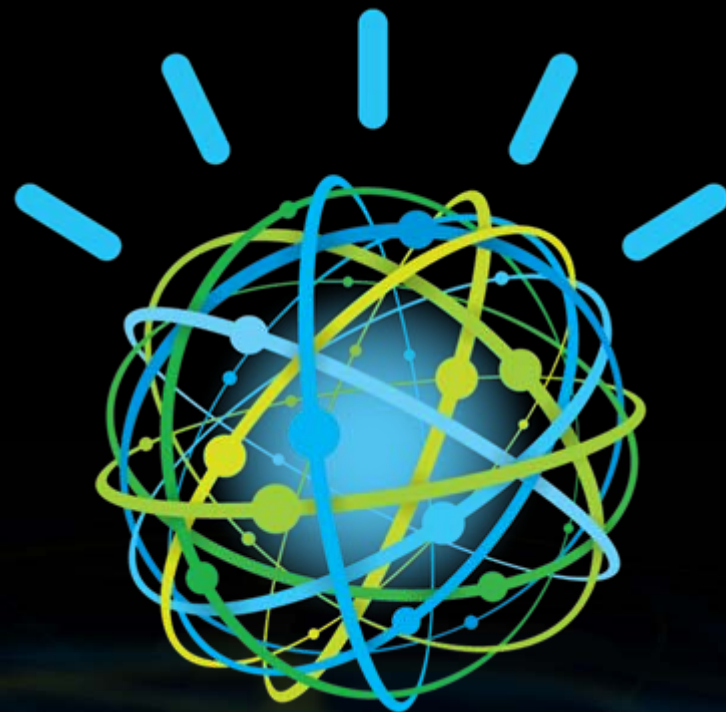
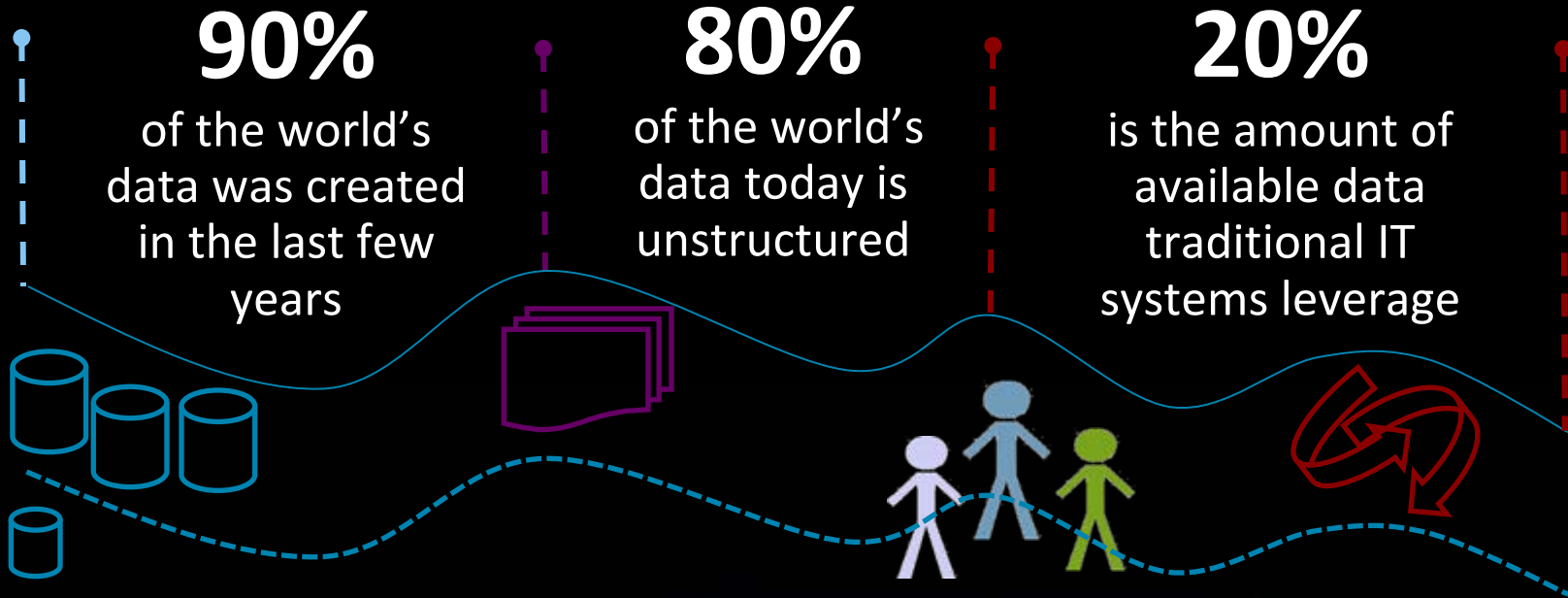


