

# Question-Answering: Overview

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Systems & Applications  
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# Roadmap

- Dimensions of the problem
- A (very) brief history
- Architecture of a QA system
- QA and resources
- Evaluation
- Challenges
- Logistics Check-in

# Dimensions of QA

- Basic structure:
  - Question analysis
  - Answer search
  - Answer selection and presentation
- Rich problem domain: Tasks vary on
  - Applications
  - Users
  - Question types
  - Answer types
  - Evaluation
  - Presentation

# Applications

- Applications vary by:
  - Answer sources
    - Structured: e.g., database fields
    - Semi-structured: e.g., database with comments
    - Free text
      - Web
      - Fixed document collection (Typical TREC QA)
      - Book or encyclopedia
      - Specific passage/article (reading comprehension)
  - Media and modality:
    - Within or cross-language; video/images/speech

# Users

- Novice
  - Understand capabilities/limitations of system
- Expert
  - Assume familiar with capabilities
  - Wants efficient information access
  - Maybe desirable/willing to set up profile

# Question Types

- Could be factual vs opinion vs summary
- Factual questions:
  - Yes/no; wh-questions
  - Vary dramatically in difficulty
    - Factoid, List
    - Definitions
    - Why/how..
    - Open ended: 'What happened?'
  - Affected by form
    - Who was the first president? Vs Name the first president

# Answers

- Like tests!
  - Form:
    - Short answer
    - Long answer
    - Narrative
  - Processing:
    - Extractive vs synthetic
  - In the limit -> summarization
    - *What is the book about?*

# Evaluation & Presentation

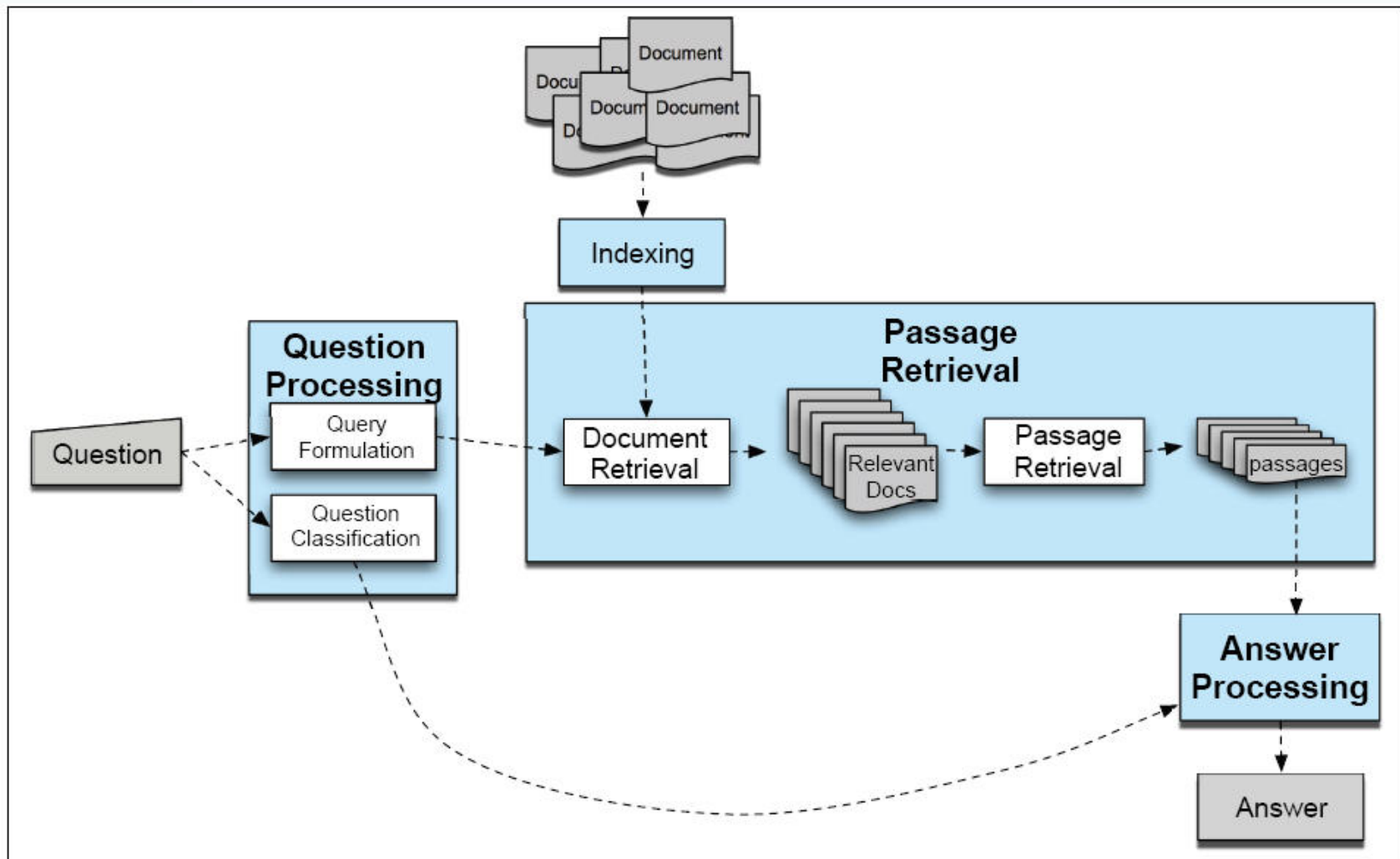
- What makes an answer good?
  - Bare answer
  - Longer with justification
    - Implementation vs Usability
- QA interfaces still rudimentary
  - Ideally should be
    - Interactive, support refinement, dialogic



