

# *Deconstructing and Debunking BOT technology*

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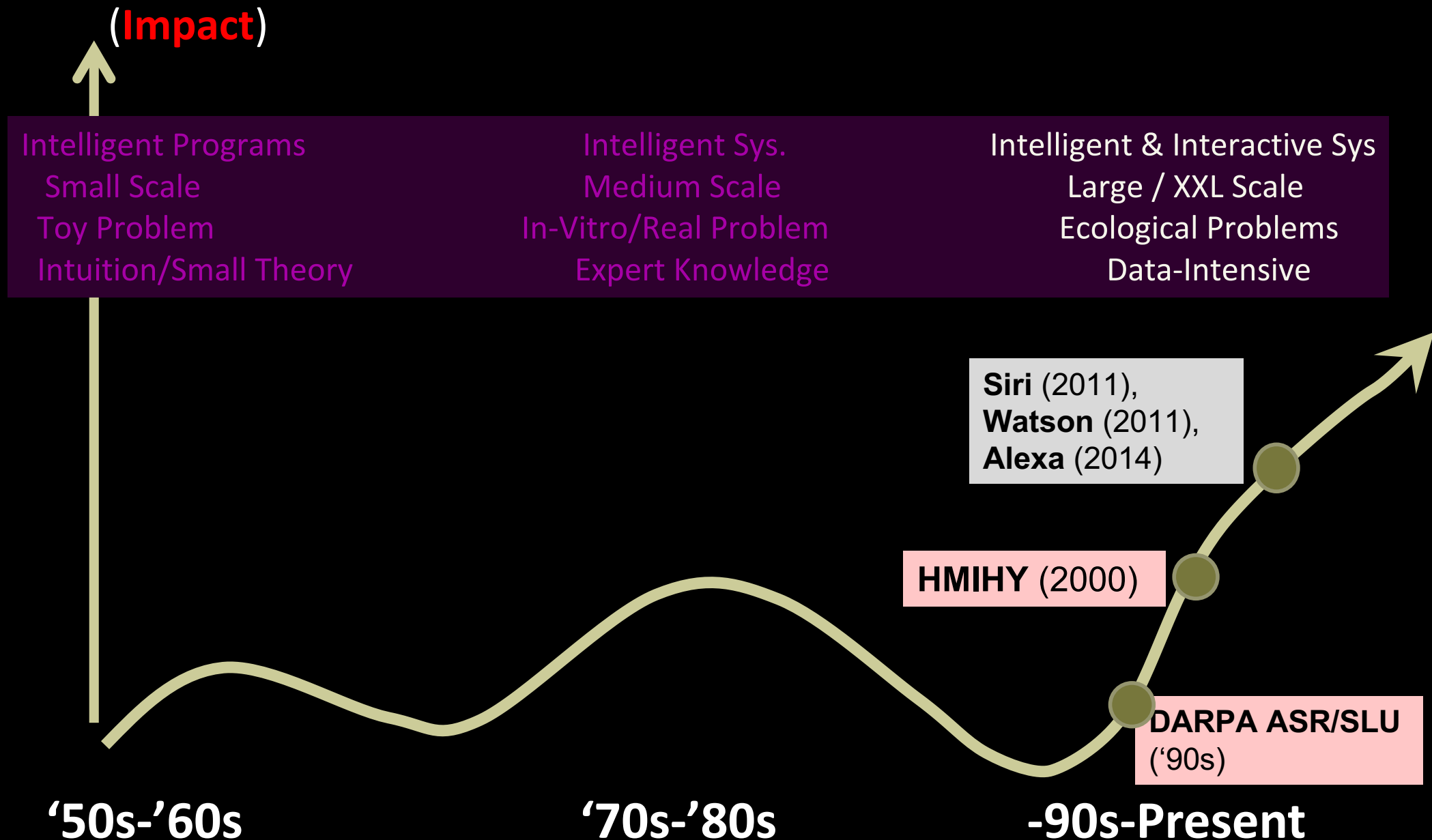
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<http://sisl.disi.unitn.it>

# Outline

- **Historical Background**
- **Context**
- **Intelligent, Interactive , Conversational Agents**
- **Industrial Perspective**
- **Platform and Tools**
- **Challenges and Opportunities**

# Artificial Intelligence Over Time





# Research Areas

**Natural  
Language  
Understanding**

**Supervised,  
Unsupervised, Active  
Learning**

**Interactive & Intelligent  
Conversational System**  
Design, Deployment and Evaluation

**User** Hi Good Morning

**Operator** Hi, How May I Help You?

**U** I am Roberta Sicconi calling from Cultural Affairs at City Hall.

**U** I had made a request for a password change yesterday.

**O** Ok do you have the date of the request?

**U** Uhmm No I can't remember.

**O** Ok do you have the date of the request?

**U** Well that was yesterday.

**O**...ok I think I can help you.

**O** It's for a password reset.

**U** Right. The password is...

How  
May I  
Help  
You?

Uh hi, My 6  
month old son  
has a fever of  
101 F - 38.4  
C....