Josko Silobrcic, MD, MPH, MS
Senior Medical Scientist, IBM Research

Innovation in Clinical Decision Support --
A New Role for Watson in Healthcare



We are “dying of thirst in a flood of data”



1 in 2

business leaders don't have access to data they feel they need

83%

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

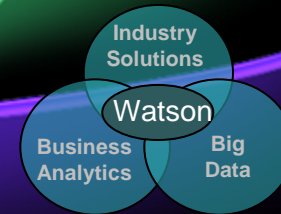
54%

of companies use analytics for competitive advantage

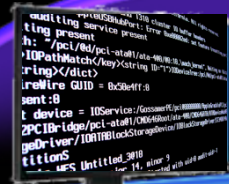
New, "learning" systems are required, ushering a new era of computing

Cognitive Computing

Programmatic Computing



Emerging IT



Traditional IT

- Structured data (local)
- Deterministic Applications
- Search-Oriented
- Machine Language
- Systems of Records

- Structured & unstructured (global)
- Probabilistic Applications
- Discovery-Oriented
- Natural Language
- Systems of Engagement

Tabulation



1900-

1950-

2011-

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

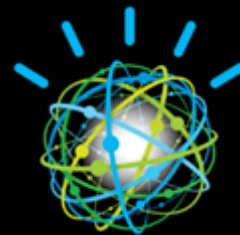
1 Understands natural language and human speech



