Cognitive Learning Assistants

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Watson is the foundation of this work…What is Watson?

- [A Jeopardy! Champion and an IBM Grand Challenge success.](#)

- An advancement in the long-standing challenge in artificial intelligence to emulate human expertise.

- An inflection point into Cognitive Computing.

- **Input**
  - Natural language questions over a
  - broad domain of knowledge

- **Output**
  - Precise answers
  - Accurate confidences

Watson: A Cognitive Computing Mission

Characteristics of Cognitive Computing

1. Assist human cognition
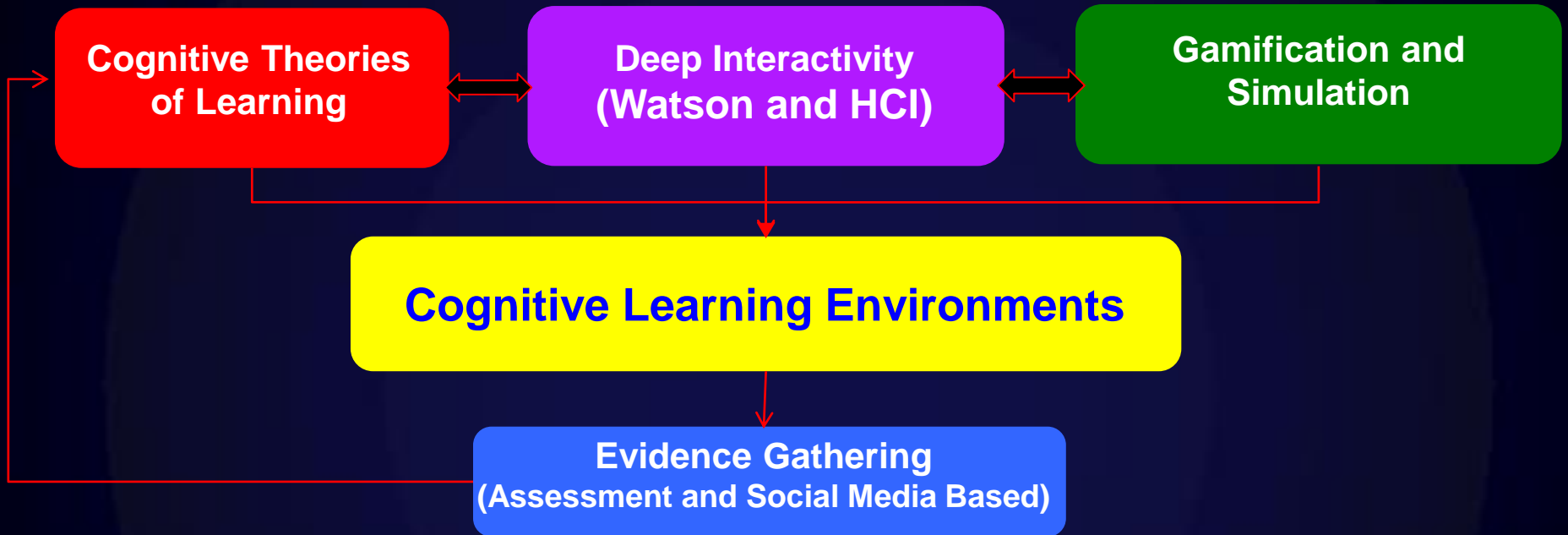2. Interact in a natural way
3. Learn and improve

Watson has these characteristics.

1. Answering questions using evidence from more sources than a person could hope to analyze.
2. Using natural language as its interface.
3. Using supervised and unsupervised machine learning techniques.

Watson Cognitive Tutor: Why?

