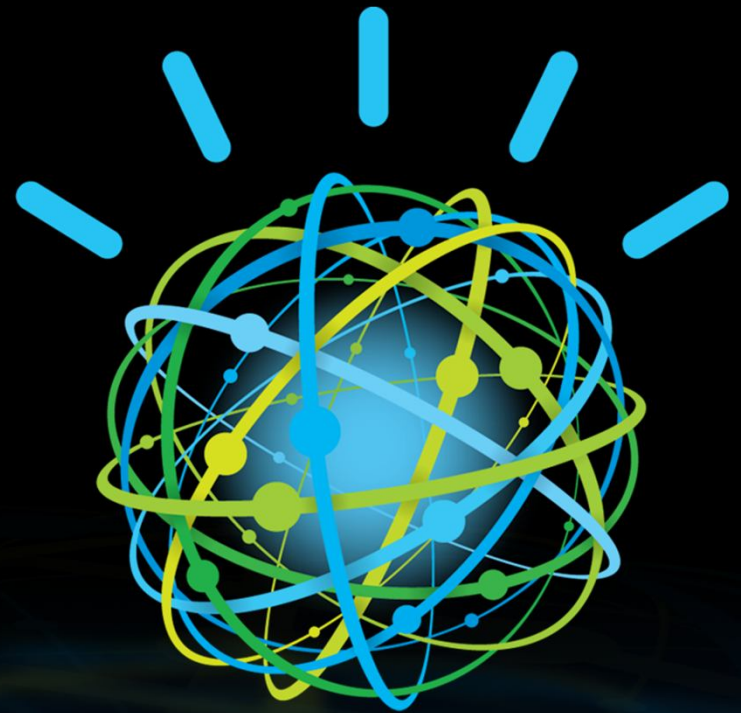




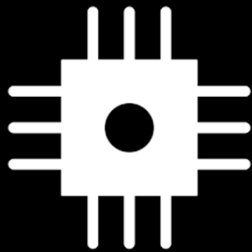
WATSON

Martin S. Kohn, MD, MS, FACEP, FACPE
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IBM Research
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Putting IBM Watson to Work In Healthcare

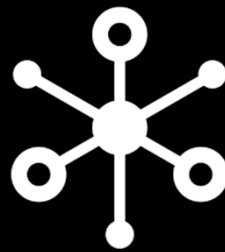


On a smarter planet, **everyone is connected to everything.**



Instrumented

Over 10 billion CPUs were produced in 2008, up 1000% in 8 years.



Interconnected

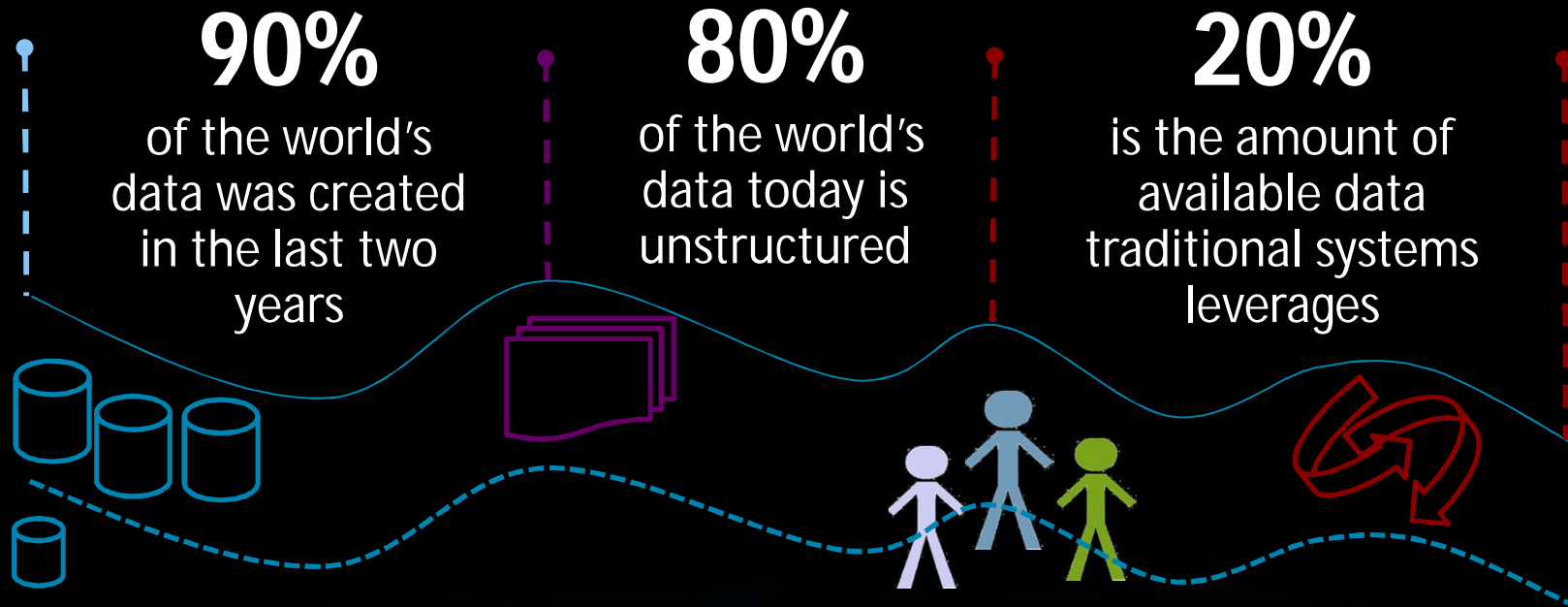
2 billion people will be on the Web by 2011... with a trillion connected objects.