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

Where to put Watson to work

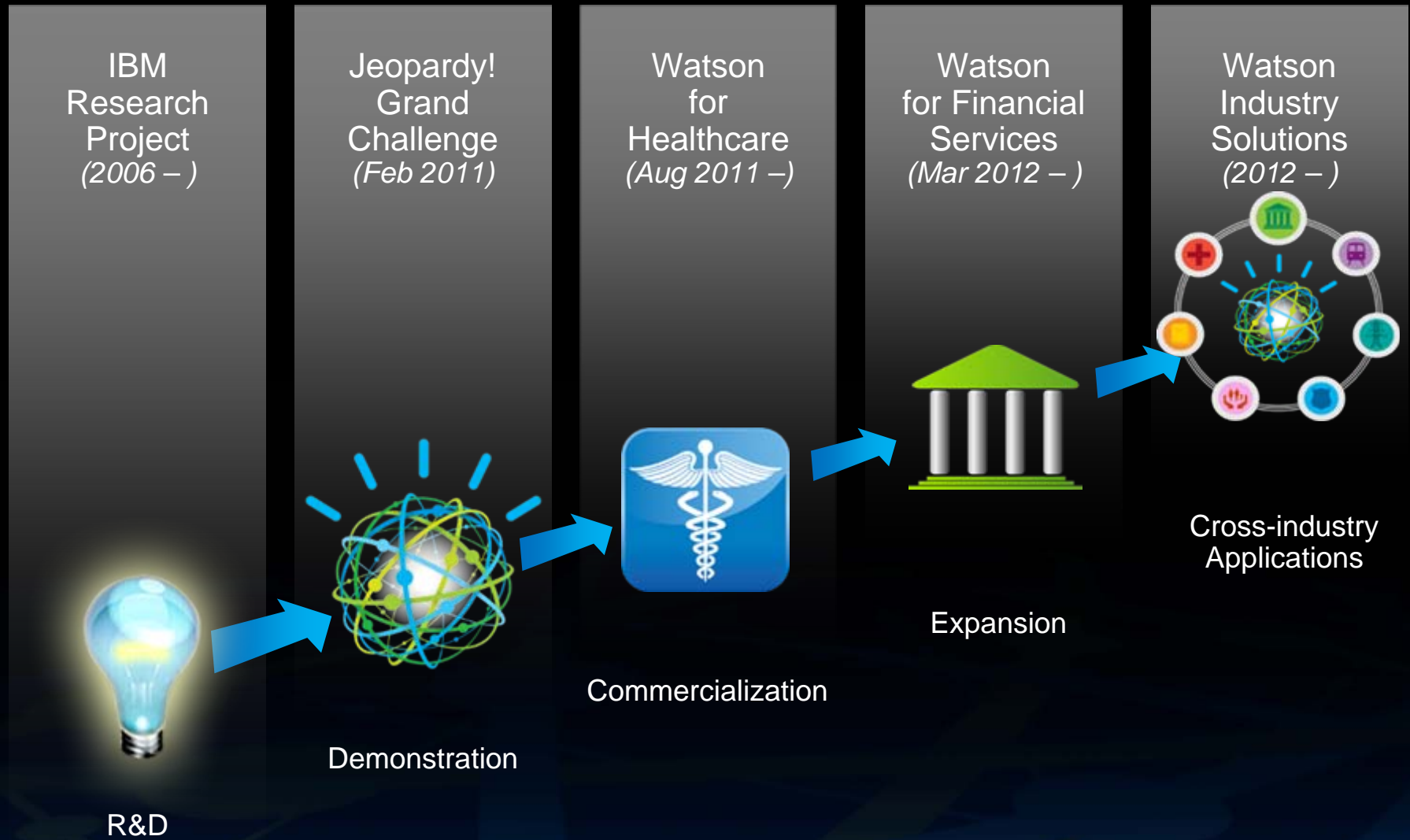
Watson Capabilities

- 1 Natural language understanding
- 2 Broad domain of unstructured data
- 3 Hypothesis generation and confidence scoring
- 4 Iterative Question/Answering
- 5 Machine learning

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

Brief History of IBM Watson



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 month 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 (and only) about 20% of the knowledge clinicians use today is evidence-based”