# (Very) Brief History

- Earliest systems: NL queries to databases (60-s-70s)
  - BASEBALL, LUNAR
  - Linguistically sophisticated:
    - Syntax, semantics, quantification, ,,,
  - Restricted domain!
- Spoken dialogue systems (Turing!, 70s-current)
  - SHRDLU (blocks world), MIT's Jupiter , lots more
- Reading comprehension: (~2000)
- Watson (2011)
- Information retrieval (TREC); Information extraction (MUC)

# General Architecture

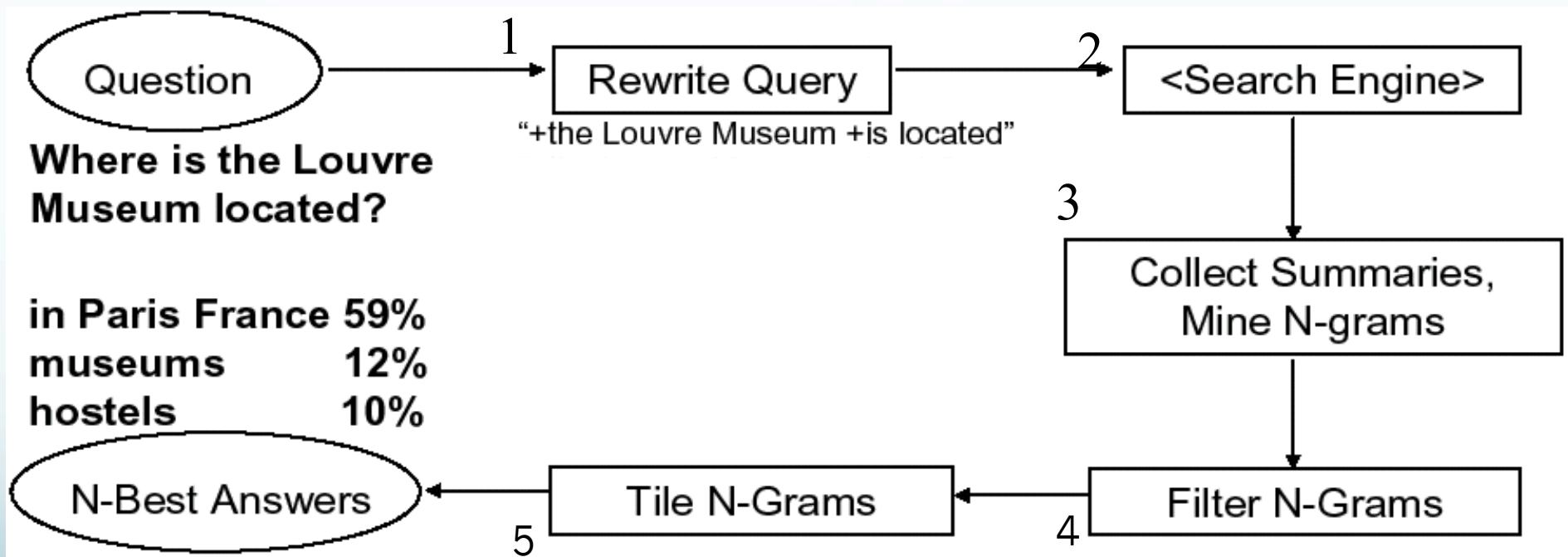


# Basic Strategy

- Given a document collection and a query:
- Execute the following steps:
  - Question processing
  - Document collection processing
  - Passage retrieval
  - Answer processing and presentation
  - Evaluation
- Systems vary in detailed structure, and complexity