Doctor



Patient

# Popular and Marketing Language

- “BIG DATA”
- “ANALYTICS”
- “COGNITIVE COMPUTING/PLATFORM”
- “BOT”
- “ROBOT PROCESS AUTOMATION”
- “DEEP LEARNING”

# Hype is good as long as

- Increase the attention of investors and decision makers
- **END-USERS** are **happy/satisfied/conscious and use tech**
- Investing on off-the-shelf technology ( API economy ) may be HICC\*
- **Build** competence in your company to manage the transformation.
  - Data → Process (Human, Machine)







# AI-powered Agents

## Industry Sectors

Tech, Media, E-Commerce,

Banking Finance,  
Insurance,

Retail, Automotive,  
Entertainment, Health

# Intelligent, Interactive Conversational, Agents

**How** Intelligent ?

**Why** Interactive ?

**Why** Conversational ?

**How** Does it behave ?



# Natural Language Query to DB

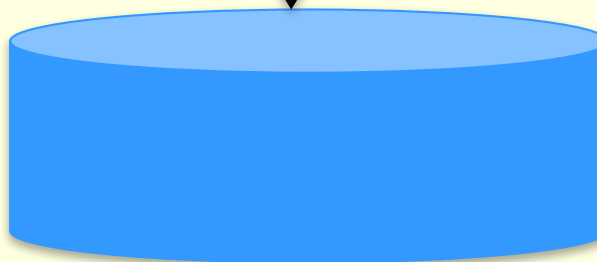
“Find the best flight from New York to Paris tomorrow business class”



Interactive Machine



Flight Database





# Natural Language Understanding

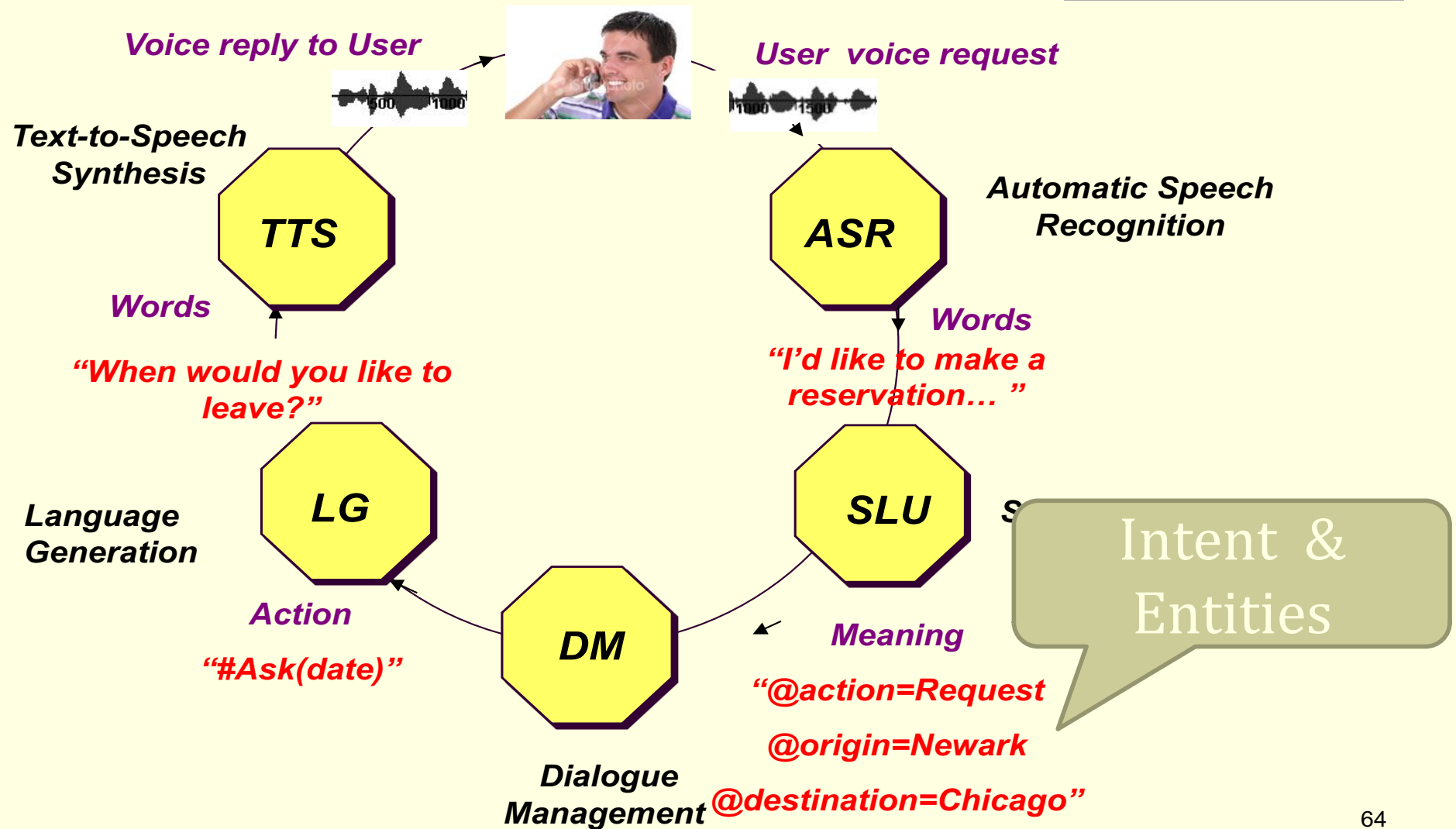
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Retrieving Info on flights  
to plan for a trip

Querying a Flight Database  
with Natural Language

Engaging into a dialogue to  
design a trip plan.

