NHHPC Member to Member Connect Webcast

Making healthcare smarter

Opportunities in Advanced Analytics by IBM

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IBM Distinguished Engineer
February 29, 2012

Inconsistent quality and increasing costs require healthcare transformation in key areas

The need for better clinical outcomes

- **One in five patients** suffer from preventable readmissions … represents $17.4 billion of the current $102.6 billion Medicare budget*
- **1.5 million** patients in the U.S. harmed annually by errors in the way medications are prescribed, delivered and taken

The need for better operational outcomes

- In 2012, **Hospitals will be penalized** for high readmission rates - Medicare discharge payments starting will be reduced in key areas**
- **$475 billion:** Estimated annual US healthcare spending on administrative and clinical waste, fraud, abuse and other waste

** New England Journal of Medicine – Rehospitalization Among Patients in the Medicare Fee-for-Service Program, April 2009*
*** http://www.healthleadersmedia.com/content/COM-263665/3-Readmissions-to-Reduce-Now*

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Smarter healthcare through analytics

What our healthcare clients are doing with information and analytics today

Independent Health

Using predictive analytics to lower health risks through more effective wellness programs

GEISINGER

Jointly created first-of-a-kind clinical intelligence system to improve patient care, research and innovation

North Carolina State University

Using big data and content analytics together to target technology investments faster

Aetna®

Using fraud and abuse analytics to reduce by detecting suspicious issues in healthcare claims

Are you unlocking the value of your information … **all of it?**

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… but the biggest blind spot still remains

- How are you measuring and reducing preventative readmissions?
- How are you providing clinicians with targeted diagnostic assistance?
- Which patients are following discharge instructions?
- How are you leveraging unstructured data to prevent and detect fraud?
- How are you using data to predict intervention program candidates?
- **Would revealing insights trapped in unstructured information facilitate more informed decision making?**

Does unlocking the unstructured data help accelerate your transformation?

- ✓ Physician notes and discharge summaries
- ✓ Patient history, symptoms and non-symptoms
- ✓ Pathology reports
- ✓ Tweets, text messages and online forums
- ✓ Satisfaction surveys
- ✓ Claims and case management data
- ✓ Forms based data and comments
- ✓ Emails and correspondence
- ✓ Trusted reference journals including portals
- ✓ Paper based records and documents

***Over 80%** of stored health information is unstructured**

* *AIIM website, accepted industry percentage*

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Unstructured data is messy but filled with key medical facts

Medical Transcription Discharge Summary Sample # 2:

DATE OF ADMISSION: MM/DD/YYYY

DATE OF DISCHARGE: MM/DD/YYYY

ADMITTING DIAGNOSIS: Syncope.

CHIEF COMPLAINT: [illegible]

HISTORY OF PRESENT ILLNESS: This is an (XX)-year-old male with a past medical history of coronary artery disease, CABG done a few years ago, [illegible] patient c[illegible] self, but did not have any syncope. No nausea or vomiting. No chest pain. No shortness of breath. Came to ER and had a CT head, which was within normal limits. The impression was atrophy with old ischemic changes but no acute intracranial findings. No focal weakness, headache, vision changes or speech changes. The patient has had similar episodes since one year. Peripheral neuropathy since one [illegible] s of 25 pounds in the last 6 months. [illegible] octitis and secondary to decreased appetite.

PROCEDU [illegible] sclerotic heart disease, pleural thickenin[illegible] red to prior examination, COPD pattern. [illegible] e intracranial findings.

CONSULT

PAST ME hyperten

FAMILY H

SOCIAL H

ALLERGIE

REVIEW O hemorrh and feet.

PHYSICAL Appearar masses. rhythm. smooth n within no

LABORAT neutroph 1.6, PTT 3

The patient had a chest x-ray, which showed cardiomega effusion, a left costophrenic angle which has not change head CT, which showed atrophy with old ischemic chang

Echocardiogram Sample Report:

DATE OF STUDY: MM/DD/YYYY

DATE OF INTERPRETATION OF STUDY:

Echocardiogram was obtained for assessment of left ventricular function. The patient has been admitte syncope. Overall, the study was subop

FINDINGS:

1. Aortic root appears normal.
2. Left atrium is mildly dilated. No gros recognized, although subtle abnormalit atrium is of normal dimension.
3. There is echo dropout of the interat could not be excluded.
4. Right and left ventricles are normal ventricular systolic function appears to fraction is around 55%. Again, due to p abnormalities in the distribution of late excluded.
5. Aortic valve is sclerotic with normal Doppler study demonstrates trace aort
6. Mitral valve leaflets are also scleroti imaging and Doppler study demonstrat regurgitation.
7. Tricuspid valve is delicate and opens clearly seen. No evidence of pericardia

CONCLUSIONS:

1. Poor quality study.
2. Eyeball ejection fraction is 55%.
3. Trace to mild degree of mitral regur
4. Trace aortic regurgitation.

