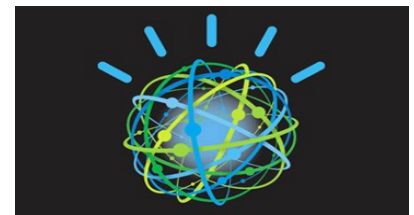


Ricerca delle informazioni e linguaggio umano: il caso WATSON

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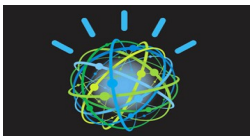
OUTLINE

- INTRODUZIONE
 - Vi presento WATSON
 - Perché la realizzazione di WATSON è stata possibile
- ALL'INTERNO DI WATSON
 - Vi do' un quadro dello stato dell'arte nel campo della sperimentazione linguistica su cui si basa WATSON
 - Quiz e domande: ma i quiz sono costituiti da domande fattuali...
- DOPO WATSON?
 - Intelligenza Artificiale e linguaggio umano su Web
 - Il nuovo task: Machine Reading



WATSON

- Watson ha vinto Jeopardy! la gara a quiz più famosa in America
- Watson è un sistema di calcolo creato da IBM
- Watson racchiude in un unico sistema tutto il meglio della conoscenza attuale nel campo della ricerca dell'informazione linguistica
- Watson è nato dallo sforzo congiunto di un team di ricercatori dell'IBM e altri provenienti da 8 diverse università americane + Trento (FBK-Università)

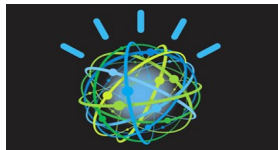


WATSON

- **Watson è un computer a calcolo parallelo con 2.880 processori POWER7 organizzati in novanta server POWER 250, con 16 Terabyte di memoria RAM e 4 Terabyte di storage; questo supercomputer è stato sviluppato dall'IBM in collaborazione con otto atenei, tra i quali figura anche L'FBK e un'università italiana: l'Università di Trento.**
- **L'intelligenza artificiale ha battuto l'uomo; il supercomputer è stato in grado di analizzare, comprendere, elaborare e rispondere a domande rivolte in linguaggio naturale ed ha dimostrato di avere una "cultura" su vari campi: medicina, arte, letteratura, storia e cultura pop.**



WATSON



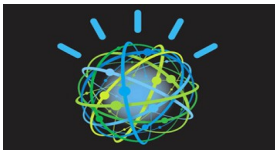
HOW MUCH... HOW FAST

- How much did it cost to develop IBM's Watson? According to a technical article it took 20 engineers 3 years to build it. With an average cost of \$300k per engineer, the labor costs look like \$18 million. But this doesn't account for the hardware and infrastructure costs, nor does it account for the cost of developing the technologies, algorithms, etc that the team used to get started (partially funded by government research). Anyone have a better estimate? If 32 core Power 750 retails for \$350 grand .. then 2,880 core would cost you \$31.5 million .. Total cost approximates 50 million dollars.
- Watson has 80,000 GFLOPS. Intel Core i7 has around 80 GFLOPS. Affordable computing power increases 10-times every 4 years: If Watson is 1000 times more powerful than your computer, you need to wait 12 years. The software already is available and will run on any personal computer. However, one of the engineers said in an interview that a single question takes about 2 hours to compute an answer to on a regular computer.



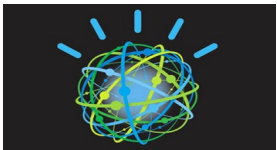
Ricerca Linguistica Sperimentale

- The **DeepQA project** at IBM shapes a grand challenge in Computer Science that aims to illustrate how the wide and growing accessibility of natural language content and the integration and advancement of Natural Language Processing, Information Retrieval, Machine Learning, Knowledge Representation and Reasoning, and massively parallel computation can drive open-domain automatic Question Answering technology to a point where it clearly and consistently rivals the best human performance. ***A first stop along the way is the Jeopardy! Challenge...***



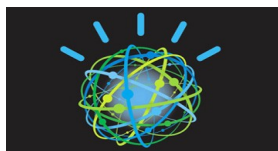
Ricerca Linguistica Sperimentale: NIST

- Da circa 20 anni il NIST – National Institute Standards in Technology, Washington – si preoccupa di stimolare la ricerca sperimentale nel campo delle tecnologie per la ricerca e l'uso dell'informazione linguistica e rende disponibili i materiali sperimentali a tutta la comunità scientifica.
- Organizza International Challenges che sono aperte all'accademia e all'industria e hanno visto la partecipazione di centinaia di gruppi di ricerca – anche quest'anno ci sono diverse gare aperte. I risultati vengono presentati in una conferenza, che prima era chiamata TREC e di recente ridenominata TAC



