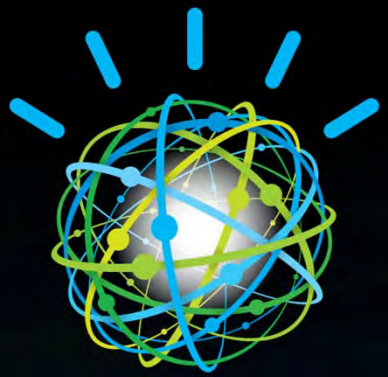
VIEW
REMOVE

D' Angelo et al.. Incidence of EGFR exon 19 deletions and L858R in tumor speciments from men and cigarette smokers with lung adenocarcinomas. *Journal of Clinical Oncology*. 2011 May; 20; 29(15): 2066–70

VIEW
REMOVE

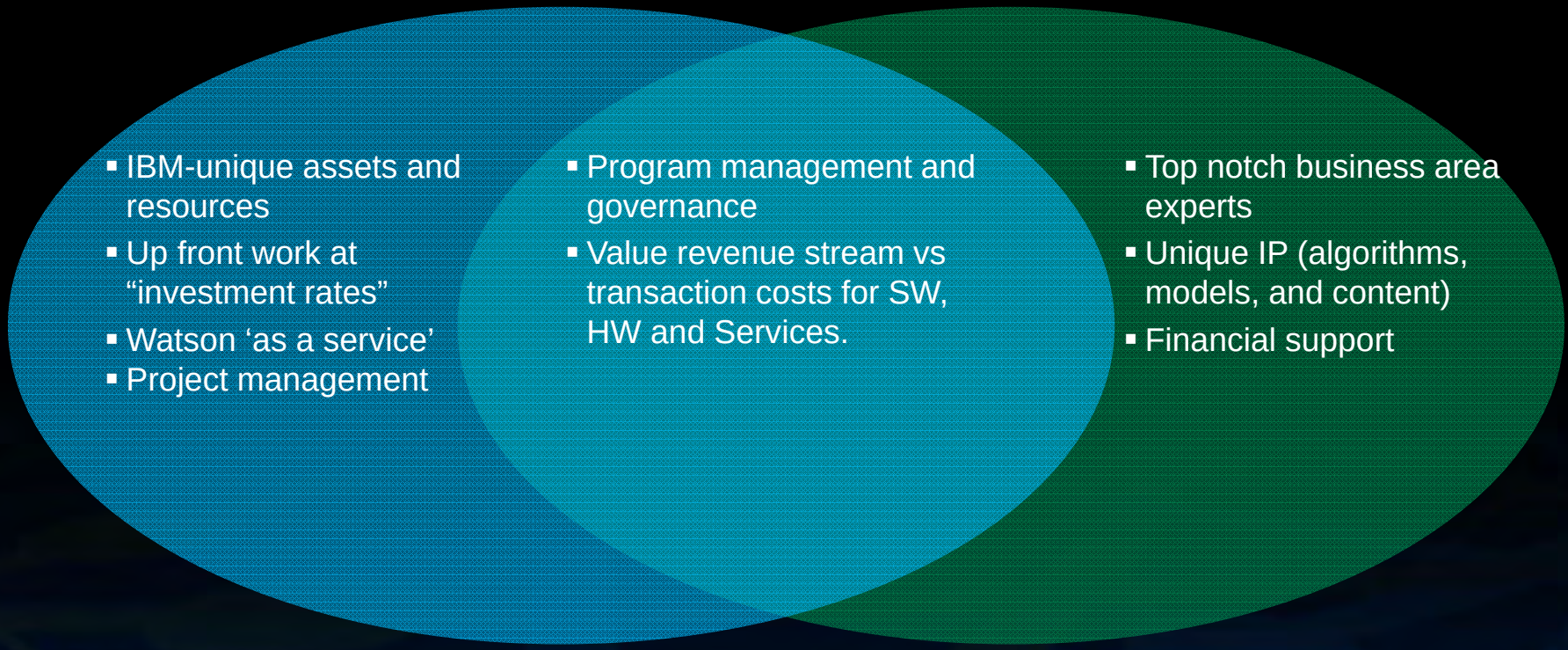

Treatment Options to Consider
WATSON:
Treatment options are listed based on the information available.
Request Pre-auth
Identified Options
Treatment plan 1
Systemic Chemo: Cisplatin, Pemetrexed, Bevacizumab
Confidence
95%
Acceptable
match with patient preferences
EVIDENCE
Treatment plan 2
Systemic Chemo: Carboplatin, Paclitaxel, Bevacizumab
Confidence
45%
Unacceptable
match with patient preferences
EVIDENCE
Treatment plan 3
Systemic Chemo: Erlotinib
Confidence
8%
Preferred
match with patient preferences
EVIDENCE
Radiation and Surgery are unlikely to be appropriate.
Ask Watson
Case Information
Test Options
Treatment Options
IBM WATSON

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



- Transforming how organizations think, act, and operate
- Learning through interactions
- Delivering evidence based responses driving better outcomes