# Human-Machine Spoken Dialog



# On Terminology

- **Conversational**, Personal, **Intelligent** Agents

- Term can be used both in the scientific/technology/business literature
- It can point to roles agents can take : for example a "assistant", "mentor", "teacher", "counselor", "companion", "travel agent" ,etc..  
THEN all the predicates associated to a role are expected.

➔ *A travel agent can*

- Search flight over DB or DBs
- Ask questions about user's intent
- Compose a trip with user preferences
- Plan for a trip and incorporating business and user constraints
- Conversational ability to sustain a conversation following appropriate, effective and socially accepted strategies.



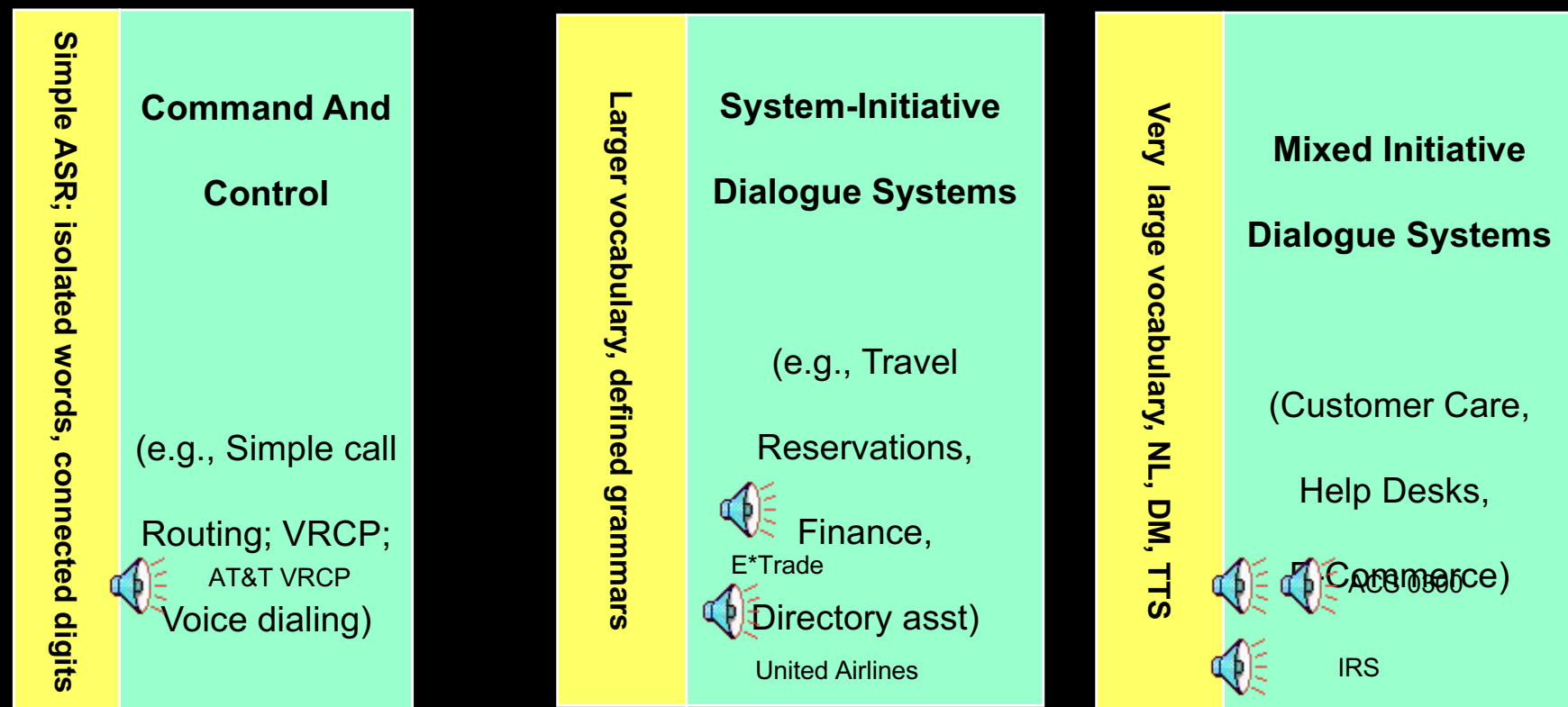
# Intelligent, Conversational and Interactive