Cardiology Consultation Transcribed Medical Transcription Sample Reports

DATE OF CONSULTATION: MM/DD/YYYY

REFERRING PHYSICIAN: John Doe, MD
CONSULTING PHYSICIAN: Jane Doe, MD
REASON FOR CONSULTATION: Surgical evaluation for coronary artery disease.
HISTORY OF PRESENT ILLNESS: The patient is a (XX)-year-old female who has a known history of coronary artery disease. She underwent previous PTCA and stenting procedures in December and most recently in August. Since that time, she has been relatively stable with medical management. However, in the past several weeks, she started to notice some exertional dyspnea with chest pain. For the most part, the pain subsides with rest. For this reason, she was re-evaluated with a cardiac catheterization. This demonstrated 3-vessel coronary artery disease with a 70% lesion to the right coronary artery; this was a proximal lesion. The left main had a 70% stenosis. The circumflex also had a 99% stenosis. Overall left ventricular function was mildly reduced with an ejection fraction of about 45%. The left ventriculogram did note some apical hypokinesis. In view of these findings, surgical consultation was requested and the patient was seen and evaluated by Dr. Doe.
PAST MEDICAL HISTORY:
1. Coronary artery disease as described above with previous PTCA and stenting procedures.
2. Dyslipidemia.
3. Hypertension.
4. Status post breast lumpectomy [illegible]

ALLERGIES: None.
MEDICATIONS: Aspirin 81 mg daily, Plavix 75 mg daily, Altace 2.5 mg daily, metoprolol 50 mg b.i.d. and Lipitor 10 mg q.h.s.
SOCIAL HISTORY: She quit s[illegible] history. She does not abuse alcohol.
FAMILY MEDICAL HISTORY: Mother died prematurely of breast cancer. Her father died prematurely of gastric carcinoma.
REVIEW OF SYMPTOMS: There [illegible] hemoptysis or productive cough. [illegible] palpitations. She notes no nausea, vomiting, constipation, diarrhea, but immediately prior to admission, she did develop some diffuse abdominal discomfort. She says that since then this has resolved. No diabetes or thyroid problem. There is no depression or psychiatric proble[illegible] problems or blood dyscrasias. No [illegible] lumpectomy procedures for this [illegible] with followup radiation therapy. She has been followed in the past 10 years and mammography shows no evidence of any recurrent problems. There is no recent fevers, malaise, changes in appetite or changes in weight.
PHYSICAL EXAMINATION: Her [illegible] She is in a sinus rhythm on the EKG monitor. Respirations are 18 and unlabored. Temperature is 98.2 degrees Fahrenheit. She weighs 160 pounds, she is 5 feet 4 inches. In general, this was an elderly appearing, pleasant female who currently is not in acute distress. Skin color and turgor are good. Pupils were equal and reactive to light. Conjunctivae clear. Throat is benign. Mucosa was moist and noncyanotic. Neck veins not distended at 90 degrees. Carotids had 2+ upstrokes bilaterally without bruits. No lymphadenopathy was appreciated. Chest had a normal AP diameter. The lungs were clear in the apices and bases, no wheezing or egophony appreciated. The heart had a normal S1, S2. No murmurs, clicks or gallops. The abdomen was soft, nontender, nondistended. Good bowel sounds present. No hepatosplenomegaly was appreciated. No pulsatile masses were felt. No abdominal bruits were heard. Her pulses are 2+ and equal bilaterally in the upper and lower extremities. No clubbing is appreciated. She is oriented x3. Demonstrated a good amount of strength in the upper and lower extremities. Face was symmetrical. She had a normal gait.
IMPRESSION: This is a (XX)-year-old female with significant multivessel coronary artery disease. The patient also has a left main lesion. She has undergone several PTCA and stenting procedures within the last year to year and a half. At this point, in order to reduce the risk of any possible ischemia in the future, surgical myocardial revascularization is recommended.
PLAN: We will plan to proceed with surgical myocardial revascularization. The risks and benefits of this procedure were explained to the patient. All questions pertaining to this procedure were answered.

Medications, diseases, symptoms, non-symptoms, lab measurements, social history, family history and much more