- Watson enables more human-like interactions with computers
- Research shows better learning outcomes with: (VanLehn, 2011)
  - Deeper engagement
  - Frequent repairs of errors
  - Personalized computing; tutors with personality
  - Context-specific instruction just when the student needs it
  - Self-explanation by the student of the learning process (Koedinger, 2002)

Cognitive Learning Environments

Cognitive Theories of Learning ⟷ **Deep Interactivity (Watson and HCI)** ⟷ **Gamification and Simulation**

Cognitive Learning Environments

Evidence Gathering (Assessment and Social Media Based)

Use Cognitive computing, informed by relevant Cognitive theories of learning, to define the next generation of content and interaction which will enable the personalization of pedagogy.
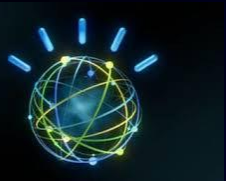
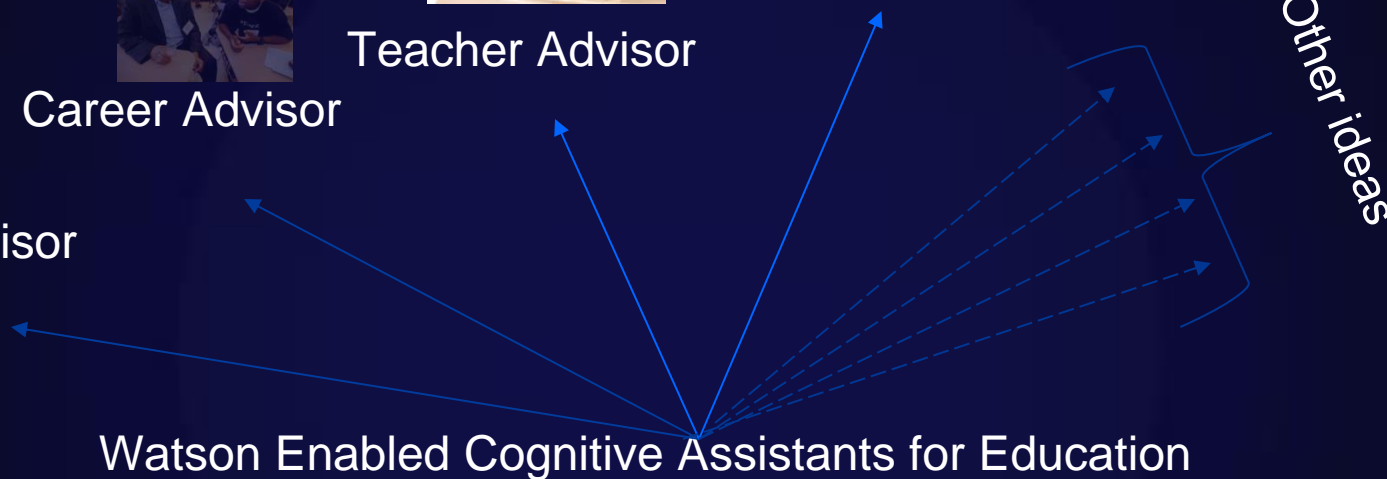# Cognitive Assistants for Learning Transformation
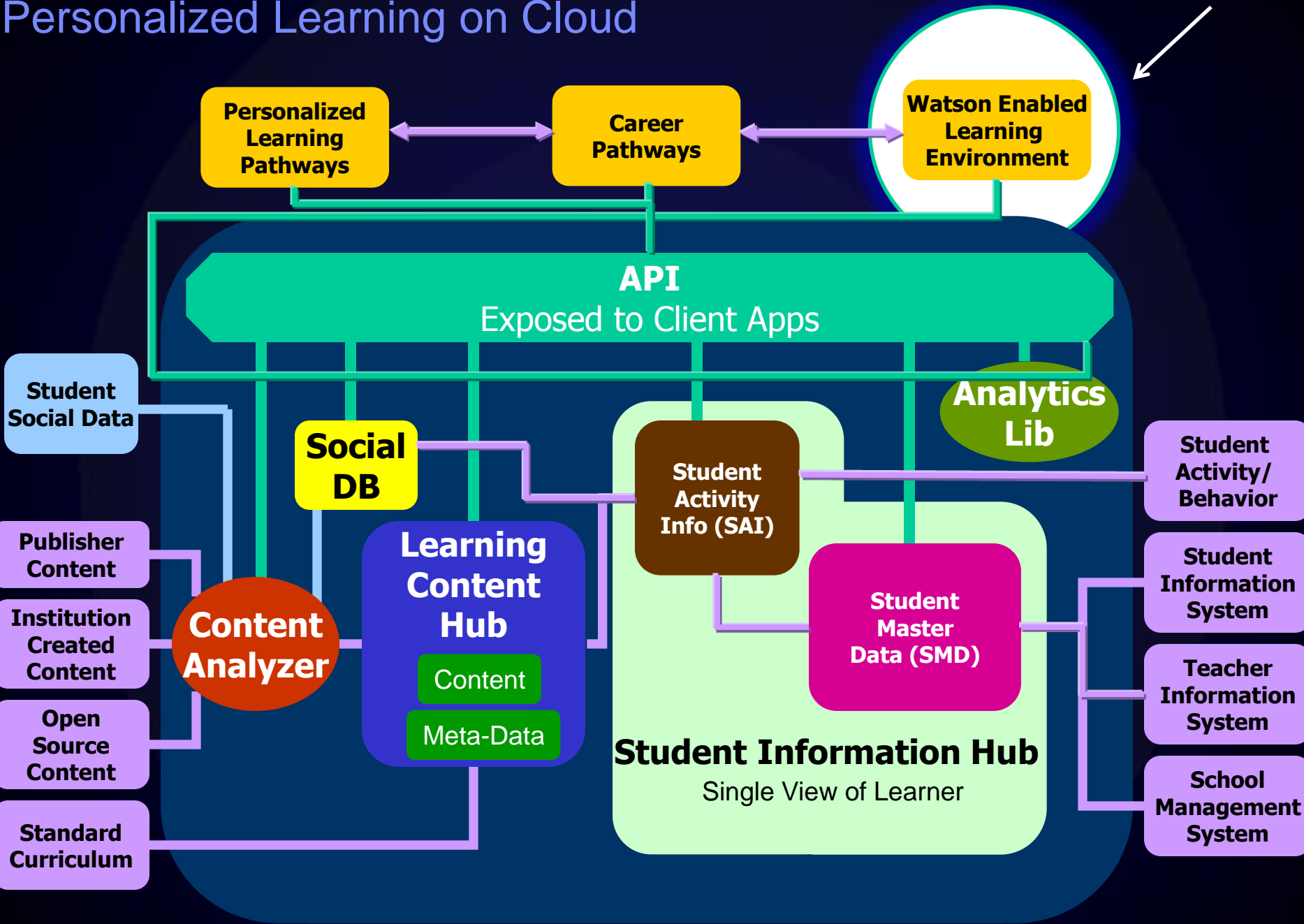