## The Early Real Applications

1990

1995

2000



Social Media



Web - Chat



Smartphones



Mail



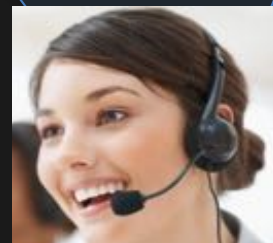
SMS



Fax



Telephone



# Intelligent, Conversational and Interactive Systems

1996

2006

2009

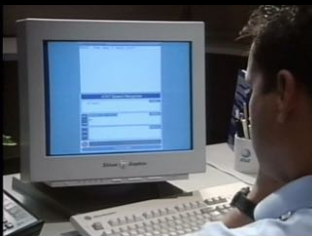
2013

2037

HelpDesk-UNITN



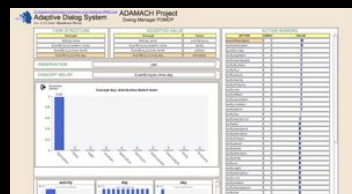
AT&T HMIHY



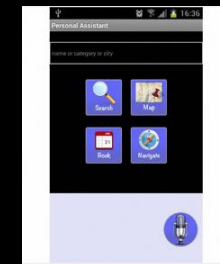
Avatar



Augmented Reality



POMDP and  
Reinforcement Learning



Mobile Assistant



Question-Answering  
IBM WATSON



Devices, IoT  
AMAZON Challenge

# AMAZON Alexa Challenge

2016

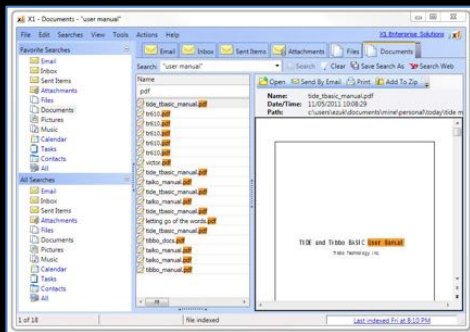
**Nov.2016:** Amazon will sponsor 12 university teams to compete in the 2016-2017 Alexa Prize. This year's inaugural competition focuses on the grand challenge of building a socialbot that can converse coherently and engagingly with humans on popular topics for 20 minutes. Amazon received over one hundred applications from leading universities across 22 countries.



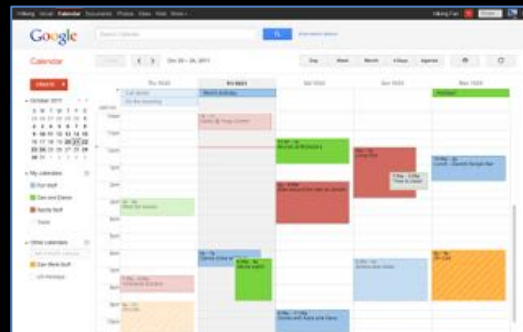
Carnegie-Mellon University	US
Czech Technical University	CZ
Heriot-Watt University	UK
Princeton University	US
Rensselaer Poly. Institute	US
U. California, Berkeley	US
U. California, Santa Cruz	US
University of Edinburgh	UK
University of Montreal	CA
<b>University of Trento</b>	<b>IT</b>
University of Washington	US

# Bot Development: Market View and Reality Checks

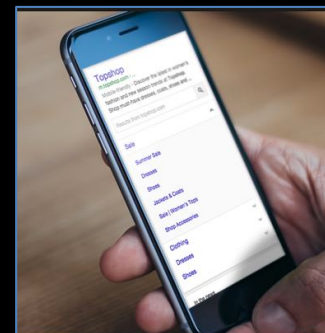
# Paradigm shift



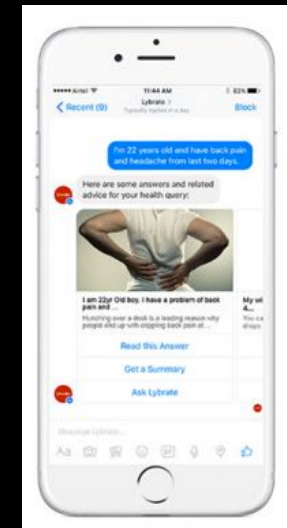
Desktop



Web



Mobile



Chatbots

4<sup>th</sup> major paradigm shift in consumer technology after desktop clients, websites, and apps

# Types of chatbots - functional

- *Proactive Notification*: provide information at the required time & place
  - flight/weather updates/reminders to pick up shopping
- *Mini-Utilities*: triggers single tasks
  - convert text to video, Search, “Play music”, “Add an entry to the calendar”
- *Productivity/Optimization*: do something better than app or website
  - Book a restaurant
  - Do unpleasant things instead of you (e.g. fighting parking ticket )
- *“Chatters”*: casual conversation
  - Tay, Xiaolce
- *Intelligent Personal Assistants*: (more of a platform)
  - Siri, Alexa, Cortana, ...
- *Crowd-based Bots*: Wisdom of the crowd
  - Swelly, Facebook M



# Bot Landscape –Hyped



## Wishlist:

- Help customers buy stuff or perform complex transactions
- Should do it through natural language
- Should understand complex instructions