Cardiology Consultation Transcribed Medical Transcription Sample Reports
REFERRING PHYSICIAN: John Doe, MD
CONSULTING PHYSICIAN: Jane Doe, MD
HISTORY OF PRESENT ILLNESS: This (XX)-year-old lady is seen in consultation for Dr. John Doe. She has been under consideration for ventral hernia repair and has a background of aortic valve replacement and known coronary artery disease. The patient was admitted with complaints of abdominal pain, anorexia, and vomiting. She underwent a CT scan of the abdomen and pelvis and this showed the ventral hernia involving the transverse colon, but without strangulation. There [illegible] phic right kidney. She had bilateral renal cysts. The hepatic flexure wall was thickened. [illegible] sigmoid diverticulosis without diverticulitis. It has been recommended to her that she undergo repair of the ventral hernia. For this reason, cardiology consult is obtained to assess whether she can be cared from the cardiac standpoint.
PAST CARDIAC HISTORY: Bypass surgery. She underwent echocardiography and cardiac catheterization prior to the operation. Echocardiography showed an ejection fraction of 50%. There was marked left ventricular hypertrophy with septal wall 1.60 cm and posterior wall 1.55 cm. Coronary arteriography showed 90% stenosis in the anterior descending artery, situated distally just before the apex of the left ventricle. Only mild to moderate narrowing was seen elsewhere in the coronary circulation.
CORONARY RISK FACTORS: Her father had an irregular heartbeat and her brother had a fatal heart attack. She herself has had high blood pressure for 20 years. She has elevated cholesterol and takes Lipitor. She has had diabetes for 20 years. She is not a cigarette smoker. She does little physical exercise.
REVIEW OF SYMPTOMS: CARDIOVASCULAR AND RESPIRATORY: She has no chest pain. She sometimes becomes short of breath if she walks too far. No cough. She has occasional swelling of her feet. Occasionally, she gets mildly lightheaded. Has not lost consciousness. She tends to be aware of her heartbeat when she is tired. She has no history of heart murmur or rheumatic fever. GASTROINTESTINAL: Recent GI symptoms as noted above, but she does not usually have such problems. She has had no hematemesis. She has no history of ulcer or jaundice. She sometimes [illegible] tion and no blood in the stool. GENITOURINARY: She tends to have [illegible] up once at night to pass urine. No dysuria, incontinence. She has had [illegible] No stones noted. NEUROLOGIC: She has occasional headaches. No [illegible] on, hearing, or speech. No limb weakness. MUSCULOSKELETAL: She [illegible] cle pains and has a history of gout. HEMATOLOGIC: No anemia, [illegible] us blood transfusion. GYNECOLOGIC: No gynecologic or breast

She has had shoulder and hand injuries and has had carpal tunnel [illegible] tic and has been on insulin. She has chronic renal insufficiency with [illegible] as had hypothyroidism. She has had morbid obesity. She has chronic [illegible] uses BiPAP. She has had hysterectomy and oophorectomy in the past.

[illegible] spital, she was taking glipizide XL 2.5 mg daily, metoprolol 50 mg [illegible] torvastatin 40 mg daily, Synthroid 75 mcg daily, aspirin 81 mg daily, [illegible] rrently, she is taking Lipitor 40 mg daily, Lantus 10 units at bedtime, [illegible] pprolol 50 mg b.i.d., and Zosyn 2.25 grams q.6h.
[illegible] s not drink alcohol.

[illegible] is not currently dyspneic, in no distress. She is alert, oriented, and

[illegible] react normally. No icterus. Mucous membranes well colored. [illegible] nopathy. Jugular venous pressure not elevated. Carotids equal. [illegible] per minute and regular and the blood pressure 132/78. The cardiac [illegible] There is a grade 3/6 ejection systolic murmur heard medial to the [illegible] with well heard radiation to the neck vessels.
[illegible] cussion and auscultation. Normal respiratory effort.
[illegible] der. The presence of a large ventral hernia is noted.
[illegible] dema. Posterior tibial pulses were felt bilaterally, but I did not feel the

[illegible] lesions are noted.
[illegible] OSTIC DATA: Electrolytes are normal. BUN and creatinine 18/2.2. [illegible] t is 7.6, hemoglobin 11.7 with hematocrit 34.9, platelets 187,000. [illegible] bin A1c 7.7. TSH 1.82. Troponin I was normal on three occasions.
[illegible] ged heart with postoperative changes, but no evidence of acute [illegible] ble left atrial enlargement. Low voltage QRS, probable inferior wall [illegible] terior wall infarction, age undetermined.

[illegible] with bioprosthetic valve. Residual systolic murmur.
[illegible] ase with severe stenosis in anterior descending artery, but this is [illegible] s only a small mass of myocardium.
[illegible] cular systolic function. The EKG appearance of previous myocardial [illegible], indicating multiple other medical problems as listed above [illegible] the chart.
It appears that she does not wish to proceed with the [illegible] if such surgery is not

Complementary approaches and technologies

- **Content Analytics**
  - Provides a robust data ingest, search, and visualization capability
  - Sitting on UIMA will handle any unstructured data for which there are “annotators” to examine, classify, and extract information
  - Primarily driven by the user – making decisions about what to look at, where to go next in the analysis
- **DeepQA** – the Watson technology
  - Also focuses on unstructured data
  - However, represents a breakthrough in AI technology, by “answering” very open-ended questions
  - Evaluates evidence obtained via text analytics to mimic the human thought process
- **Predictive Analytics**
  - Encompasses a variety of statistical techniques from modeling, machine learning, data mining and game theory that analyze current and historical facts to make predictions about future events.
  - Predictive models exploit patterns found in historical and transactional data to identify risks and opportunities. Models capture relationships among many factors to allow assessment of risk or potential associated with a particular set of conditions, guiding decision making for candidate transactions.