Intelligent

Stockholm leverages GPS data to predict traffic – reducing congestions and emissions.

Businesses on a Smarter Planet are "dying of thirst in an ocean of data"



1 in 2

business leaders don't have access to data they need

83%

of CIO's cited BI and analytics as part of their visionary plan

54%

of companies use analytics for competitive advantage

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



Medical information is doubling every 5 years, much of which is unstructured



81% of physicians report spending 5 hours or less per week reading medical journals



1 in 5

diagnosis that are estimated to be inaccurate or incomplete



1.5 million

errors in the way medications are prescribed, delivered and taken in the U.S. every year



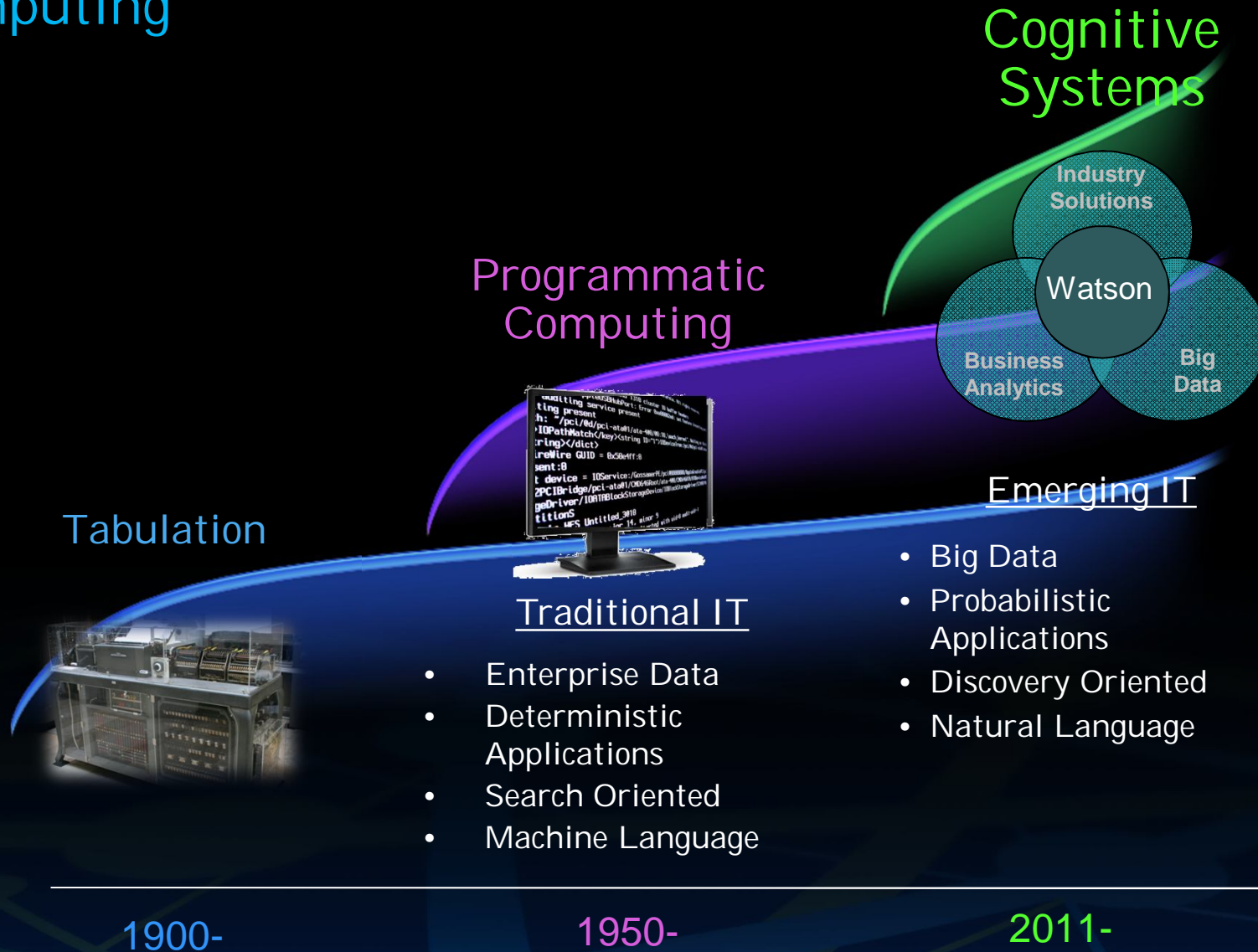
44,000 -98,000

of Americans who die each year from preventable medical errors in hospitals alone

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

Steven Shapiro, Chief Medical & Scientific Officer, UPMC

Learning systems are ushering a new era of computing

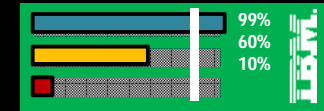
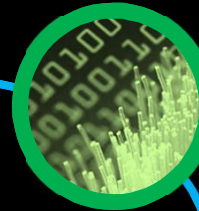