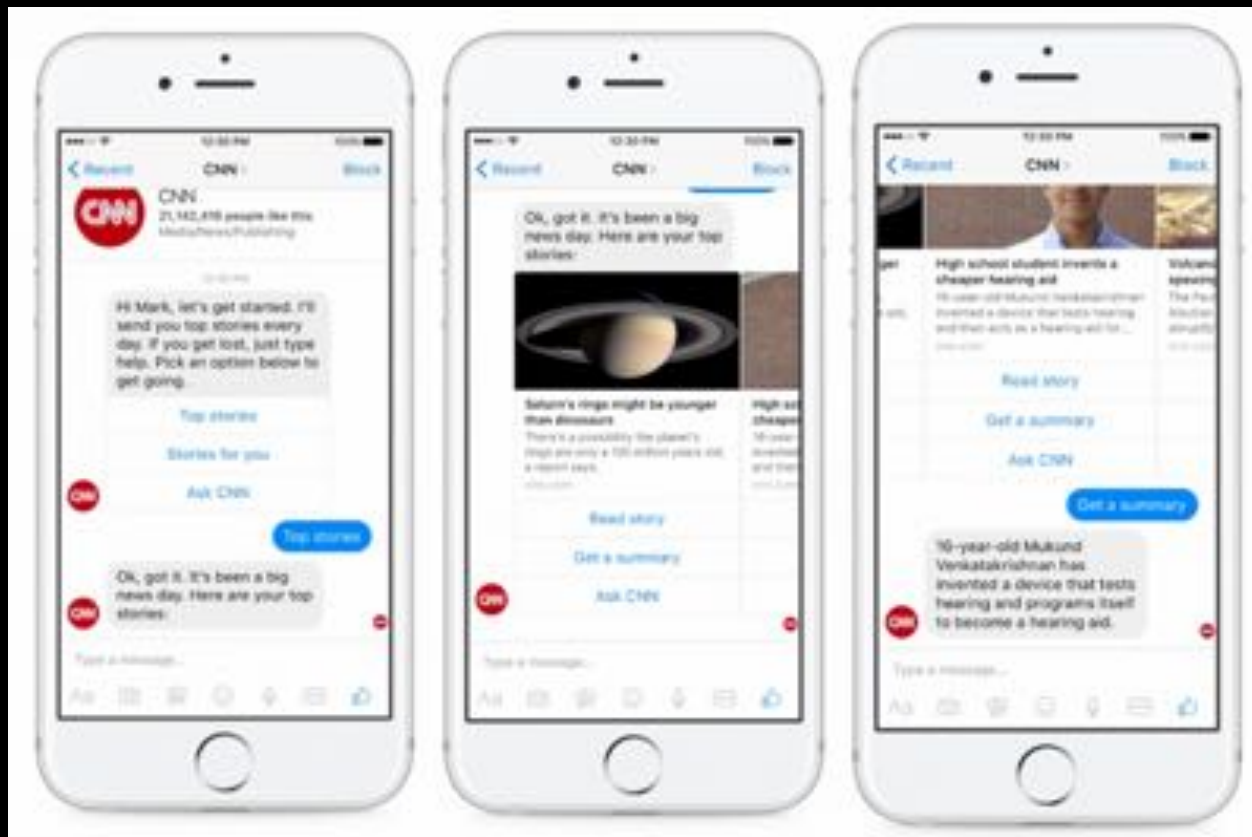
# Objectives vs Tools

- Full automation of call centers and BPOs
  - Understanding of User Requests to identify user intentions.
  - Natural language responses to solve problems.
- Simple call routing and canned automatic responses.
  - Parsing based on keyword spotting and pattern matching.
  - Responses based on predefined Question/Answer pattern coding and information retrieval.

# DEMO

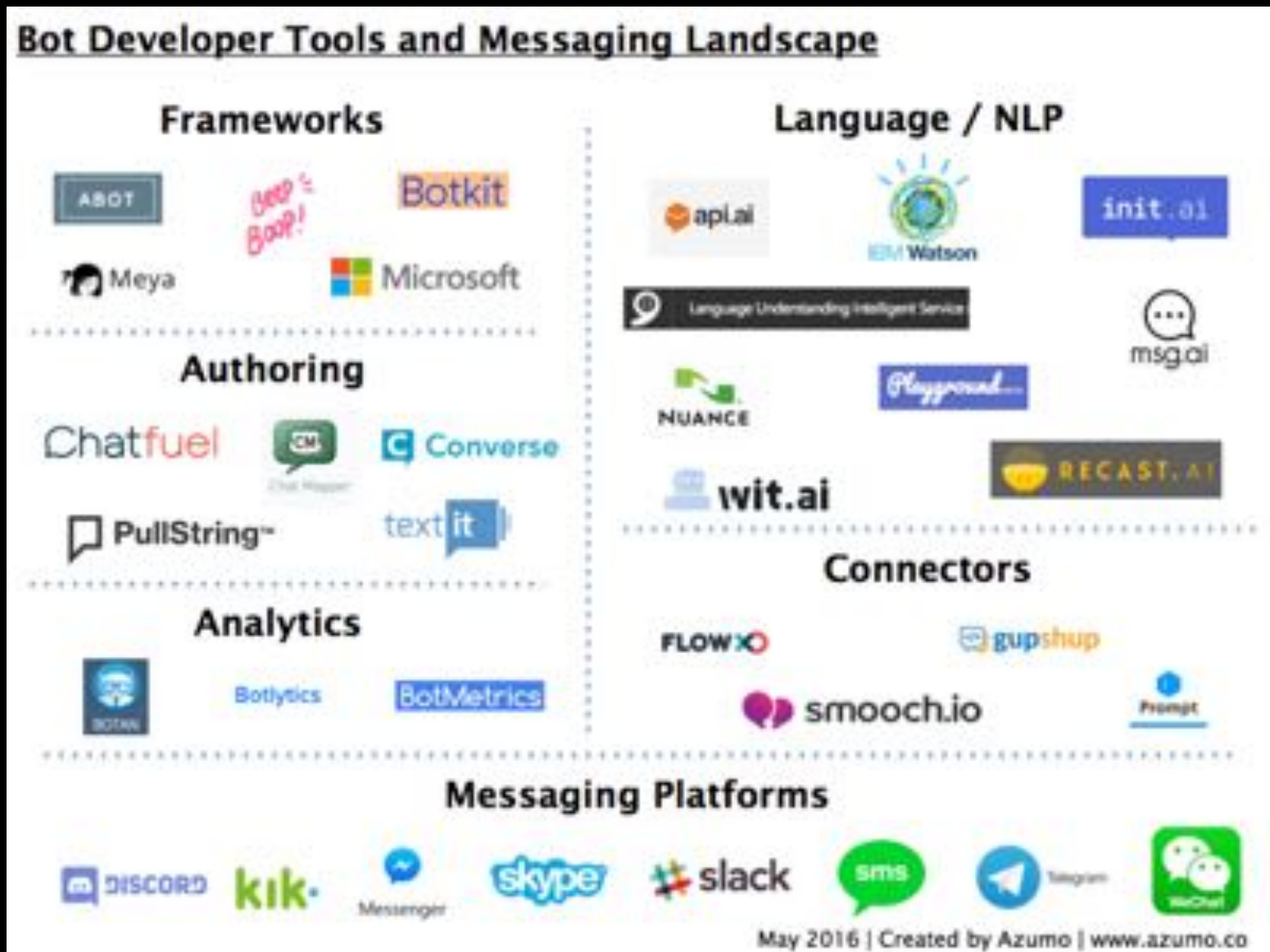
1. How to use commercially available platform to develop bots
2. Discussion of a real example
  1. BlueMix ( video )
  2. Wit.ai ( video )