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California Pacific Medical Center

Using advanced cardiac risk models to reduce risks and recovery times for patients

"IBM SPSS offers many time-saving features that enable us to obtain and publish results faster… With data analysis, we have been able to reduce heart attack patient mortality by 8%"

Dr. Richard Shaw, Director of Cardiac Research, Division of Cardiology, California Pacific Medical

Business Challenge

Cardiac research program needed to manage, track and analyze vast amounts of disparate patient data collected from departments throughout the hospital.

What's Smart?

Implemented models that improved patients' long-term outcomes and shorten patients' length of stay and reduced costs of treatment.

Smarter Business Outcomes

Cal Pacific Medical Center has been able to shorten patients' length of stay and reduce costs of treatment. IBM SPSS provides the power, flexibility and ease of use the research team needed to support multi-disciplinary, data-intensive projects.

California Pacific Medical Center

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BJC Healthcare and Washington University Partnership

Improving care and increasing revenue while lowering research costs

"We anticipate this solution to be a game changer in biomedical research and patient care … accelerate the pace of clinical and translational research …"

Dr. Rakesh Nagarajan, MD, PhD, Associate Professor, Department of Pathology and Immunology, Washington University

Business Challenge

Existing Biomedical Informatics (BMI) resources were disjointed, siloed, redundant and only available to a few researchers - key insights not accessible, trapped in unstructured clinical notes, diagnostic reports, etc.

What's Smart?

Leverage unstructured information along with structured data by using IBM Content Analytics with IBM InfoSphere Warehouse

Smarter Business Outcomes

Researchers now able to see new trends, patterns and **find answers in days instead of weeks or months** eliminating manual methods also enables new grant revenue

BJC HealthCare

Washington
WASHINGTON·UNIVERSITY·IN·ST·LOUIS

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Using analytics to help transform healthcare

*Revealing clinical and operational insights in the **high impact overlap** between clinical and operational – **enabling low cost accountable care***

IBM Content and Predictive Analytics for Healthcare

Diagnostic assistance

Clinical treatment effectiveness

Critical care intervention

Research for improved disease management

Readmission prevention

Claims management

Fraud detection and prevention

Voice of the patient

Patient discharge and follow-up care

- ✓ **Improved patient satisfaction at lower costs**
- ✓ **Enhanced patient care with optimized outcomes**

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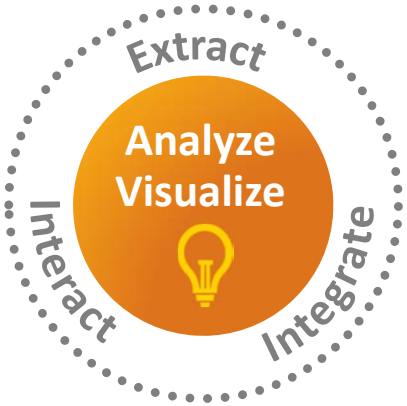
IBM Content and Predictive Analytics for Healthcare

An overview



Extract medical facts and relationships from multiple clinical and operational information sources

Analyze and **Visualize** past, present and future scenarios to create an evidence based corpus of information

- *Content Analytics with natural language processing to analyze trends, patterns, deviations, anomalies and more unstructured information – detect discrepancies in structured data*
- *Predictive Analytics for predictive scoring and probability analysis*
- *Healthcare Solution Accelerator enabling medical fact and relationship extraction through pre-built annotators – built from expertise in previous engagements*
- *Planned integration to IBM Watson for Healthcare for deep question answering capability**

Enable clinicians, executives and knowledge workers to **Interact** with information and derive insight in new ways