Partnership with IBM on Watson is a unique opportunity



IBM Watson goes to work in healthcare

1. Accelerate Time to Clinical Insights

Support researchers and clinicians in discovery of new cancer therapies

2. Improve Decisions and Outcomes

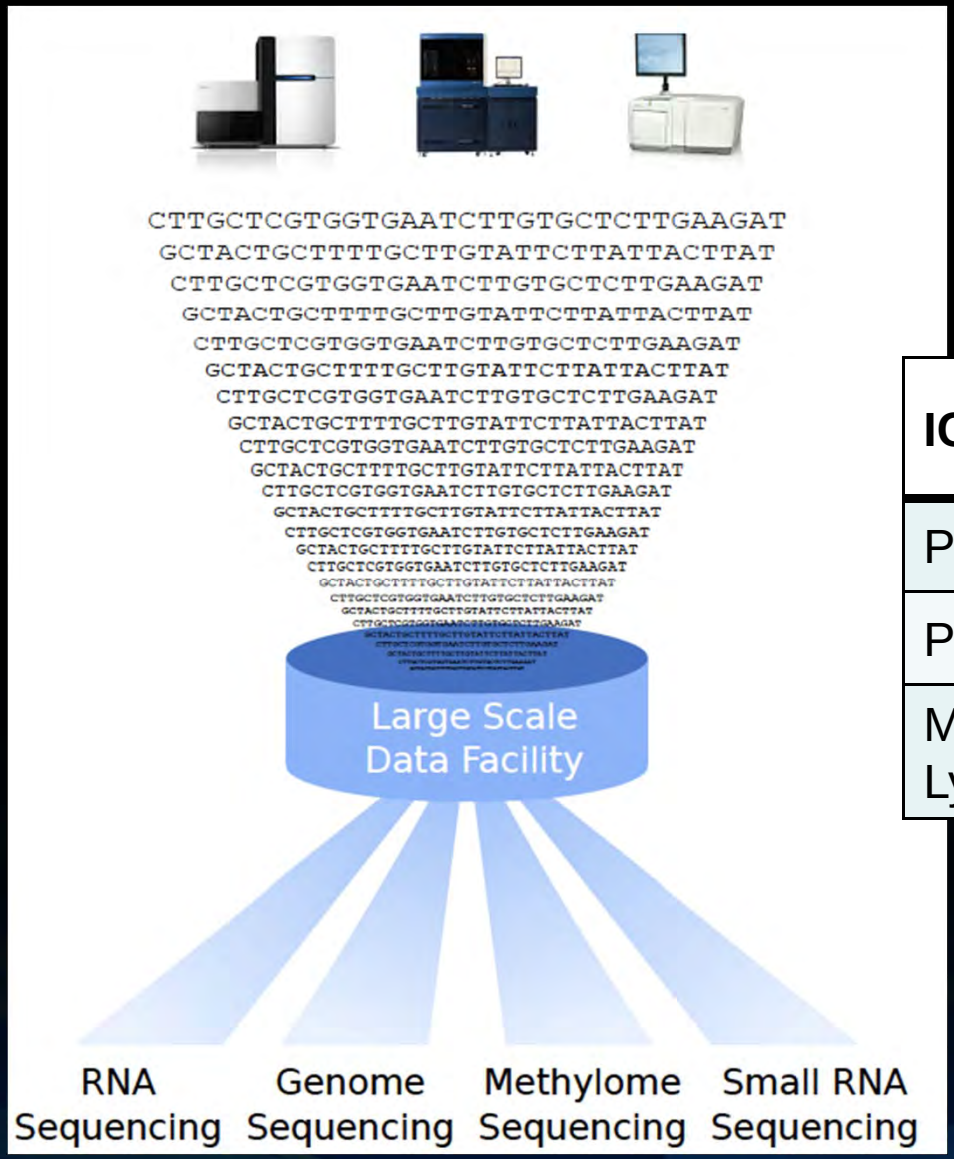
Assist physicians and care providers with evidence based diagnosis and treatment

MEDICAL RESEARCH

MEDICAL PRACTICE & PAYMENTS

Ultimate Goal: Become the Most Essential Company

Gesamtgenomanalyse stellen hohe technologische Anforderungen



ICGC Projekte	Patienten / Proben	Speicher -bedarf
PedBrain Tumor	600/1200	6 PB
Prostastat	300/600	2 PB
Malignant Lymphoma	300/600	2 PB