# Current State – In Reality



- Limited conversational capability.
- Keyword spotting.
- Mostly combinations of clicks and swipes.

# Bot development tools and technologies



**Set Up AI** English Q

Set up keyphrases and the corresponding bot replies. Your bot will understand user phrases similar to those you've set up and reply with some text or a block.

**+ ADD AI RULE**

<p>IF USER SAYS SOMETHING SIMILAR TO:</p> <p>Press "↵ Enter" to add more phrases</p>	<p>BOT REPLIES WITH TEXT <span>+</span> <span>RANDOM</span></p> <p>Enter text</p>
<p>IF USER SAYS SOMETHING SIMILAR TO:</p> <p>I am looking for a backpack</p>	<p>BOT REPLIES WITH TEXT <span>+</span> <span>RANDOM</span></p> <p>What kind of backpack do you want?</p>

- Chatfuel is the most popular bot authoring tool to create bots for facebook and Telegram.
- Developer has to handcraft responses
- Based on simple Regular Expressions





# Conversation

Build chatbots that understand natural language and deploy them on messaging platforms and websites, on any device

## #complaint

+ Add a new user example...

- ☐ Can I get some help
- ☐ I need this fixed
- ☐ I've got a problem
- ☐ I wish to register a complaint
- ☐ Please help me out
- ☐ Something's wrong