- Steven Shapiro Chief Medical and Scientific Officer, UPMC

Moving beyond Jeopardy! presents a new set of challenges

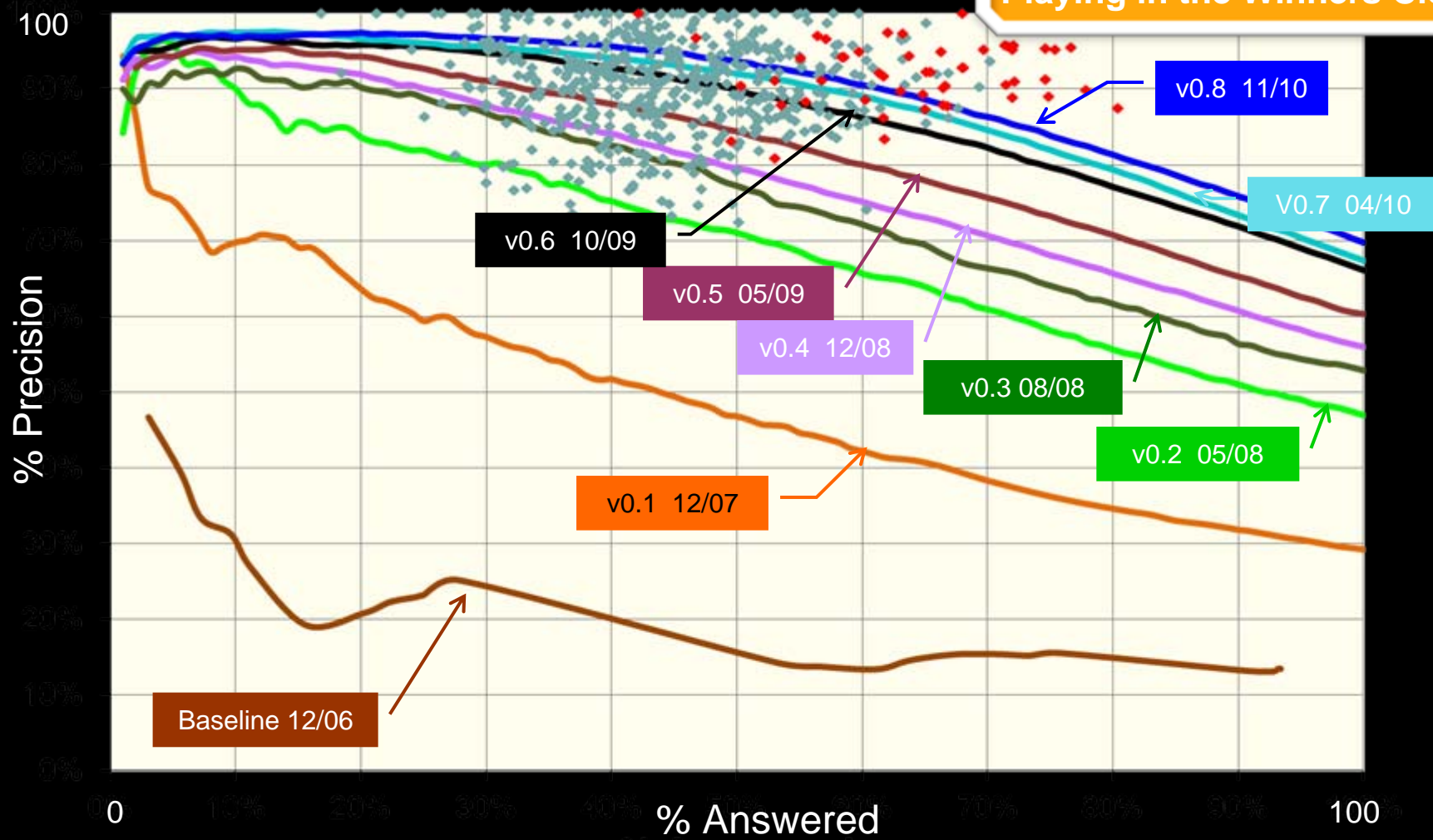
Watson at Play

Watson at Work in Healthcare

One user	➔	1000s of concurrent users
Max. input – two sentences	➔	Extended text input (e.g., LPR)
“Stateless”	➔	“Statefull”
Focus on single response	➔	Focus on top responses
Periodic content updates	➔	Dynamic content ingestion
Supporting evidence absent	➔	Supporting evidence integral
Q&A environment	➔	Q&A + case management
Basic security	➔	High security (e.g., HIPAA)
No user prompting	➔	User interaction/prompting

Watson: Incremental Progress in Answering Precision on the Jeopardy Challenge: 6/2007-11/2010