Integrate and leverage other systems to *turn insight to action*

 * *Future optional capability*

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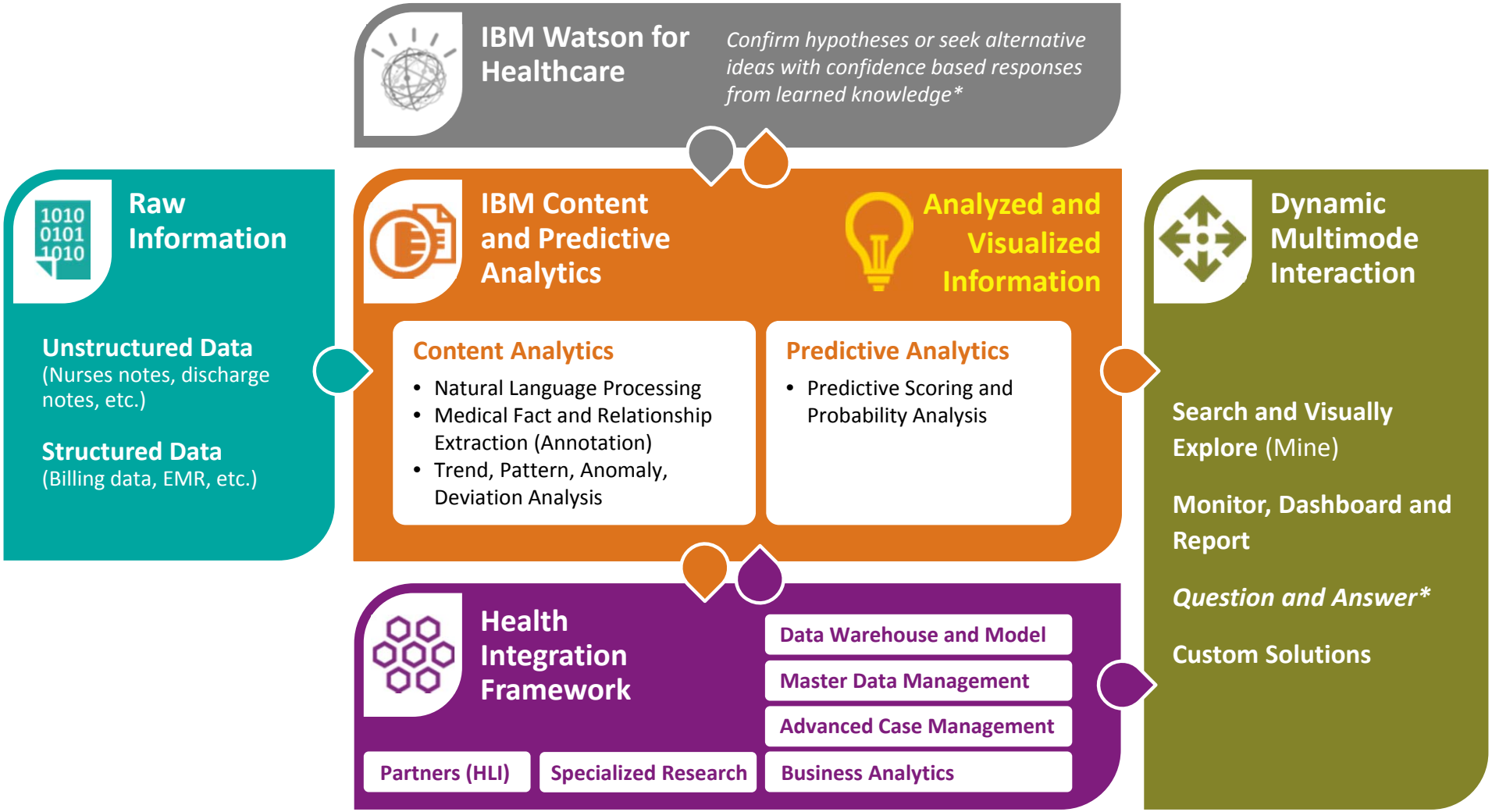
IBM Content and Predictive Analytics for Healthcare

How it works



 * Future optional capability

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What is UIMA and NLP?

- **Natural Language Processing (NLP)** is the cornerstone to translate interactions between computers and human (natural) languages
  - Watson uses **IBM Content Analytics** to perform critical NLP functions
- **Unstructured Information Management Architecture (UIMA)** is an open framework for processing text and building analytic solutions
  - Many IBM products leverage UIMA text analytics processing including Watson and IBM Content and Predictive Analytics for Healthcare
  - Now an OASIS open source standard
  - Apache UIMA is sponsored project by the Apache Software Foundation