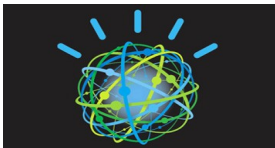
Ricerca Linguistica Sperimentale: NIST

- TREC sta per Text Retrieval Conference mentre TAC sta per Text Analysis Conference: da qui si capisce il cambio di paradigma.
- Il Retrieval si fa con strumenti matematico statistici e poche conoscenze linguistiche
- L'Analysis invece richiede la messa in gioco di tutta la tecnologia linguistica disponibile e spinge la ricerca a forme ibride



Ricerca Linguistica Sperimentale: NIST

- I task o temi della ricerca che è stata sponsorizzata dal NIST sono essenzialmente di due tipi:
 - Question/Answering
 - Summarization
 - Information Retrieval/ Information Extraction
 - Shallow NLP / Deep NLP



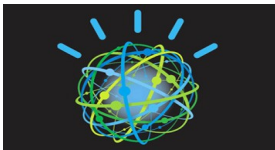
A CHE PUNTO SIAMO?

- E' possibile rispondere in tempo reale (solo con WATSON) a domande FATTUALI
 - Ma non tutte le domande sono così
- E' possibile riassumere un testo in poche parole (fare riassunto per estrazione)
 - Ma e' difficilissimo generare un Abstract (per astrazione)
- Ma già sta nascendo una nuova realtà: la Semantic Web che permetterà di rispondere a domande direttamente dal web e non solo...
 - In realtà è già nata da tempo ma pochi lo sanno

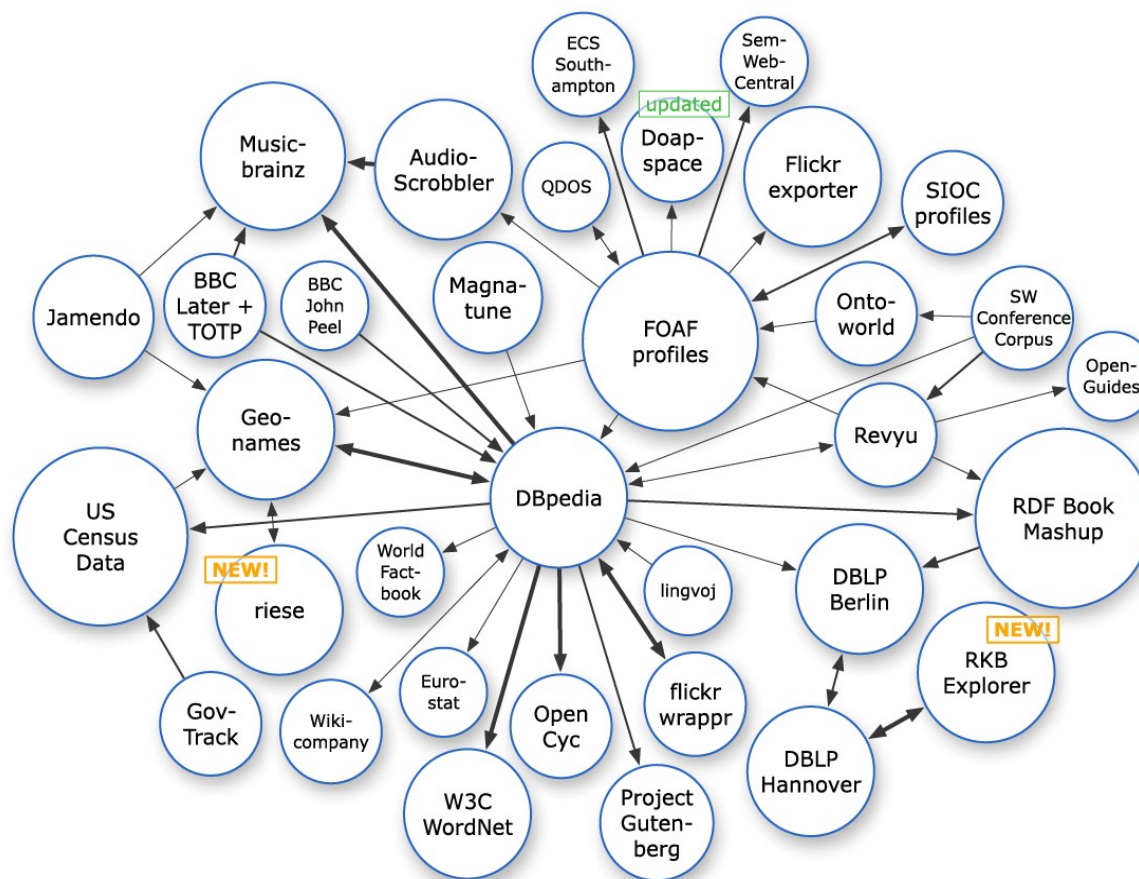


La Semantic Web e il LOD

- Il futuro del web è rappresentato da una rete molto più veloce di quella attuale e dalla disponibilità in enormi quantità di informazione linguistica **STRUTTURATA** in forma **LOGICA**.
- Il web contiene già milioni e milioni di pagine strutturate con informazioni su entità di ogni tipo – informazioni geografiche, biografiche, mediche etc., chiamato il LOD.