Cognitive Tutor

Teacher Advisor

Career Advisor

Other ideas

Student Advisor

Watson Enabled Cognitive Assistants for Education

NLP and Machine Learning Component Technologies +
Personalized Learning on Cloud Platform

Content: Publisher and Open Education Resources

Personalized Learning on Cloud

Watson Teacher Advisor (In partnership with Corporate Citizenship)

Features (Guided Exploration):

- Watson guides teachers to find appropriate information through dialog, allowing them to navigate the rich corpus of learning content

- Helpful information for the teacher will include how to:
  - Clarify certain concepts for students using progressions in common core (concept dependency graphs)
  - Create lesson plans aligned to their curriculum and understand classroom management techniques
  - Use specific pedagogical instructions in classroom settings
  - Advance their career and become certified master teachers
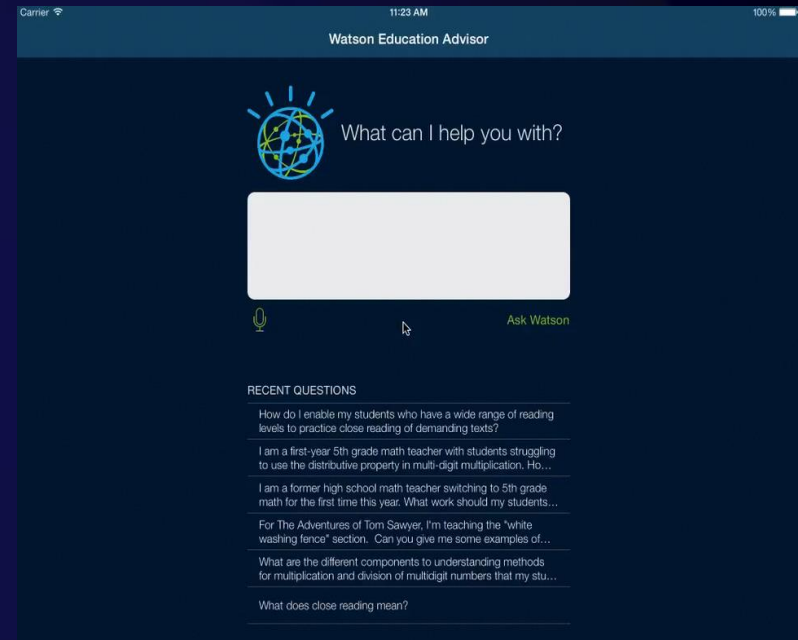
Dec 2015 Pilot to ~ 100 Teachers in NY/MA

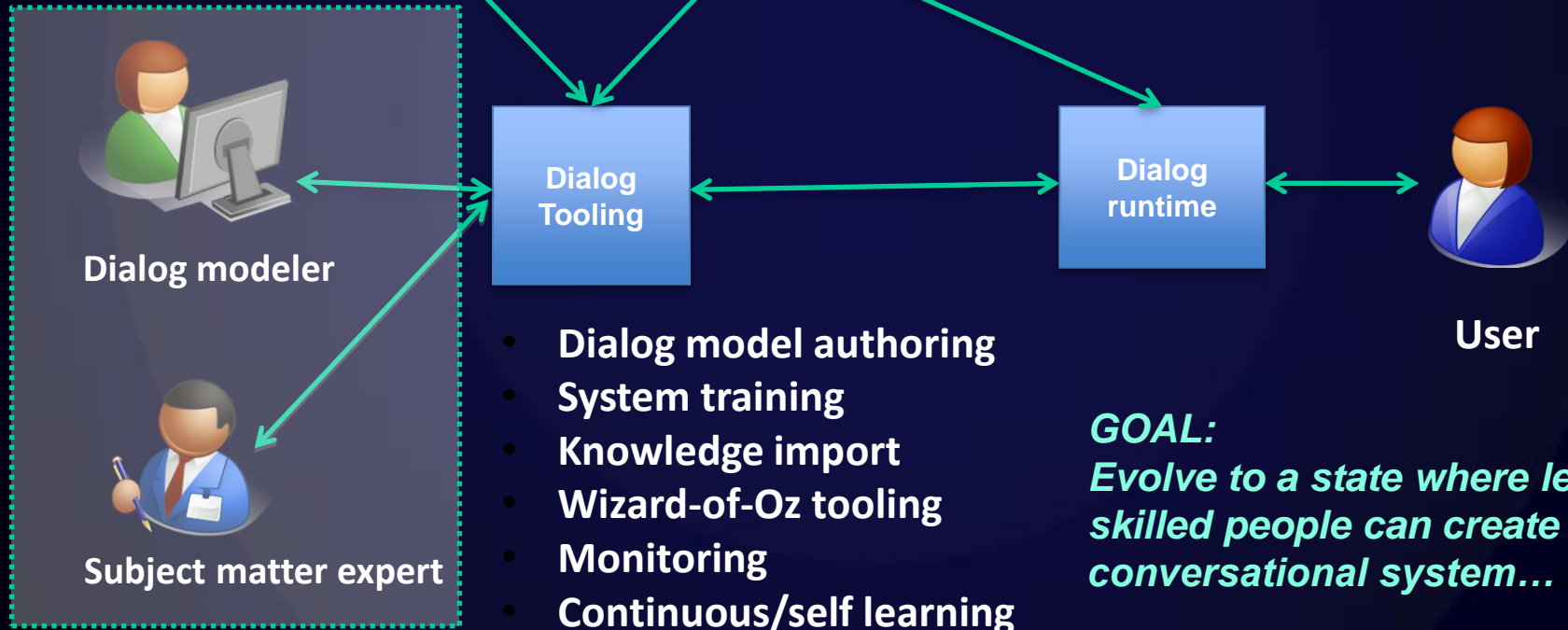# Building Cognitive Conversational Competence: Dialog