Unstructured Information Management Architecture
An Apache Project

OASIS
Advancing open standards for the information society

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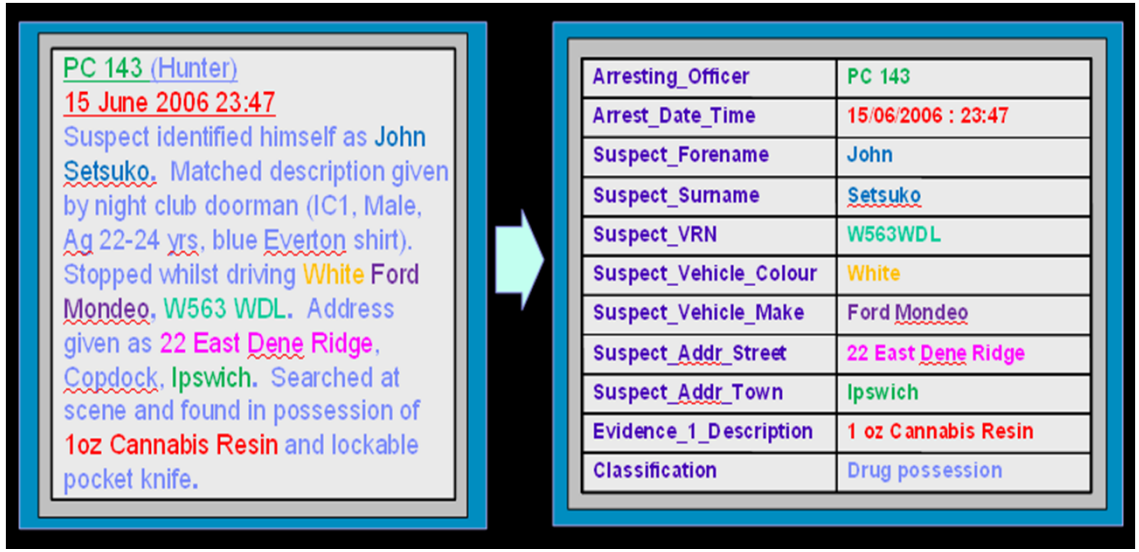
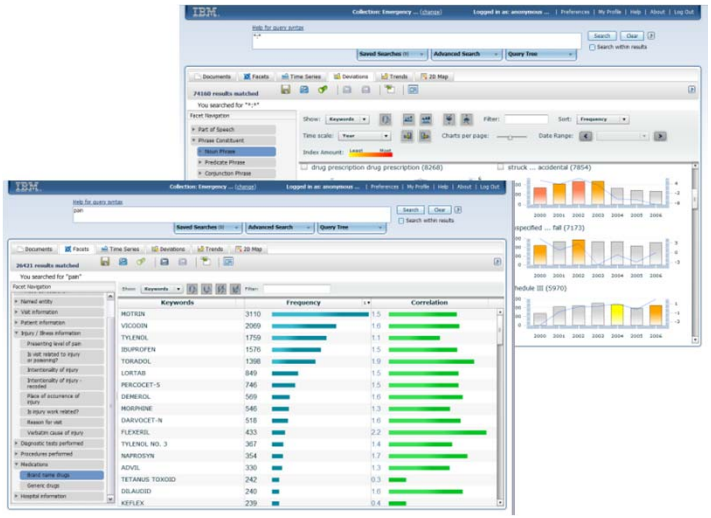
Content Analytics: Some Key Definitions…

What is Text Analytics?

Text Analytics describes a set of linguistic, statistical, and machine learning techniques that allow text to be analyzed and key information extracted for business integration.





What is Content Analytics?

Content Analytics (Text Analytics + Mining) refers to the text analytics process plus the ability to visually identify and explore trends, patterns, and statistically relevant features found in various types of content spread across various content sources.

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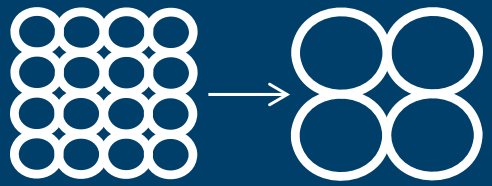
The Healthcare Solution Accelerator

Healthcare Solution Accelerator

- Based on expertise drawn from previous solution engagements and extended for new situations (e.g. Space/Astronaut Medicine) providing core medical fact extraction and contextual relationships
- Enables medical facts and information relationships (context) to be extracted from information sources through pre-built annotators designed accelerate time-to-value and shorten the solution development process
- *Example:* Extraction of clinical notes by identifying types of clinical named entities including medications, dosages, diseases/disorders, signs/symptoms, lifestyle indicators and other contextually relevant information



*ICPA includes a **Healthcare Solution Accelerator** which extracts discreet medical facts and relationships from multiple electronic information sources*

- *Enhanced medical measurements*
- *Findings, procedures, treatment notes*
- *Billing, insurance, operational data*

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IBM Content and Predictive Analytics for Healthcare

Analyze past, present and future

IBM Content and Predictive Analytics

Leverage content and predictive analytics for evidence based visual analysis

Content analytics

- Leverage and customize best-of-breed Natural Language Processing (NLP) technology to accurately understand text based information
- Create and visualize an evidence based corpus of analyzed information that reveals trends, patterns, deviations, anomalies and more for 2D analysis and exploration
- Detect discrepancies in structured data such as mis-identification of patient status
- Speed time to solution value with Healthcare Solution Accelerator to extract medical facts and understand the relationships such as drugs, diseases, symptoms, non-symptoms, and measurements
- Exploit powerful, scalable open standard UIMA pipeline architecture

Unstructured Information Management Architecture
An Apache Project

Predictive analytics

- Leverage predictive models, scoring and probability analysis to identify root causes and optimize outcomes

Deep question answering via IBM Watson for Healthcare*

- *Access trusted knowledge sources to confirm diagnosis, treatment options or seek new ideas*

 ** Future optional capability*

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Working together

IBM Content and Predictive Analytics for Healthcare and IBM Watson for Healthcare

Evidence Based Learned Knowledge

Books, clinical guidelines, web resources, journals and other healthcare authoritative resources

IBM Content and Predictive Analytics for Healthcare

*Past, present and future analysis compliments Watson – with focus on customer data for **clinical** and **operational** outcomes*

Ready for Watson

IBM Watson for Healthcare

Leverage learned knowledge with QA-style interactions for clinical applications such as diagnosis

WellPoint and IBM Announce Agreement to Put Watson to Work in Health Care

September 12, 2011

"… clinical best practices to help a physician advance a diagnosis and guide a course of treatment"