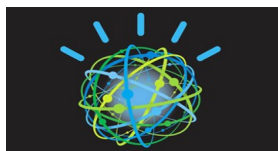
Linking Open Data dataset cloud



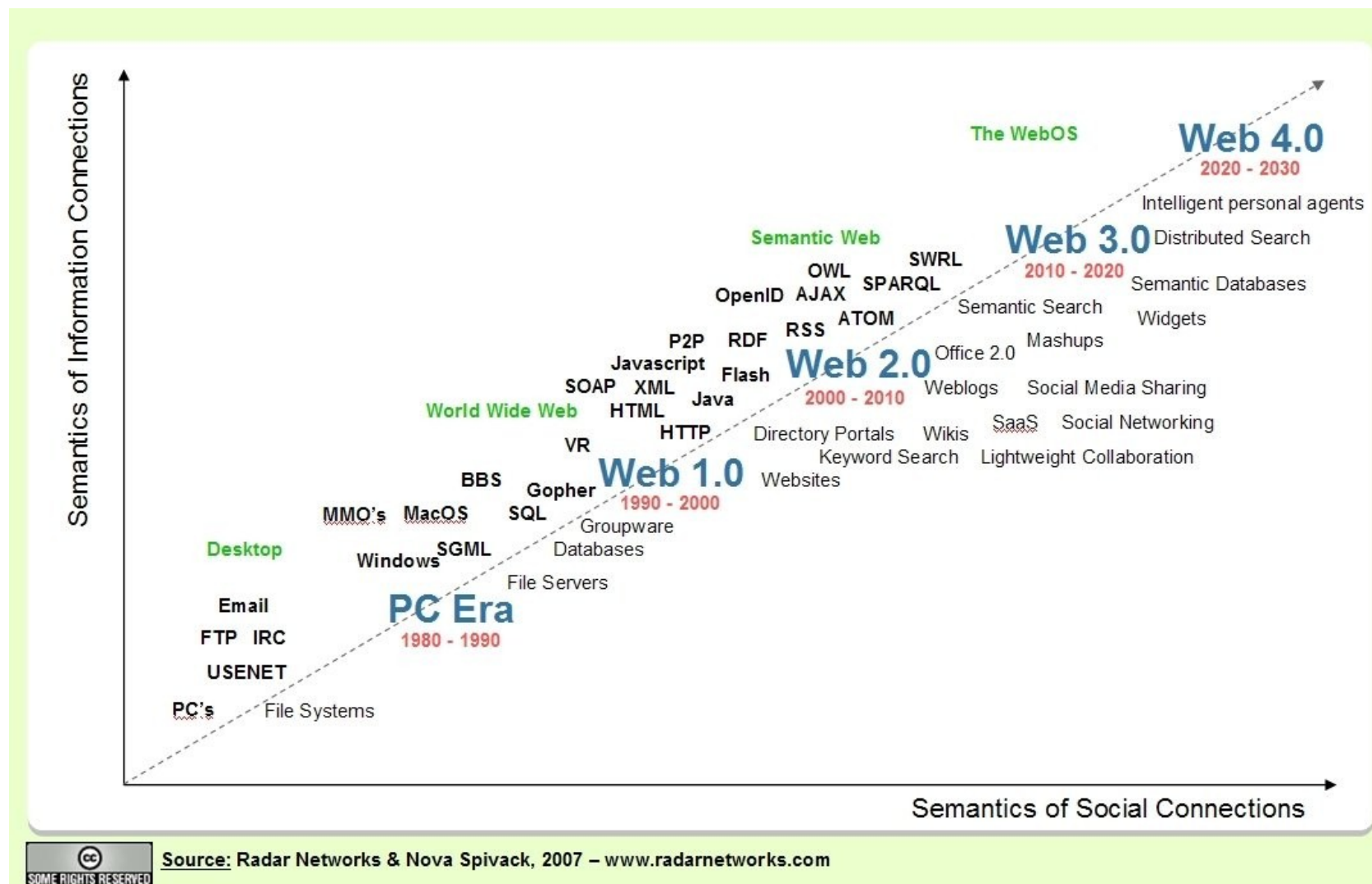
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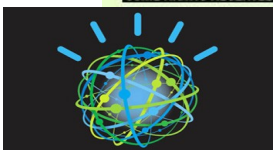
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Evolution of the web



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Machine Reading

- Questo è il nome del task che domina adesso la scena delle Challenges internazionali
- Si chiede a un sistema di leggere un testo reale, di notevole complessità, - in media di 800 parole - e poi di rispondere a una serie di domande sul suo contenuto, scegliendo la risposta tra quelle proposte
- In gergo linguistico, si tratta di un esercizio di Reading Comprehension con 10 domande e 5 risposte a scelta multipla per ogni domanda; una sola risposta è giusta e ci sono 4 distractors



Un esempio

Solar power from Africa could power all of Europe.