IBM Watson brings together a set of analytic technologies to drive optimized outcomes

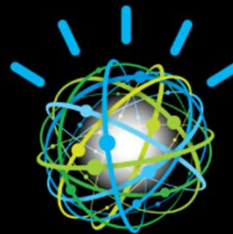
1 Understands natural language and human speech



2 Generates and evaluates hypothesis for better outcomes



3 Adapts and Learns from user selections and responses



...built on a massively parallel probabilistic evidence-based architecture optimized for POWER7

So why is it so hard for computers to understand humans

- Noses that run and feet that smell?
- Ship by truck and send cargo by ship?
- How can a slim chance and a fat chance be the same, while a wise man and a wise guy are opposites?
- How can a house can burn up as it burns down?
- Why do we fill in a form by filling it out?
- How does an alarm go off by going on?

Welch ran this?

Person	Organization
L. Gerstner	IBM
J. Welch	GE
W. Gates	Microsoft

" If leadership is an art then surely Jack Welch has proved himself a master painter during his tenure at GE. "

IBM Watson goes to work in Healthcare

What if ...

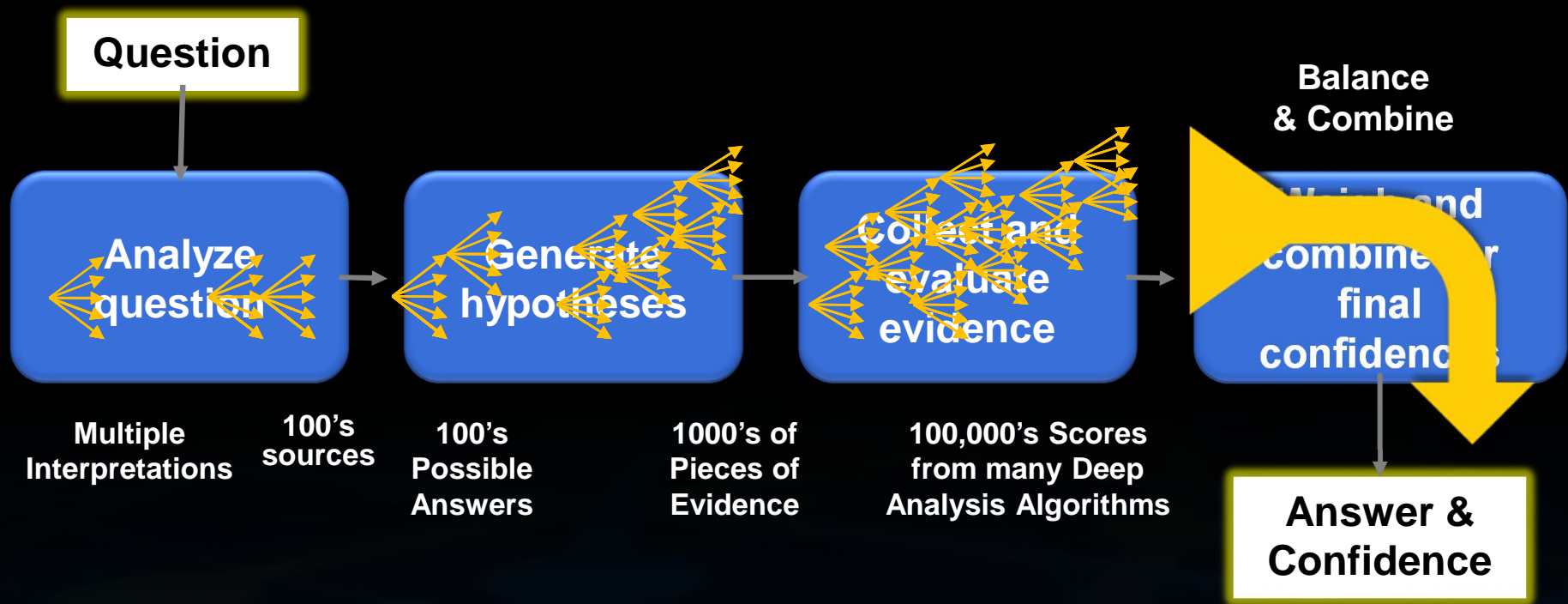
healthcare could leverage the latest insights improving the quality of patient care while lowering costs?