Source: Prof. Eils, DKFZ

IBM Watson can help healthcare payers streamline pre-approvals

Faster pre-approvals can lead to

better patient care and outcomes

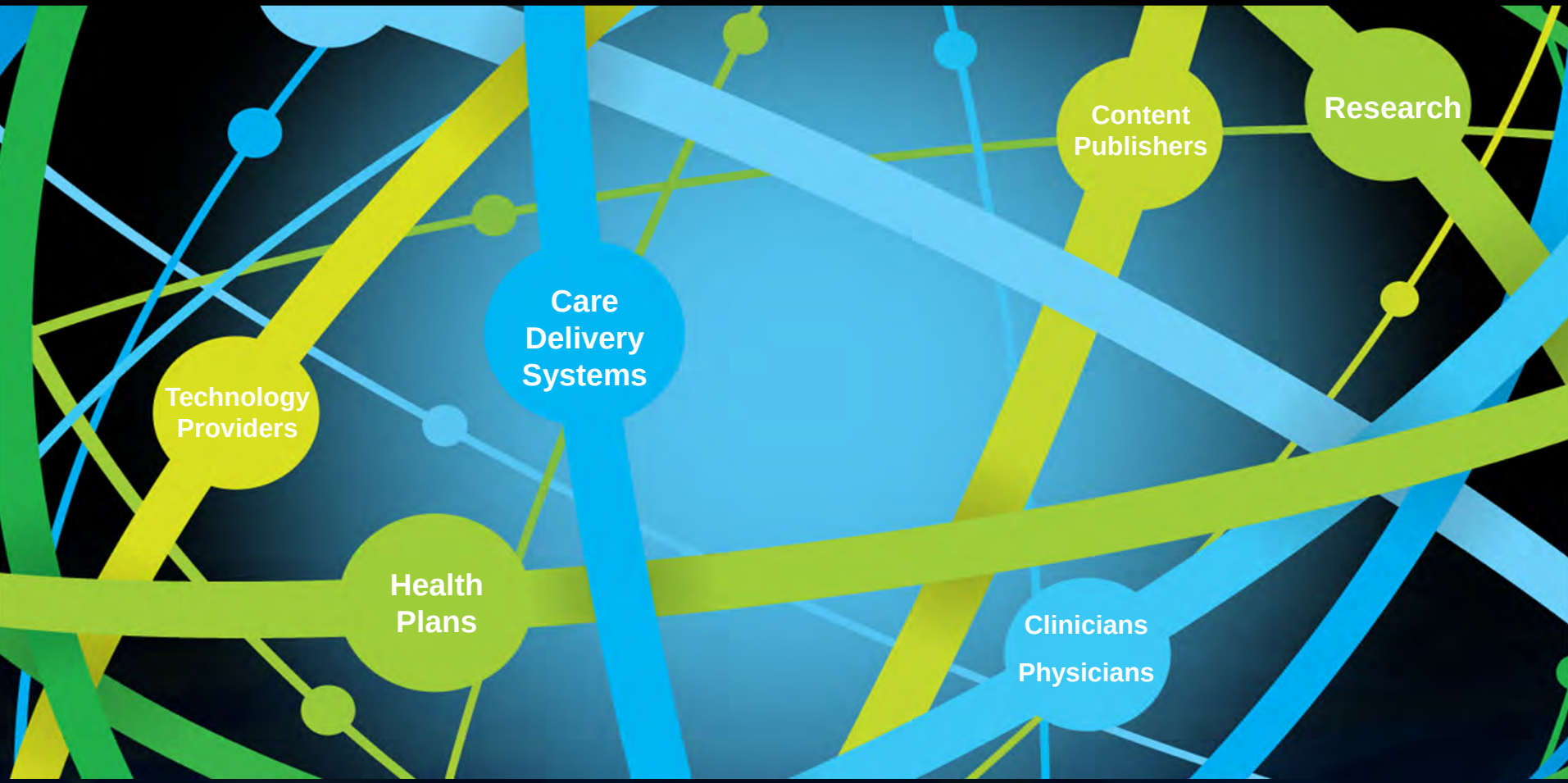
Business problem:

Need to support clinicians in the review and authorization of medical procedures and treatment

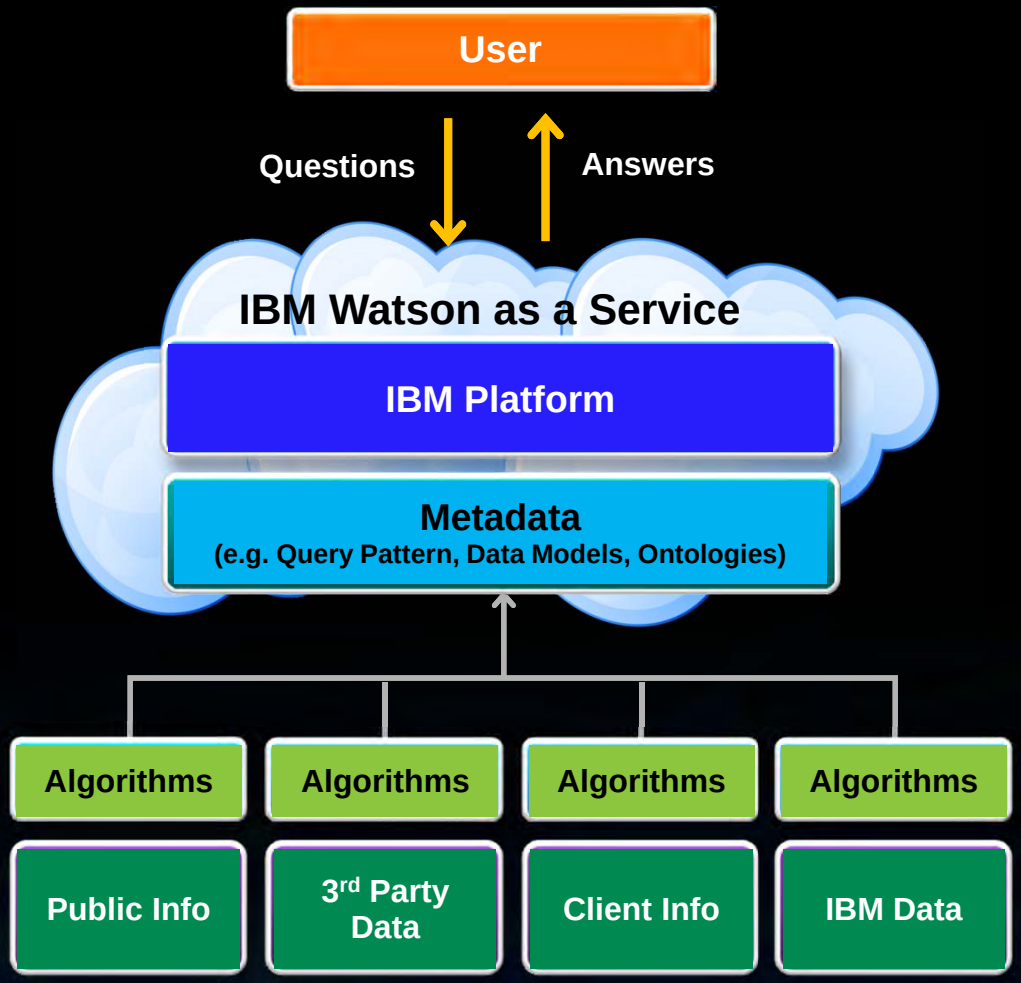
Solution:

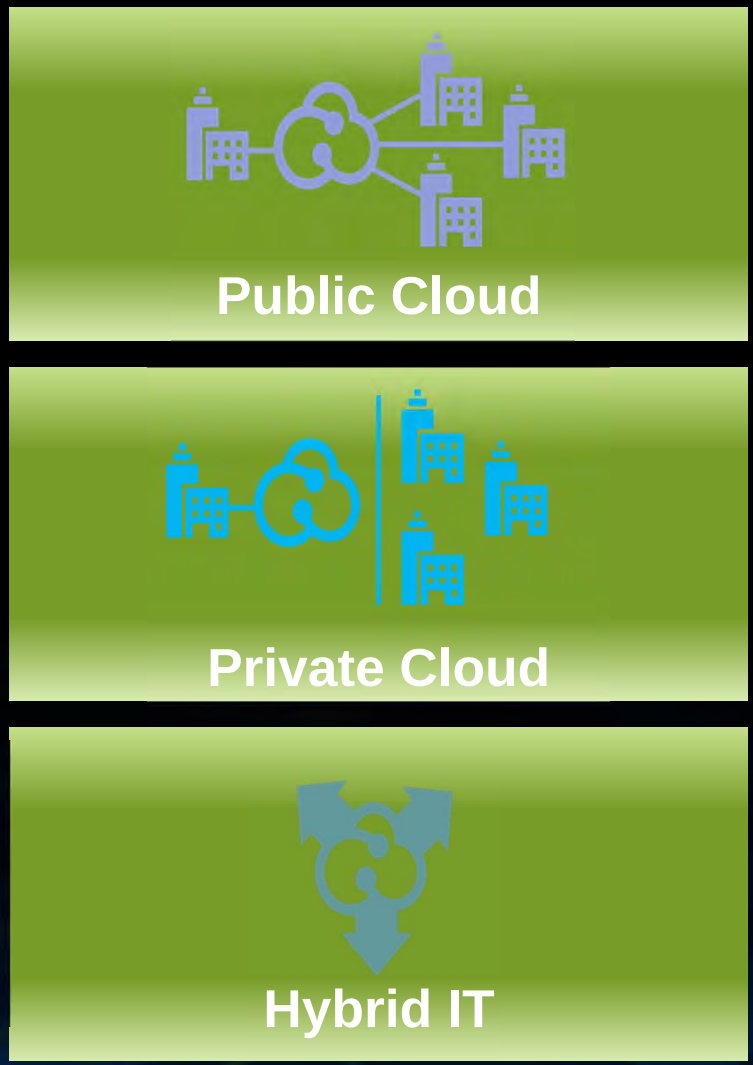
- Objective review of requested procedure based on clinical, medical, and patient data
- Actionable, confidence-weighted analysis based on relevant content, policies, and guidelines
- Prompt for additional information and learn from experience

It takes a community to change the world…



IBM Watson Is delivered as a service accessible through the cloud





2012 Watson Faculty Awards

The Goal:

Build curricula and courses to support skill development

The Offering:

Award recipients announced last week

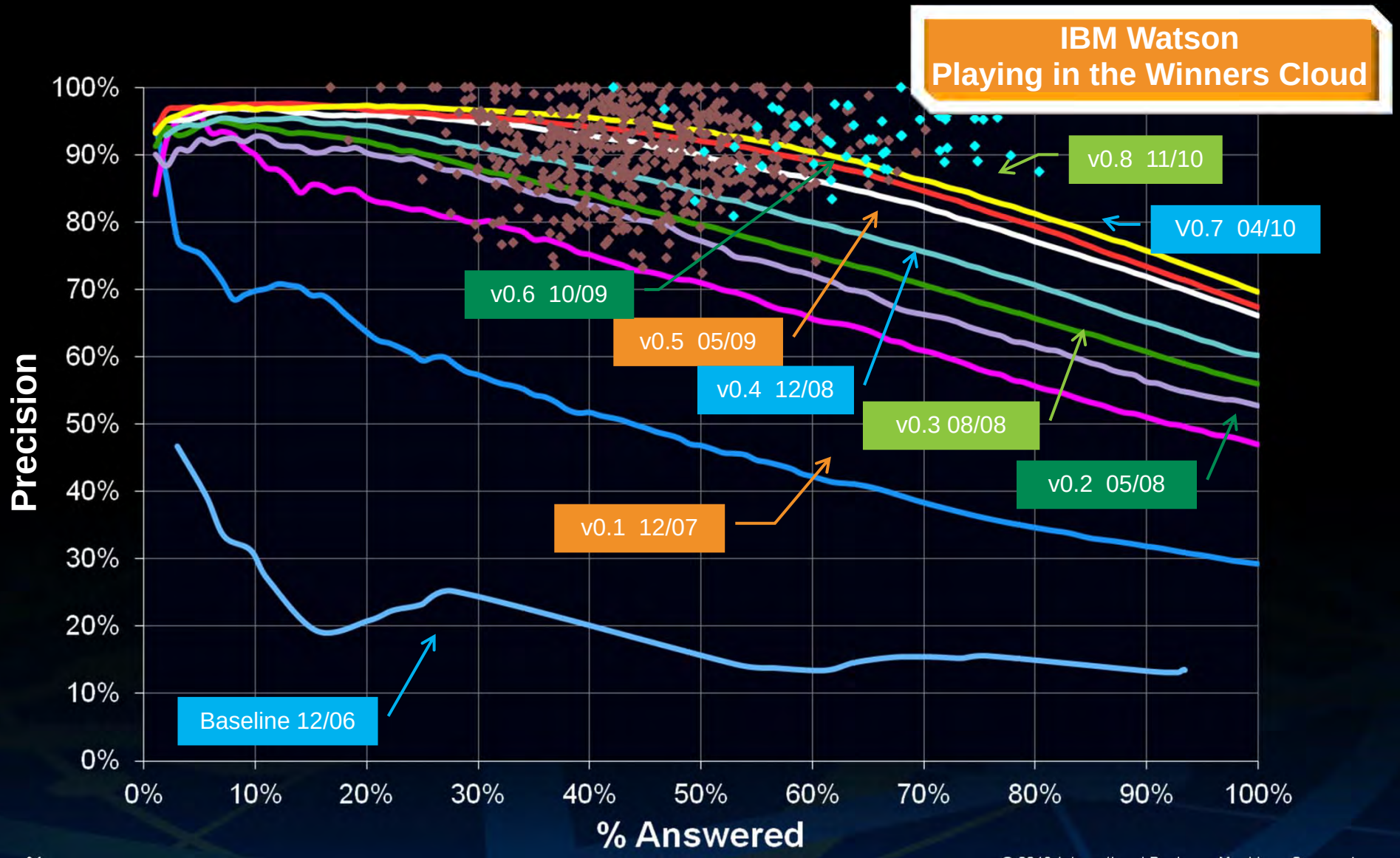
Status:

- Curricula and course work to start soon

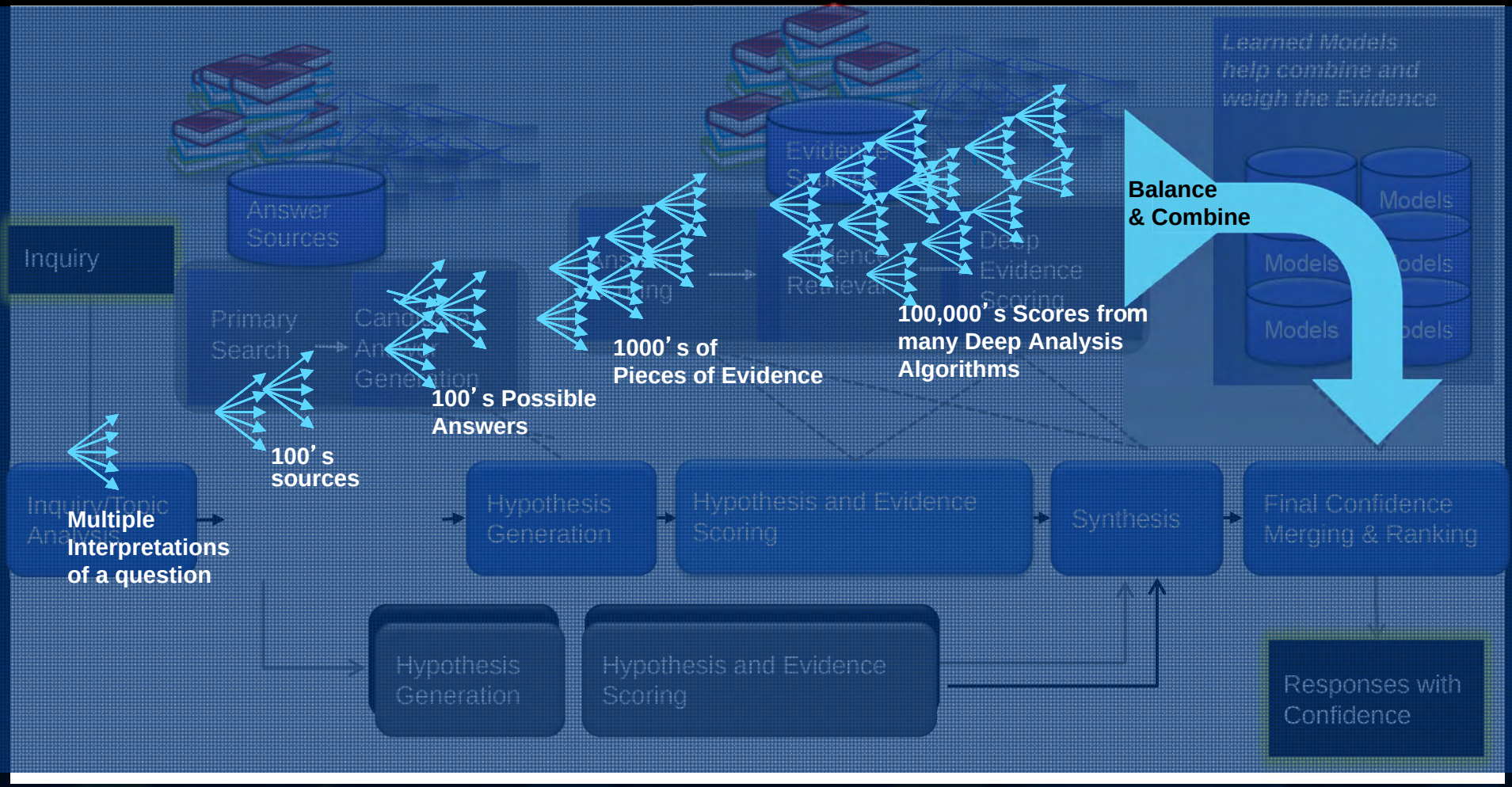
2012 Awards

- Raja Sooriamurthi, Carnegie Mellon University (CMU) -
- Andrew Rosenberg, City University of New York City (CUNY)
- Nitesh Chawla, University of Notre Dame
- Wullianallur Raghupathi, Fordham University
- Heng Ji, University of New York City (CUNY)
- Andrey Soares, Southern Illinois University
- Diego Klabjan, Northwestern University
- Girish Punj, University of Connecticut (UCONN
- Zsuzsanna Fluck, Michigan State University (MSU)
- Noushin Ashrafi, University of Massachusetts

Watson made incremental progress in precision and confidence



How Watson works: DeepQA Architecture



Interns

2013 Jobs Posted

The Goal:

Build skills and identify potential permanent candidates

The Offering:

Offer business and technical summer internships in IBM Watson Solutions.

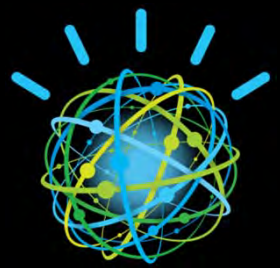
Status:

•2012 interns were a great success. 17 interns worked in Watson Solution Development and Marketing on a variety of projects.

•2013 internships are posted on IBM.com

IBM Watson Postgraduate Internship - Job ID: SWG-0513642 - Cognitive Software Engineers into the Watson Solutions teams in Littleton, MA, Rochester, MN, Raleigh, NC and Austin, TX. To be eligible: Must have a BS, MS or advanced degree within the last 18 months, or they are graduating in 2012 or 2013.

IBM Watson Undergraduate Internship - Job ID: SWG-0513643 - Cognitive Software Engineers into the Watson Solutions teams in Littleton, MA, Rochester, MN, Raleigh, NC and Austin, TX. This position is for Bachelors degree candidates (Students who have completed their Bachelors/BS degree are not eligible for this posting and should only apply to SWG-0513642 IBM Watson Postgraduate Internship).



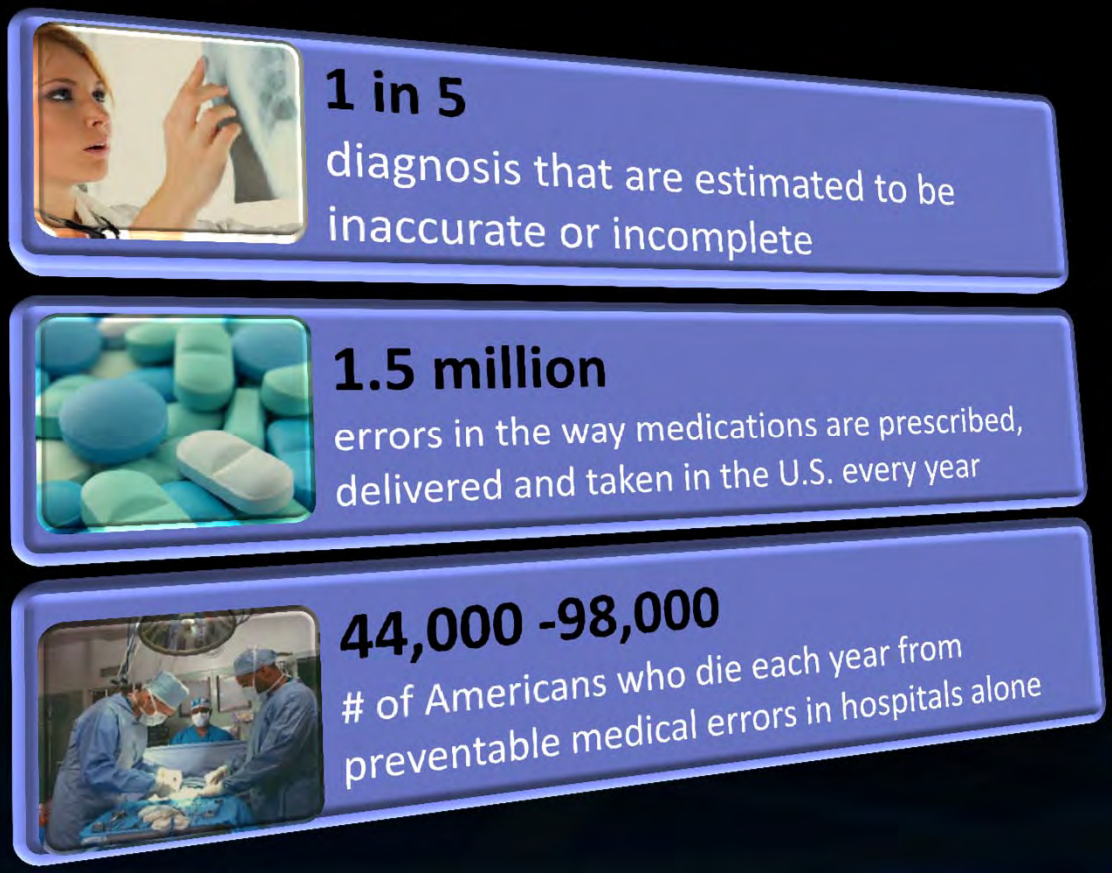
Components:

- Online application

Intern projects

Healthcare faces some of the most complex information challenges

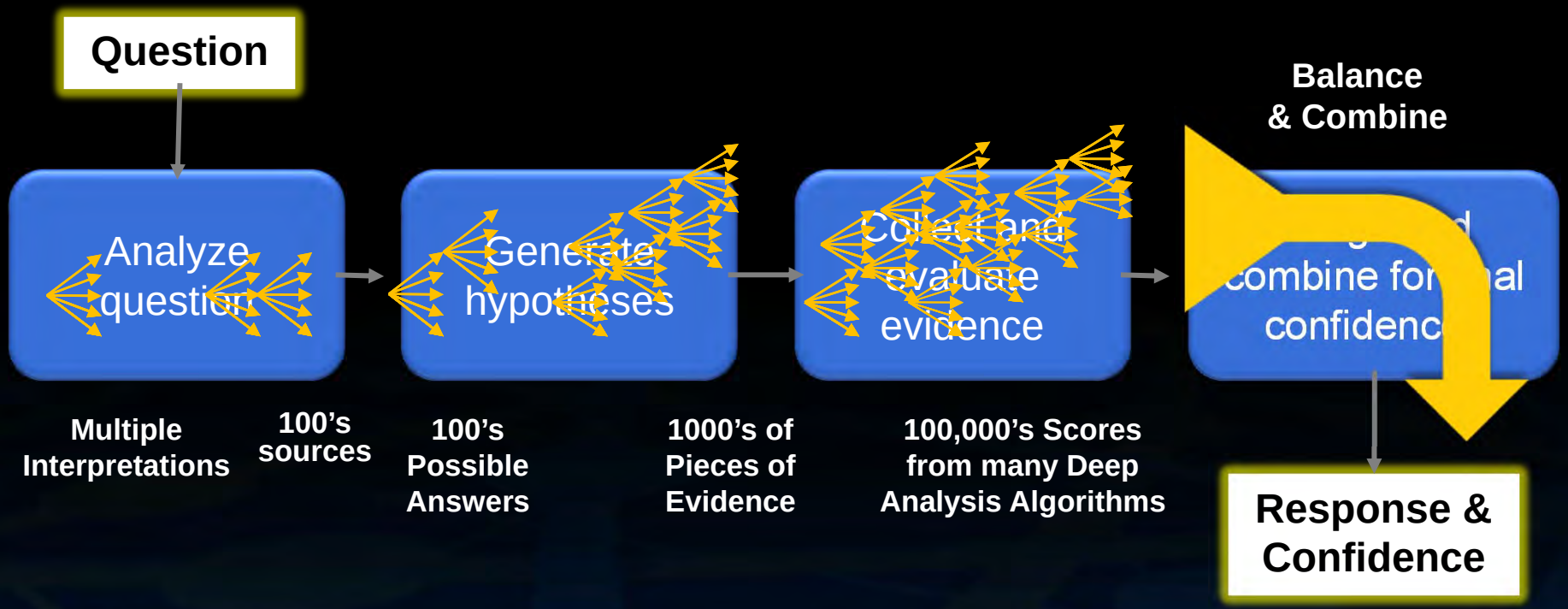
- Medical information is doubling every 5 years, much of which is unstructured
- 81% of physicians report spending 5 hours or less per month reading medical journals



"Medicine has become too complex. Only about 20% of the knowledge clinicians use today is evidence-base."

Steven Shapiro, Chief Medical & Scientific Officer, UPMC

How Watson works: parse, hypothesize, evaluate, and respond



Data volume is expanding at an incredible rate

…data will grow 800% in the next five years

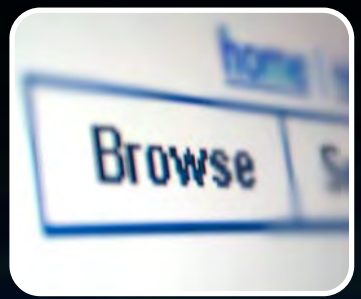
…Unstructured data grows 10-50X faster than structured

Data is getting more social. . .