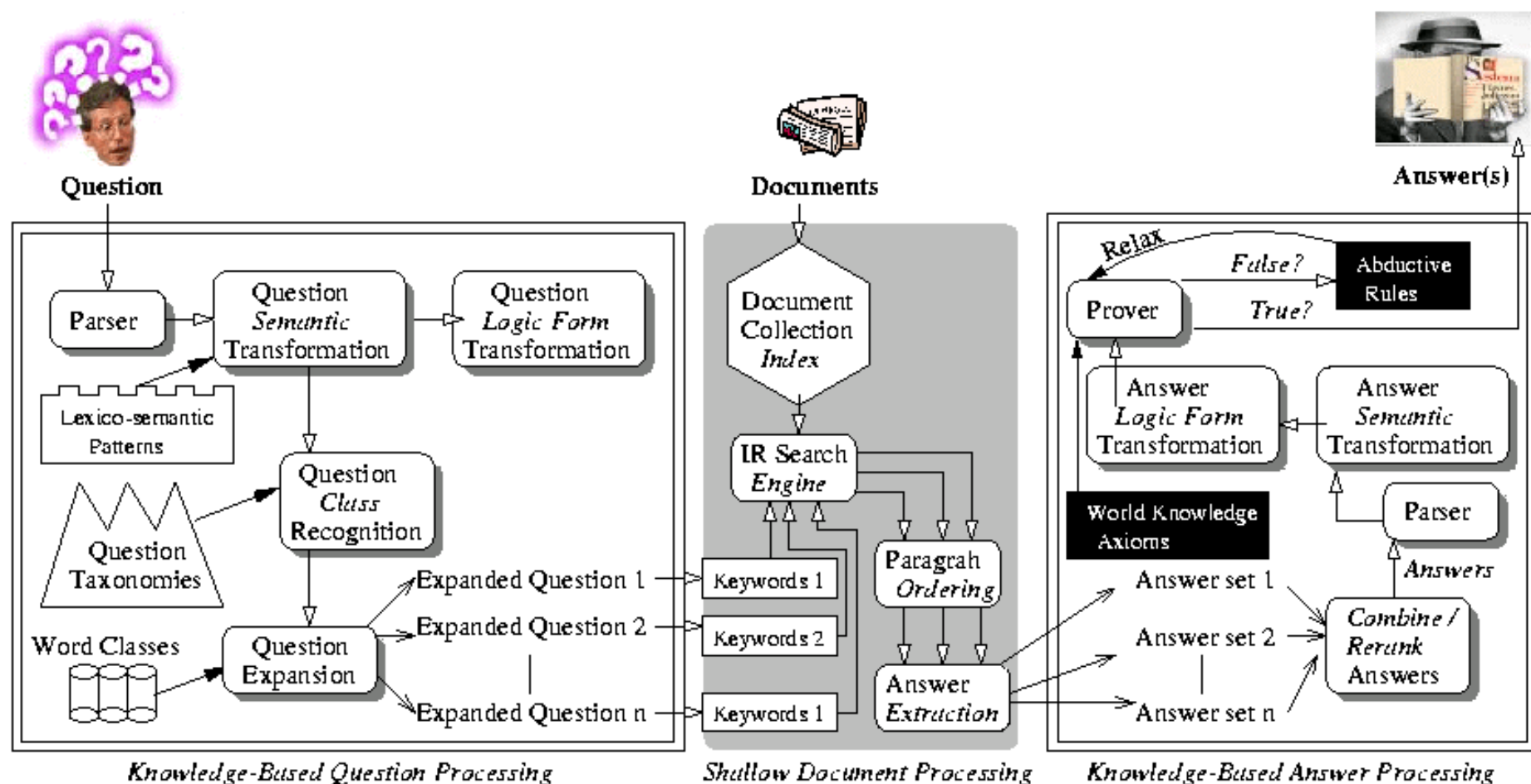
# AskMSR

- Shallow Processing for QA



# Deep Processing Technique for QA

- LCC, QANDA, etc (Moldovan, Harabagiu, et al)



# Query Formulation

- Convert question to suitable form for IR
- Strategy depends on document collection
  - Web (or similar large collection):
    - ‘stop structure’ removal:
      - Delete function words, q-words, even low content verbs
  - Corporate sites (or similar smaller collection):
    - Query expansion
      - Can’t count on document diversity to recover word variation
      - Add morphological variants, WordNet as thesaurus
      - Reformulate as declarative: rule-based
        - Where is X located -> X is located in

# Question Classification

- Answer type recognition
  - Who -> Person
  - What Canadian city -> City
  - What is surf music -> Definition
- Identifies type of entity (e.g. Named Entity) or form (biography, definition) to return as answer
  - Build ontology of answer types (by hand)
- Train classifiers to recognize
  - Using POS, NE, words
  - Synsets, hyper/hypo-nyms



Tag	Example
ABBREVIATION	
abb	What's the abbreviation for limited partnership?
exp	What does the "c" stand for in the equation $E=mc^2$ ?
DESCRIPTION	
definition	What are tannins?
description	What are the words to the Canadian National anthem?
manner	How can you get rust stains out of clothing?
reason	What caused the Titanic to sink ?
ENTITY	
animal	What are the names of Odin's ravens?
body	What part of your body contains the corpus callosum?
color	What colors make up a rainbow ?
creative	In what book can I find the story of Aladdin?
currency	What currency is used in China?
disease/medicine	What does Salk vaccine prevent?
event	What war involved the battle of Chapultepec?
food	What kind of nuts are used in marzipan?