## Entity

@Appliance

### Value

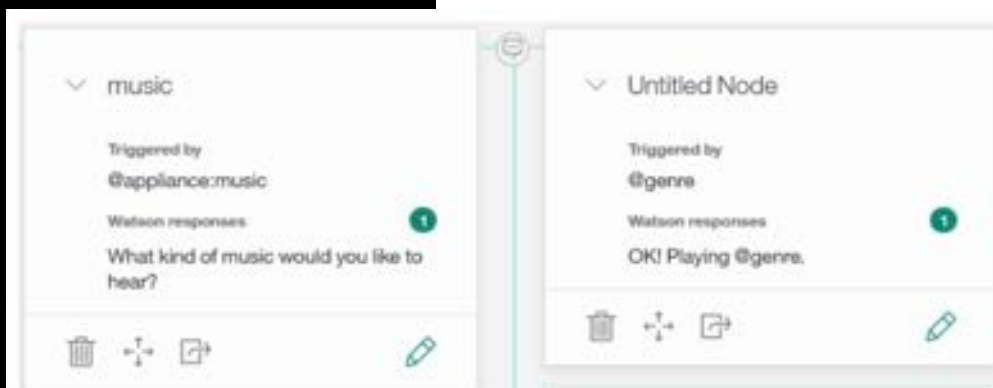
Add a value, for example, Cat

Music

Lights

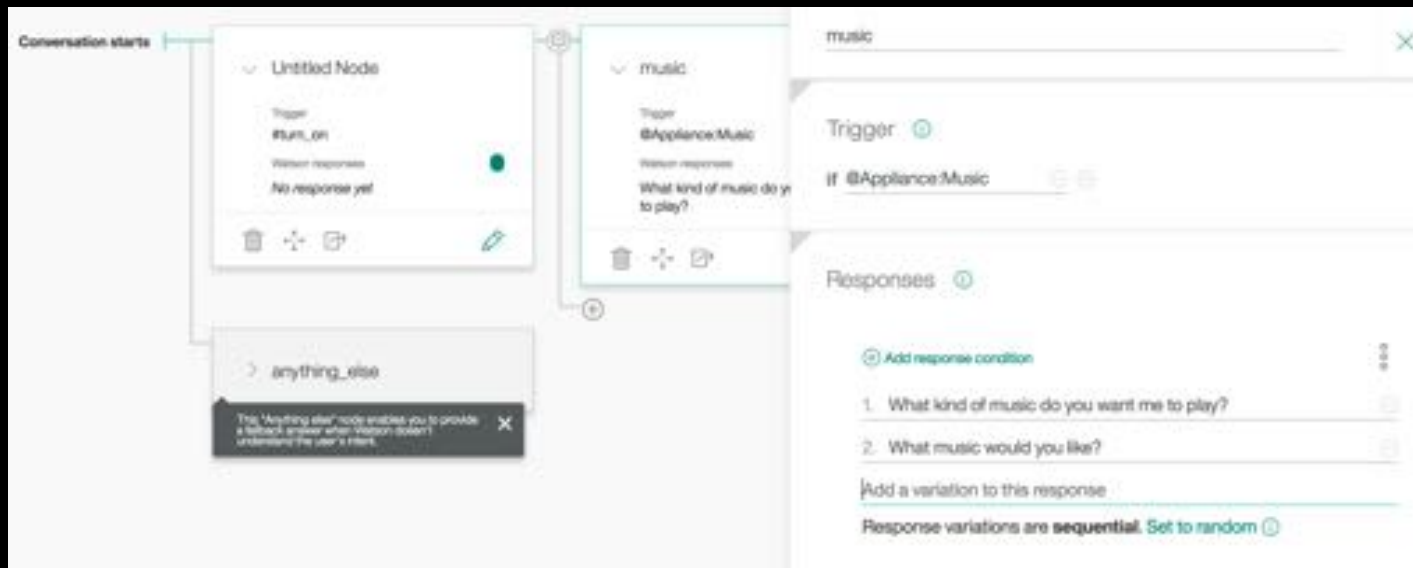
AC

- Watson conversation Service is powered by IBM watson.
- Better than Chatfuel
- Based on Intents and Entities.
- Developer must manually provide example utterances to match intents
- Developer must provide example entities.
- Conversations must be manually built.
- You pay per intent you have in your dialogue.