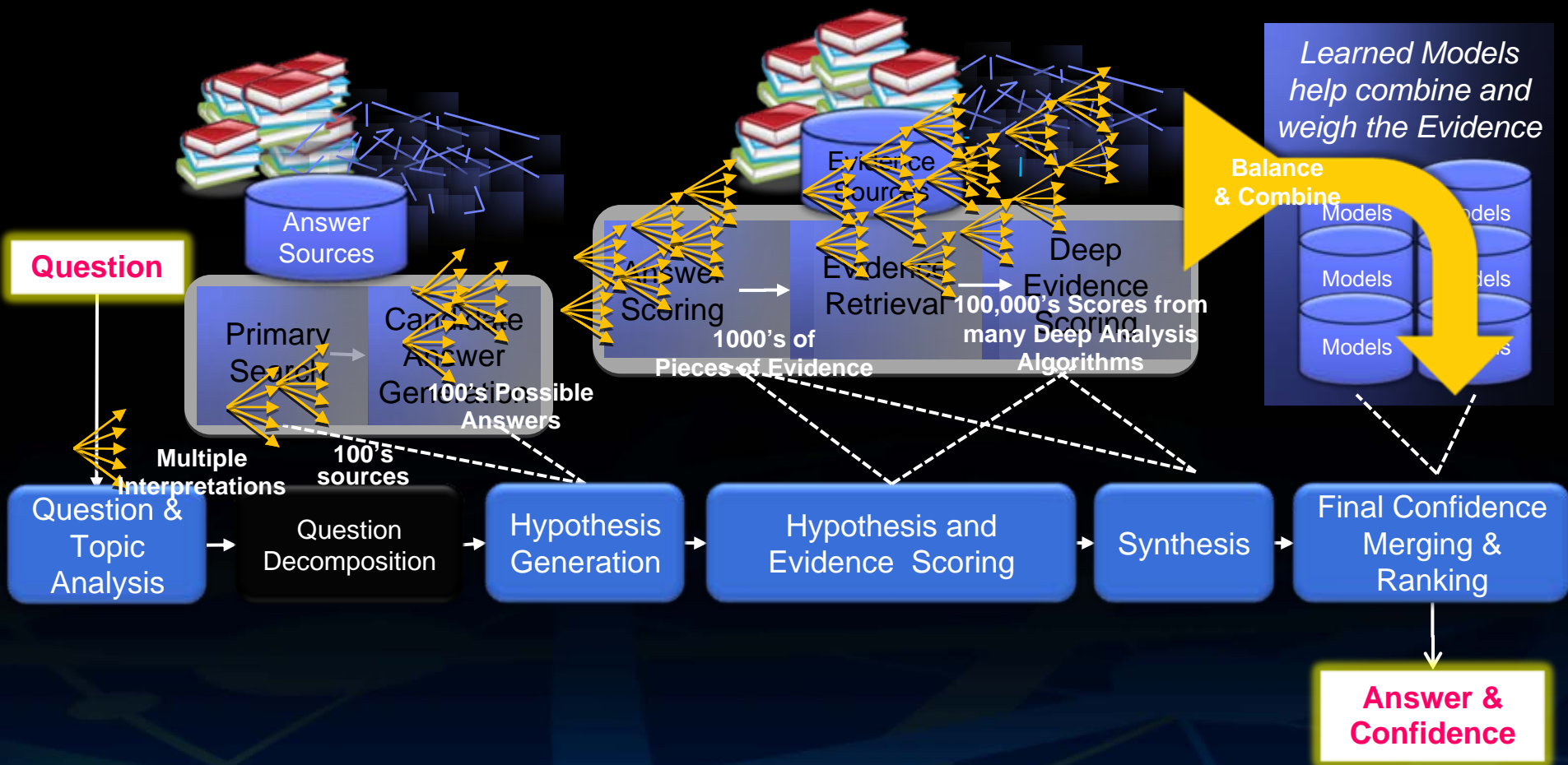
**IBM Watson
Playing in the Winners Cloud**



Watson Technology:

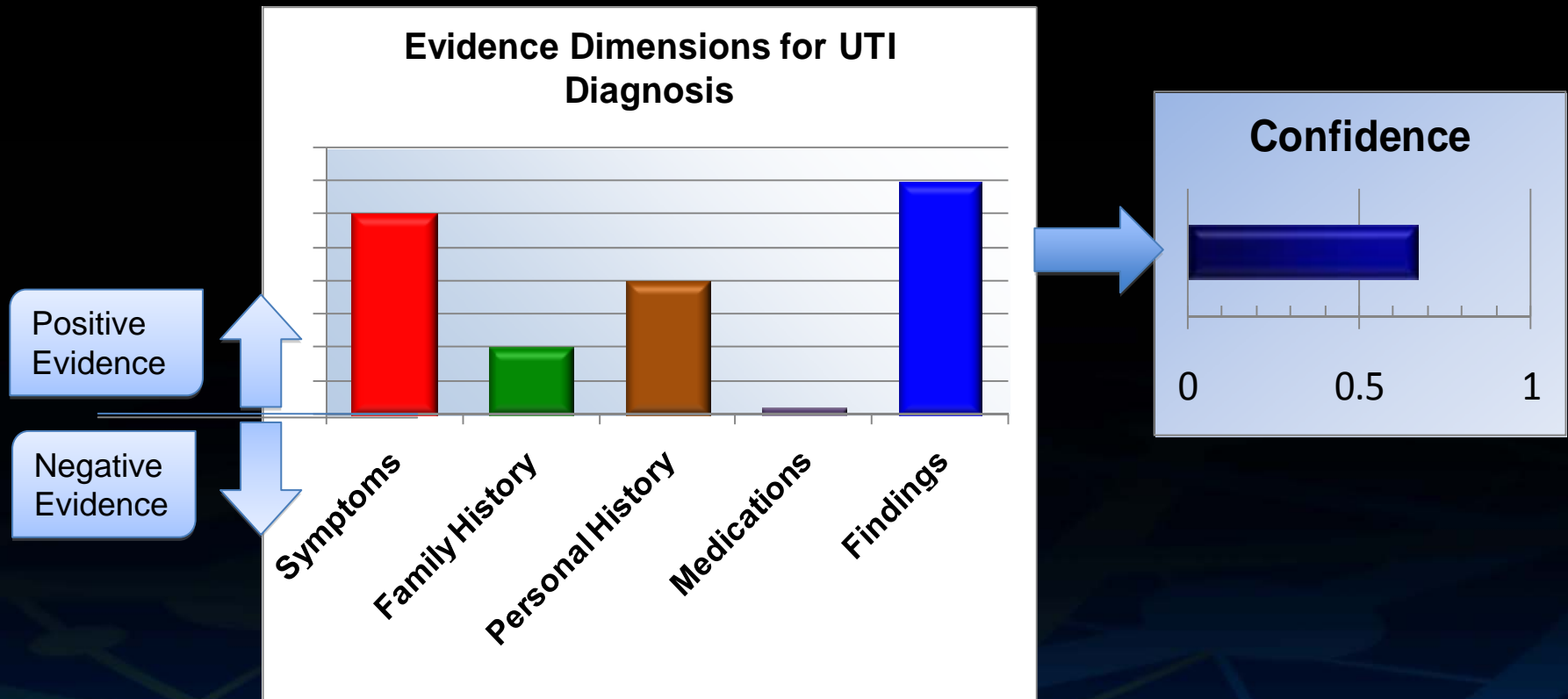
Massively Parallel, Probabilistic, Evidence-Based Architecture

Generates and scores many hypotheses using a combination of 1000's of **Natural Language Processing, Data Mining, Machine Learning and Reasoning Algorithms**. These gather, evaluate, weigh and balance different types of **evidence** to deliver the answer with the best support (confidence) found



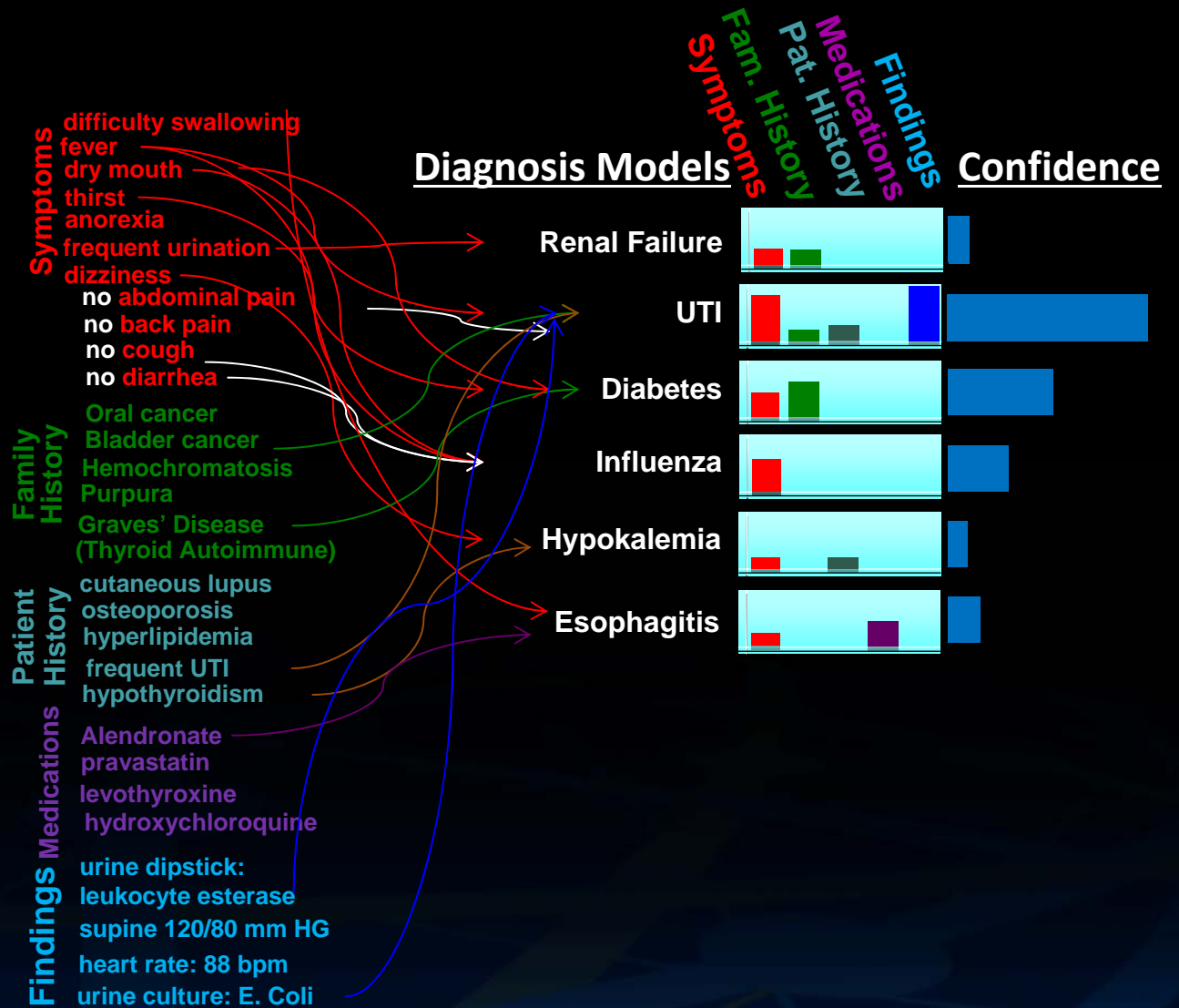
Watson Technology Collects and Combines Evidence into Evidence Profiles