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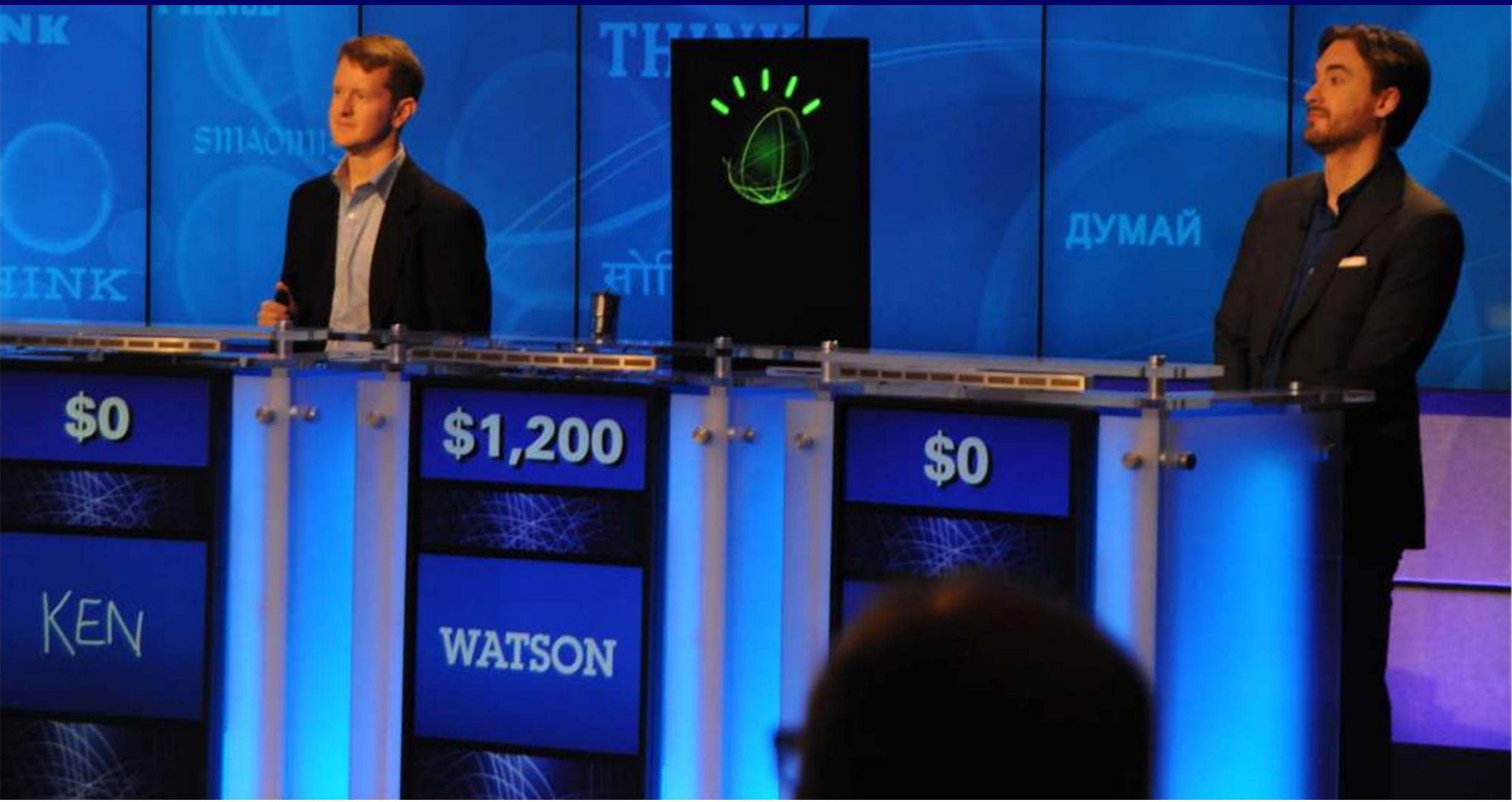
Watson answers a grand challenge

Can we design a computing system that rivals a human's ability to answer questions posed in natural language, interpreting meaning and context and retrieving, analyzing and understanding vast amounts of information in real-time?



Automatic Open-Domain Question Answering

- *A Long-Standing Challenge in Artificial Intelligence to emulate human expertise*

- Given
  - Rich **Natural Language Questions**
  - Over a **Broad Domain of Knowledge**

- Deliver
  - **Precise Answers:** Determine what is being asked & give precise response
  - **Accurate Confidences:** Determine likelihood answer is correct
  - **Consumable Justifications:** Explain why the answer is right
  - **Fast Response Time:** Precision & Confidence in <3 seconds

Question What is Known

Complement ICPA with **Watson for Healthcare** to get real time, confidence based answers with evidence based learning

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The Big Idea: Evidence-Based Reasoning over Natural Language Content