- Deep diagnosis and treatment assistance for physicians
- Improved clinical outcomes based on confidence based responses
- Extended data assessment based on research, clinical, medical, market and patient data
- Applied learning based on action taken and outcome derived



How Watson Works:

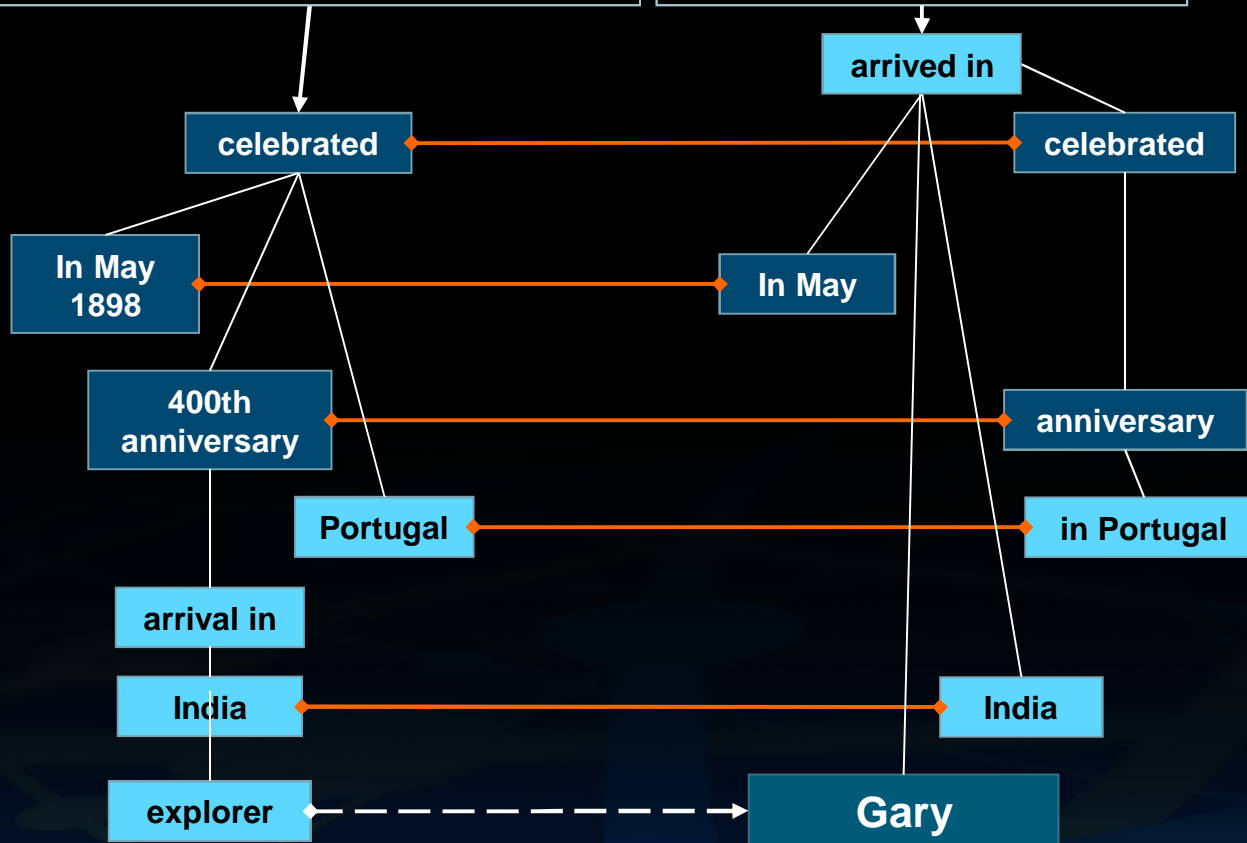
Parse request, generate hypotheses, evaluate evidence, and respond with confidence