The French President Nicolas Sarkozy earlier this summer launched, with the support of EU, a new Mediterranean union with the aim to “tackle issues such as regional unrest, immigration to pollution.”

The new international body will include 16 non-EU states from around the Mediterranean and all 27 EU member states. The union will focus on dealing with energy, security, counter-terrorism, immigration and trade. The union will include 756 million people from Western Europe to the Jordanian desert.

Some say that the Union was launched mainly because Nicolas Sarkozy wanted to “exchange” nuclear power expertise with North African gas reserves. Nicolas Sarkozy on the other hand says the union is supposed “to ensure the region's people could love each other instead of making war.”

But some people are more positive and hope the union is the first steps towards large scale solar plants in northern Africa with focus of generating green and renewable electricity to Europe.

Scientists from the EU are planning for a new supergrid between the different EU member states. This new supergrid will be built using new DC (HVDC) lines which are perfect for transmissions of energy over long distances. The supergrid could allow Denmark and the UK to export wind energy and Iceland to export geothermal energy at times when production exceeds demand to other EU member states.

But the supergrids main purpose would be to transmit renewable solar energy from the Saharan desert to Europe. The scientists want to build a series of huge solar farms in the Saharan desert and connect them to the supergrid.



Un esempio

Arnulf Jaeger-Walden of the European commission's Institute for Energy says “it would require the capture of just 0.3% of the light falling on the Sahara and Middle East deserts to meet all of Europe's energy needs.”

According to the scientists the sunlight in Sahara could “generate up to three times the electricity compared with similar panels in northern Europe” because the sunlight in this area is so intense.

The supergrid project has been met optimistically by both politicians, like Nicholas Sarkozy and Gordon Brown, and environment organisations, such as Greenpeace.

“Assuming it's cost-effective, a largescale renewable energy grid is just the kind of innovation we need if we're going to beat climate change,” said Doug Parr, Greenpeace UK's chief scientist.

Arnulf Jaeger-Walden believes that the solar energy from the Saharan desert would be cheap and “below what the average consumer is paying:”

“The biggest PV system at the moment is installed in Leipzig and the price of the installation is €3.25 per watt. If we could realise that in the Mediterranean, for example in southern Italy, this would correspond to electricity prices in the range of 15 cents per kWh, something below what the average consumer is paying.”

The project would take many years to complete and huge investments at a total cost of around €450 billion would be needed. But the scientists expect that by 2050 solar energy from the Saharan desert could produce 100 GW. That is more than all the energy sources in the UK combined could ever generate.

The project would also help Europe to meet its own climate change commitments to generate 20% of all the energy from renewable energy sources, decrease energy consumption by 20% and reducing CO2 emissions by 20% by 2020.



Domande/Risposte

- Who launched the Mediterranean Union ?
 - 1.Gordon Brown;2.Sarközy de Nagy-Bocsa;3.Arnulf Jaeger-Walden;4.Greenpeace UK's chief scientist;5.Simon Leufsted
- How many different states will be involved in the international organisation which Nicolas Sarkozy launched ?
 - 1. 16;2. 27;3. 756 million;4. six;5. 43
- Which of the following is true of the statement that the President of France wishes to exchange expertise on nuclear power for North African gas reserves ?
 - 1.it is definitely true;2.it is definitely false;3.it is said by Sarkozy;4.it is said by Brown;5.it is said by others



Domande/Risposte

- Is Greenpeace in favour of the supergrid project ?
 - 1.definitely;2.definitely not;3.unknown;4.no;5.sometimes
- Why is the Sahara better than northern Europe for generating solar electricity ?
 - 1.there are more scientists;2.there is more sunlight;3.there is not so much sunlight;4.the day is shorter;5.the panels are similar
- Which of the following is Europe committed to ?
 - 1.increasing production of CO₂ by 2020;2.increasing the amount of sunlight;3.decreasing political speeches;4.decreasing the amount of energy used by 2020;5.increasing political activity



Domande/Risposte

- How does Doug Parr qualify his support for an energy grid ?
 - 1.it must beat climate change;2.it must be an innovation;3.it must be supervised by Greenpeace;4.it must produce a benefit greater than its cost;5.it must include the Sahara
- “Assuming it's cost-effective, a largescale renewable energy grid is just the kind of innovation we need if we're going to beat climate change,” said Doug Parr, Greenpeace UK's chief scientist.
- cost-effective?? Đ 4.