- Dialog is a natural interaction mechanism, avoids having to learn interface
- Dialog is engaging, more personal
  - Allows application to convey a personality
  - More opportunities to tune the user experience based on user personality
- Users lose confidence in the system's intelligence if it cannot deal with conversational language
- Understanding ambiguous language by applying context-based inference
- Works with audio-only interface
  - Important for hands-free usage scenarios such as mobile and in-car

Logical view of a conversational system

- Technology Considerations

- **Documents**
- **Graphs**
- **Ontologies**
- **Classes**

Dialog model

- **Model the TASK**
- **Model the INTERACTION**
- **Model the LANGUAGE: (vocabulary, grammar)**
- **Personality & socialization model**

Dialog modeler

Subject matter expert

Dialog Tooling

Dialog runtime

User

- **Dialog model authoring**
- **System training**
- **Knowledge import**
- **Wizard-of-Oz tooling**
- **Monitoring**
- **Continuous/self learning**

GOAL:
Evolve to a state where less skilled people can create a conversational system…

Sample Dialog System: Watson Engagement Advisor

Conversational Experience

- Using natural language, it enables a conversational dialogue with the customer in context

Answers to Questions

- When asked a question, Watson consults its vast corpus of knowledge to provide the answer

Actionable Outcome

- By integrating the system with other business processes, Watson can allow the customer to take appropriate actions

Learns over Time

- Watson learns from its interactions with customers. It becomes more confident in answering questions as usage of the system grows

Cognitive Tutor

- ## [Demonstration](#)

Cognitive Systems learn and interact naturally with people to extend what either humans or machines could do on their own. They help us solve problems by penetrating the complexity of Big Data.

Cognitive Systems Era

Programmable Systems Era

Tabulating Systems Era

Sensors & Devices

You are here

Social Media

VoIP

Enterprise Data

Data is the Next Natural Resource

13

Windows of Opportunity

Cybersecurity	Cancer Treatment	Education

$400 Billion in cybercrime losses annually

seconds

44% misdiagnosis rate for some forms of cancer

months

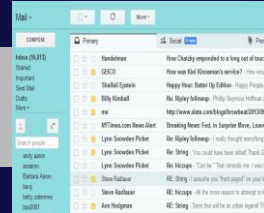**22%** of students worldwide graduate High School

years

Enhancing human capability

Physical limitations

Connectivity limitations

Productivity limitations

Complexity limitations   We need enhanced cognition.

Cognitive Systems: The New Tools for the 21st Century

The New IT Frontier

Cognitive Systems

Cognitive Computing enables a new partnership between people and computers that enhances and scales human expertise.

Computer Intelligence

Calculators

Watson 2011

Deep Blue 1997

System/360 1964

ENIAC circa 1945

Counting Machine Circa 1820

Napier's Rods circa 1600

Antikythera Astronomical Computer circa 87 BC

Abacus circa 3500 BC

Time

Thank you!