Answering complex natural language questions requires more than keyword evidence

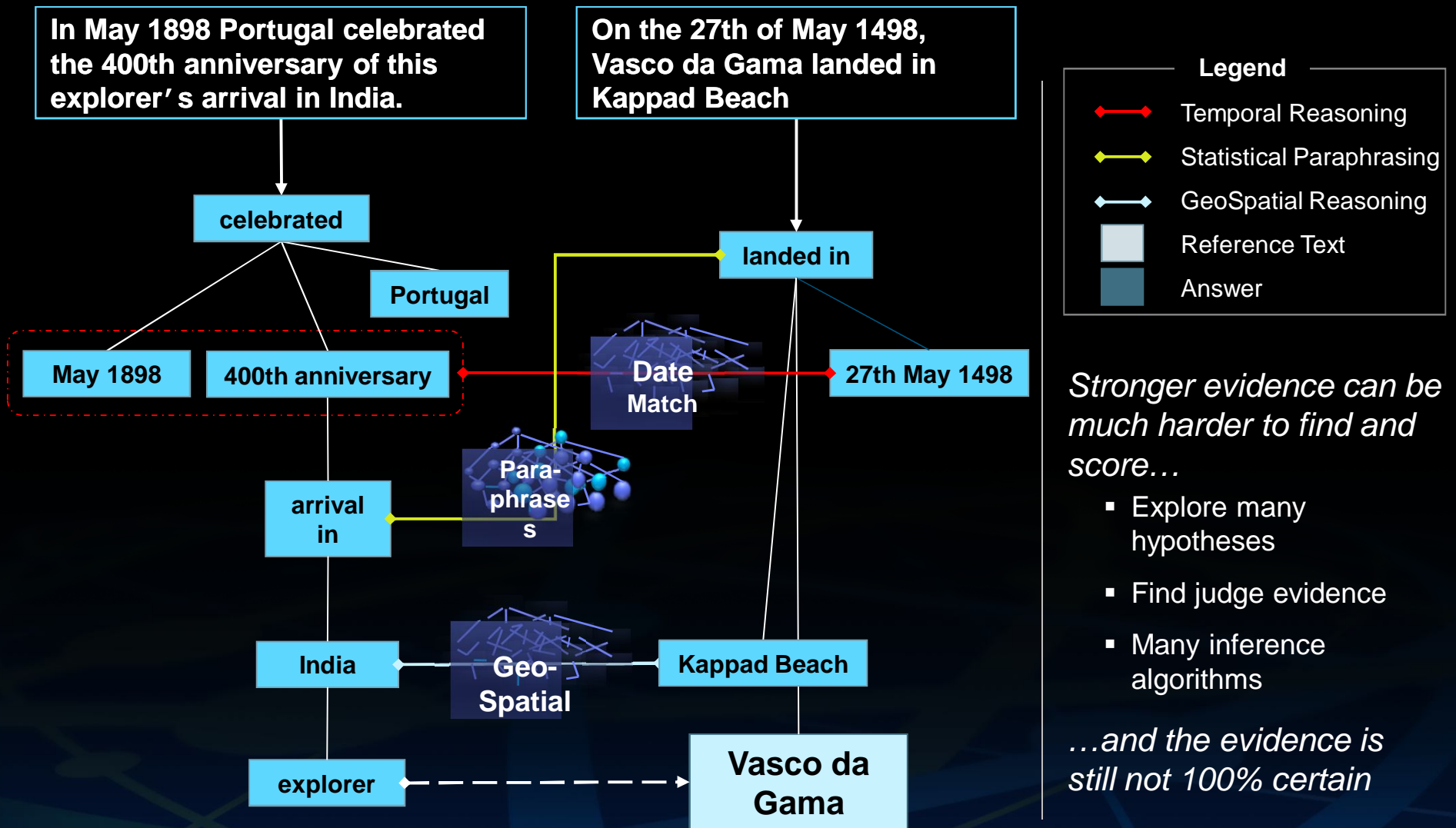
In May 1898 Portugal celebrated the 400th anniversary of this explorer's arrival in India