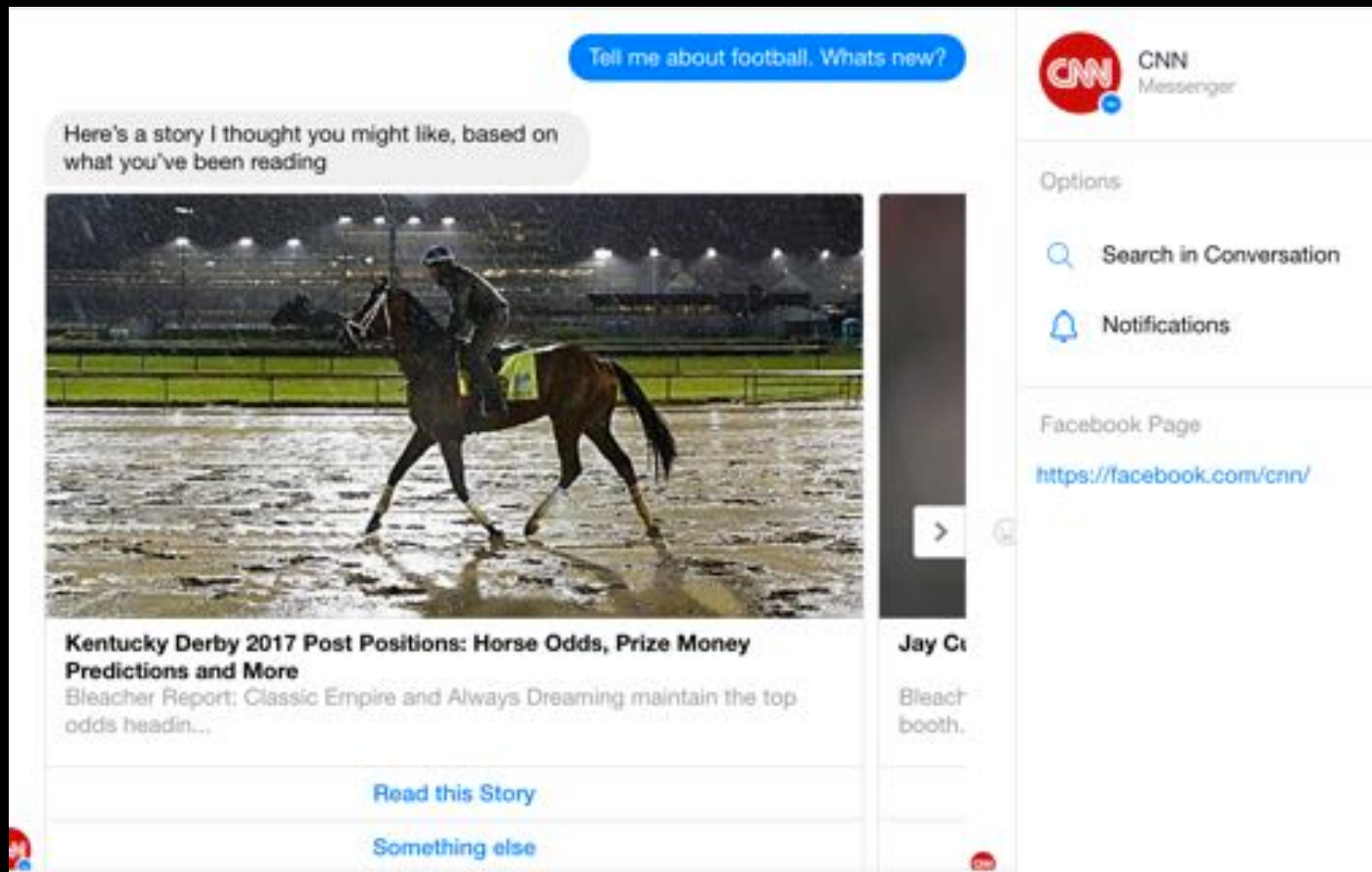


# Creating Dialogues



- **Developer** must handcraft the dialogue Turn by Turn
- Good for short tasks ( command-and control)
  - Lot of manual labour, and time intensive for long conversations.

# Current State – CNN bot on messenger



- Natural Language understanding is very limited.
- I asked about football !!!

# Limitations

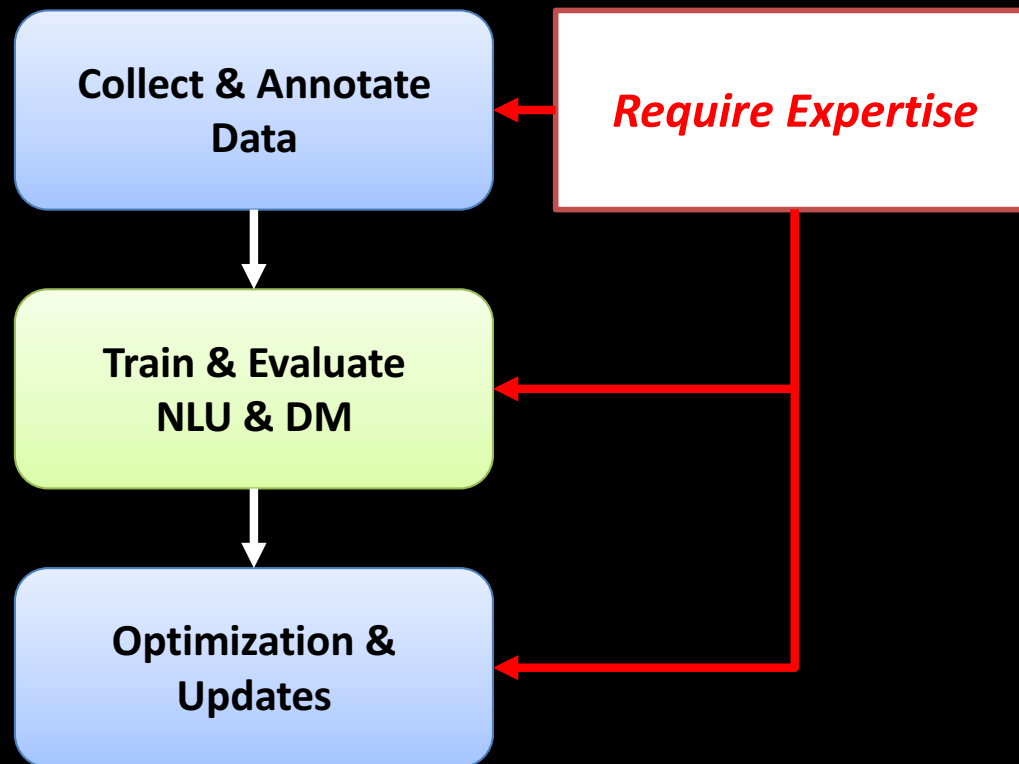
- Bots on messengers have limited conversational capability (mostly based more on swipes and clicks).
- Most development tools are based on simple Regular Expression Parsing or keyword spotting for **understanding**
- Most Systems (e.g. wit.ai/Watson) are based on **Intents** and **Entities** and **Question-Answer if-then-else coding**.
- Hardly any system considers **context** in **understanding** and/or **dialogue**
- ➔ They require **extensive manual effort and expertise** to develop a continuous exchanges of question/answers.

# Challenges and Opportunities

- How to design a complete conversational stack ?
  - Parsing ( NLU , Discourse )
  - Context and State Management
  - Dialogue strategies
  - Development tools
- How to design a complete conversational stack for multimodal and multisensorial interaction ?
- How to use data to improve the training of agents ?
- How to train a dialog model from data and human input that evolves over time ?

# Bot Development Process

Data + Human + Algorithms + SW = Intelligent & Interactive Conversational Agent



- *More “natural” conversation*

## Data-Driven:

- Machine Learning
- Adaptable NLP

## Hybrid:

- ML-based NLU
- Knowledge-based DM

# Q&A