instrument	What instrument does Max Roach play?
lang	What's the official language of Algeria?
letter	What letter appears on the cold-water tap in Spain?
other	What is the name of King Arthur's sword?
plant	What are some fragrant white climbing roses?
product	What is the fastest computer?
religion	What religion has the most members?
sport	What was the name of the ball game played by the Mayans?
substance	What fuel do airplanes use?
symbol	What is the chemical symbol for nitrogen?
technique	What is the best way to remove wallpaper?
term	How do you say " Grandma " in Irish?
vehicle	What was the name of Captain Bligh's ship?
word	What's the singular of dice?



HUMAN	
description	Who was Confucius?
group	What are the major companies that are part of Dow Jones?
ind	Who was the first Russian astronaut to do a spacewalk?
title	What was Queen Victoria's title regarding India?
LOCATION	
city	What's the oldest capital city in the Americas?
country	What country borders the most others?
mountain	What is the highest peak in Africa?
other	What river runs through Liverpool?
state	What states do not have state income tax?
NUMERIC	
code	What is the telephone number for the University of Colorado?
count	About how many soldiers died in World War II?
date	What is the date of Boxing Day?
distance	How long was Mao's 1930s Long March?
money	How much did a McDonald's hamburger cost in 1963?
order	Where does Shanghai rank among world cities in population?
other	What is the population of Mexico?
period	What was the average life expectancy during the Stone Age?
percent	What fraction of a beaver's life is spent swimming?
speed	What is the speed of the Mississippi River?
temp	How fast must a spacecraft travel to escape Earth's gravity?
size	What is the size of Argentina?
weight	How many pounds are there in a stone?