In May, Gary arrived in India after he celebrated his anniversary in Portugal



This evidence suggests "Gary" is the answer BUT the system must learn that keyword matching may be weak relative to other types of evidence

Watson leverages multiple algorithms to gather deeper evidence



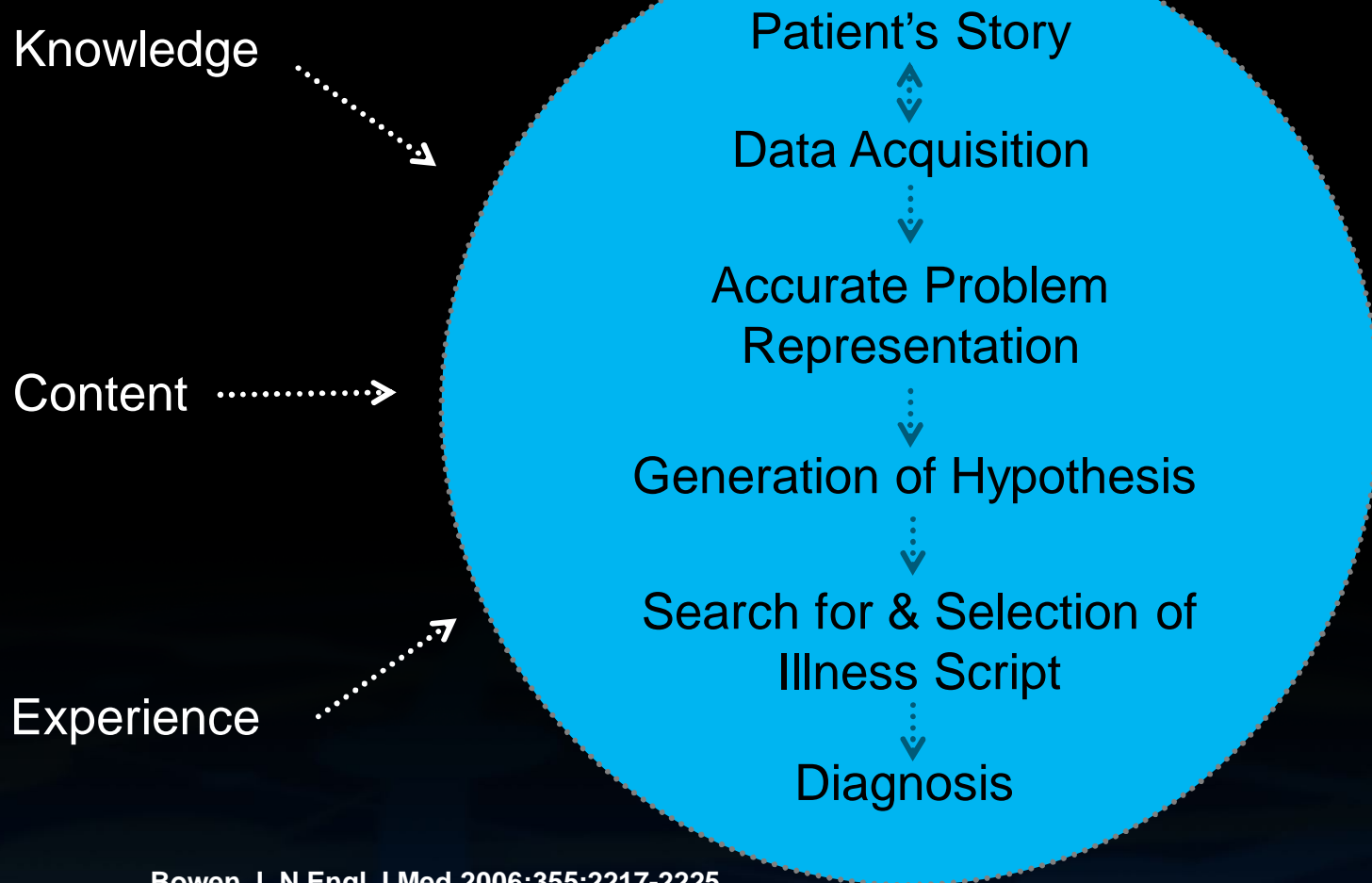
Evidence must be Evaluated for Different Forms

- Temporal Reasoning
 - Developed for Jeopardy! Has application in Healthcare as sequence or timing of symptoms may be relevant
- Geospatial Reasoning
 - Earth geography algorithms can be reworked for human body (*the Pain started in my fingertips and progressed up my left arm*)
- Statistical Paraphrasing
 - New Algorithms required to, for example, Map between medical terminology and lay terms.