- **Deep Analysis** of clues/questions AND content
- Search for many possible answers based on different interpretations of question
- **Find, analyze and score EVIDENCE** from many different sources (not just one document) for each answer using many advanced NLP and reasoning algorithms
- **Combine evidence** and compute a confidence value for each possibility using statistical machine learning
- **Rank** based on confidence
- If top is above a threshold – buzz in else keep quiet

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Informed Decision Making: Search vs. Expert Q&A

Decision Maker

- Has Question
- Distills to 2-3 Keywords
- Reads Documents, Finds Answers
- Finds & Analyzes Evidence

Search Engine

- Finds Documents containing Keywords
- Delivers Documents based on Popularity

Decision Maker

- Asks NL Question
- Considers Answer & Evidence

Expert

- Understands Question
- Produces Possible Answers & Evidence
- Analyzes Evidence, Computes Confidence
- Delivers Response, Evidence & Confidence

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Why Watson for NASA?

- On July 20, 1969, Neil Armstrong and Buzz Aldrin had entered the Lunar Module they named 'Eagle' and were descending to the surface. They were about 6,000 feet above the surface and the descent engine was halfway through its final 12-minute burn that would land them safely on the moon, when a yellow caution light lit up on the computer control panel. It was a 1202 error, indicating a memory overload, and the astronauts asked Mission Control for instructions.

- M.I.T. engineer, George Silver, who was usually at the office at Cape Kennedy. George had been involved in and witnessed many pre-flight tests. I asked him in frustration if he had ever seen the Apollo Guidance Computer run slowly and under what conditions. To my surprise and rather matter of fact, he said he had. He called it "cycle stealing" and he said it can occur when the I/O system keeps looking for data. He had seen it when the Rendezvous Radar Switch was on (in the AUTO position) and the computer was looking for radar data. He asked "the Switch isn't on, is it?" "Why would it be on for Descent, it's meant for Ascent?"

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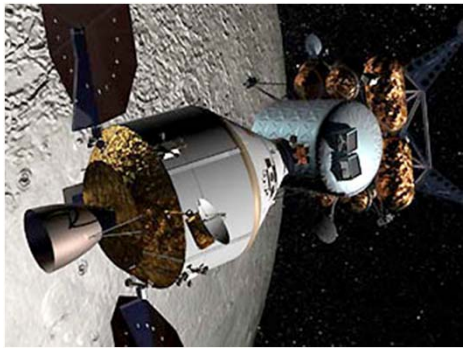
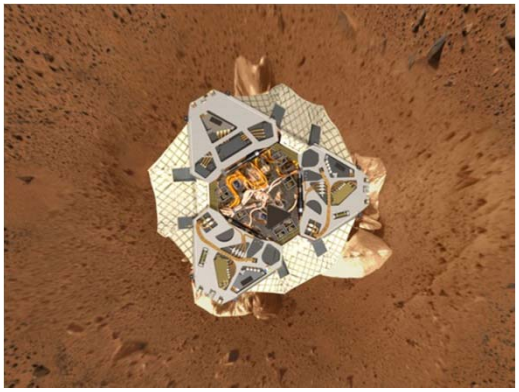
Background: Operations



- Mission Duration: Near Earth Objects
  - Cruise time: 90 days
  - Mission durations: ~ 6 months
  - Communication delay: minutes
  - Communications blackouts: zero (assuming you pay for DSN coverage)



- Mission Duration: Mars
  - Cruise time: 9 months
  - Mission durations: ~ 3 years
  - Communications delay: 6 minutes to 50 minutes
  - Communications blackouts: weeks at a time every 780 days

From the NASA 'Exploration Technology Development Program Automation for Operations (A4O)' Transition Review

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Background: Operations

- Mission Operations
  - State of practice : Many tools, tools often modified, new tools must be added, lack of tool interoperability
  - Need: Flexible, evolvable and sustainable mission operations tools
- Crewed Spacecraft Operations
  - State of practice : Crew relies on ground to support and control operations
  - Time delays reduce crew flexibility and efficiency
  - Need: Crews able to operate systems more independently
- Uncrewed Spacecraft Operations
  - State of practice: Requires direct human command and monitoring
  - Time delays reduce flexibility and efficiency, large staff requirements
  - Need: Safe, efficient and effective uncrewed operations

From the NASA 'Exploration Technology Development Program Automation for Operations (A4O)' Transition Review

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So what could “Watson in Space” do?

- Exploit IBM WATSON technology to create a small WATSON for a crewed vehicle that can deal with questions that need immediate advice in particular situations where the communications latency between the CV and mission control is long

- And/or utilize a version of WATSON on board the ISS (or ground-based) to assist in diagnosing system anomalies, assist in science experiments, and augment human EVA capability – possibly in conjunction with Robonaut

- And/or develop a WATSON version to be used by mission control to get advice and answers on any mission control issue (current issue related to data store)

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Thank You

Find out more about IBM Content and Predictive Analytics for Healthcare

http://www.ibm.com/software/ecm/content-analytics/predictive.html

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