…20M articles on Wikipedia

…30B pieces of Facebook content are shared monthly

…There are 156M public blogs



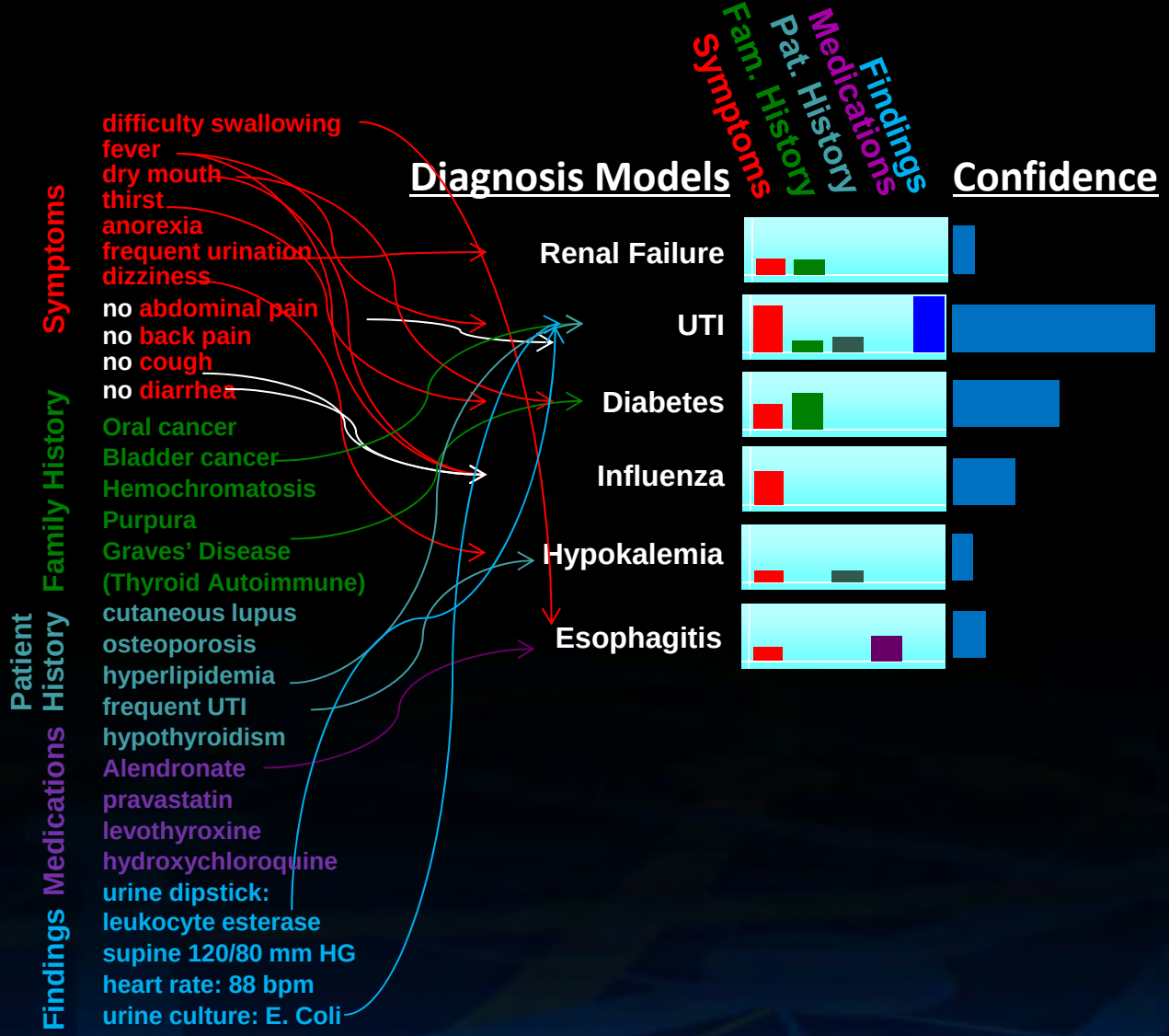
There are over 2.3B people on the Web today ...

… and a trillion connected objects – cars, appliances, cameras, roadways, pipelines

These cognitive services deliver net new business value

	Ask	Discover	Decide
Features	• Natural language • Identify relevant responses	• Adv. Analytics • Validate actions through outcomes	• Decipher complex cases • Prioritize candidate actions
Attributes	• Q&A Platform / Chat • 90% shared content	• Research App. • Learning platform • Custom and shared content	• Decision support application • Analysis platform • Custom content
Benefits	• Improved interactions • Improved client satisfaction	• Accelerate time to market • Better outcomes via better insights	• Evidence-based decisions • Personalize actions

Acting at the point of impact can be life changing



Big Data is creating new possibilities and insights fueled by analytics

Volume

12 terabytes

of Tweets create daily

Analyze product sentiment

Velocity

5 million

trade events per second

Identify potential fraud

Variety

100's video feeds

from surveillance cameras

Monitor events of interest

350 billion

meter readings per annum

Predict power consumption

500 million

call detail records per day

Prevent customer churn

80% data growth

are images, video, documents…

Improve customer satisfaction