TEMPORAL REASONING EXAMPLE

Typical influenza in adults is characterized by sudden onset of chills, fever, prostration, cough, and generalized aches and pains (especially in the back and legs). Headache is prominent, often with photophobia and retrobulbar aching. Respiratory symptoms may be mild at first, with scratchy sore throat, substernal burning, nonproductive cough, and sometimes coryza.

Key Elements of the Clinical Diagnostic Reasoning Process



Bowen J. N Engl J Med 2006;355:2217-2225



The NEW ENGLAND
JOURNAL of MEDICINE

Watson's Reasoning

- “Shallower” reasoning over large volumes of data
- Delivers weighted responses to clinicians to assist in making a informed evidence based decision
 - Considers large amounts of data (e.g. EMR, Literature)
 - Unbiased
 - Learns
- Hits sweet spot of human judgment (e.g. problems with bias, Big Data)
- Identifies missing information
- Watson's interactive process helps clinician vector in on the appropriate decisions
- Not limited by database structure

Oncology Diagnosis and Treatment Demonstration




EMR Patient EMR

Patient Details: MBN: 040102110970840 Name: Lin J. Yamato Age: 27


Treatment Options to Consider




WATSON:
Treatment options are listed based on the information available.
[Request Pre-auth](#)

Identified Options

<input checked="" type="radio"/>	Treatment plan 1 Systemic Chemo: Cisplatin, Pemetrexed, Bevacizumab	Confidence 95%	Acceptable match with patient preferences	 EVIDENCE
<input type="radio"/>	Treatment plan 2 Systemic Chemo: Carboplatin, Paclitaxel, Bevacizumab	Confidence 45%	Unacceptable match with patient preferences	 EVIDENCE
<input type="radio"/>	Treatment plan 3 Systemic Chemo: Erlotinib	Confidence 8%	Preferred match with patient preferences	 EVIDENCE

Radiation and Surgery are unlikely to be appropriate.