- Each evidence dimension contributes to supporting or refuting hypotheses, based on:
 - Strength of evidence
 - Importance of dimension to the question – e.g., diagnosis/treatment (learned from training data)



Putting the proper pieces together at the point of impact can be life changing

Patient
Family
Medications
Findings
History



Advanced Decision Support – Getting Closer

- TODAY

- Using mostly structured data, some unstructured (natural language patterns) data
- Fixed (static) rules-based, rules derived periodically from evidence by experts
- Evidence is “curated” by scores of experts – laborious, time-consuming, prone to some bias, error, delay
- Limited user interaction model – e.g., checklist-based
- Definitive, categorical suggestions of diagnostic options
- “Black box” – difficult to fully understand the underlying evidence and its impact on the quality/strength of the diagnostic suggestion provided
- Guidelines often not “granular enough” for individual patient consideration

- (NEAR) FUTURE

- Fully leverage both structured and unstructured data (w/ natural language understanding), professional and layperson terminology
- Evidence and the associated rules are dynamically “uncovered”, as they evolve
- Evidence is “curated” with the help of the system, through experience data and evidence-based machine learning (the system is “trained” and continues to “learn”)
- Extensive interaction with user, with intelligent, evidence-based prompting for missing data and information input
- Suggestions with varying degrees of confidence, reflecting strength (quality, relevance) of evidence
- Tracing to all the contributing, as well as refuting, evidence, with evidence analysis and prioritization
- Personalization of suggestions to patient, accounting for complexities, multiple co-morbidities

Advanced Decision Support

The Pitfalls

- Forgetting the GIGO rule: the importance of comprehensive, quality input data
- “But, will they come ... ?”: User Interface and Interaction Model issues – e.g., onerous input, response times, ...
- Quality and timeliness of evidence data: need for timely (continuous), careful evidence data “curation”
- Forgetting that “decision support” is not “decision-making”, and is not infallible (!)
- Misuse: mis-interpretation of the DSS tools’ results/suggestions – e.g., of the varying confidence levels, the value of highlighted “unexplained” data
- Failure to respond to prompts and investigate (disambiguate) further – unquestioning acceptance of top, but possibly “low confidence” or “comparable confidence”, suggestions
- General over-reliance on DSS, the “seduction of automation”

IBM Watson represents a new class of industry-specific analytic solutions



Thank
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