 Ask Watson



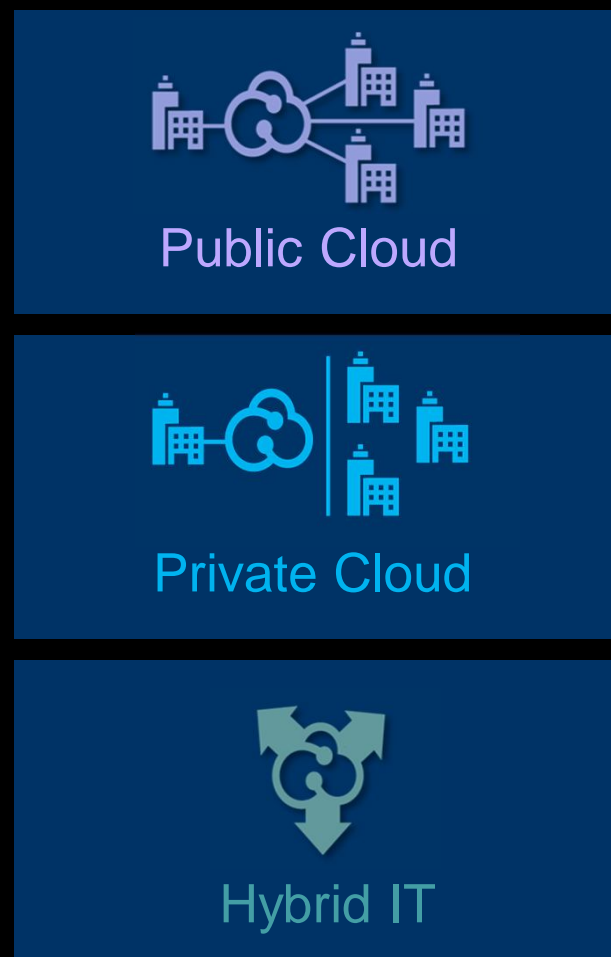
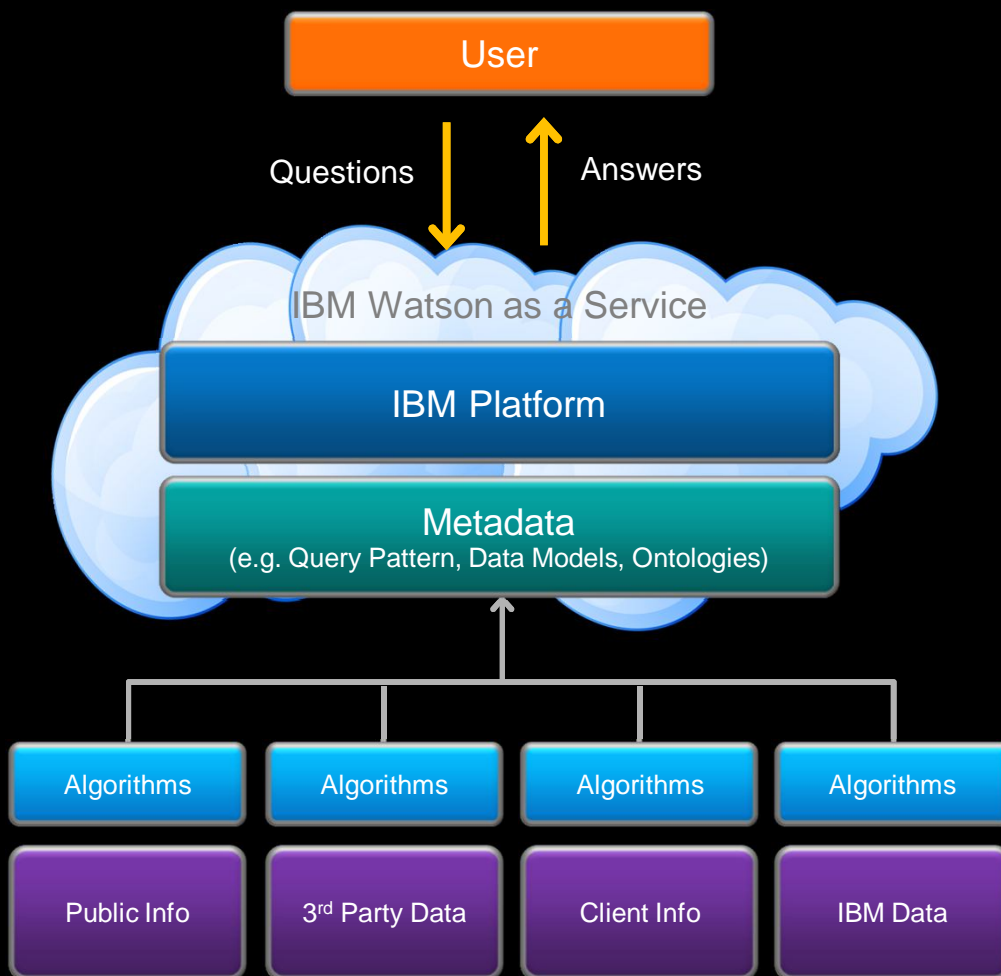
Case Information

Test Options

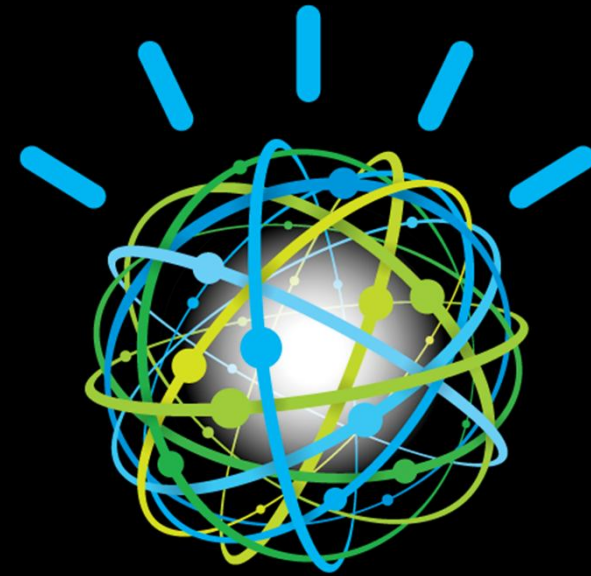
Treatment Options

IBM WATSON

IBM Watson Is **Delivered** as a Service Accessible through the Cloud



THANK YOU!



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IBM Research
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