No Smartness Without Data

**(...äh... No Intelligence without Knowledge
or „Knowledge is Power")**

Dieter Fensel

University of Innsbruck

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Acknowledgement

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Contents

1. Artificial Intelligence

- Kick off: The **Dartmouth Summer Research Project on Artificial Intelligence** 1956.
- First Phase: **General Problem Solver**. Any problem can be solved, …. *in principle*.
  - While such a General Problem Solver can solve simple problems, *it could not solve any real-world problems*.
- Second Phase: *Knowledge is Power*.
  - Intelligence is the ability to apply knowledge to manipulate one's environment.
  - Knowledge Representation as a research field arose.

1. Artificial Intelligence

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Third Phase: **Knowledge Acquisition**

- The phrase was used to describe the initial tasks associated with developing an expert system, namely finding and interviewing domain experts and capturing their knowledge via rules, objects, and ontologies.
- **Knowledge acquisition bottleneck**
    - Acquiring, modelling, and representing this knowledge was an extremely costly endeavor.
    - Most knowledge iceland were extremely limited and brittle.
    - Projects such as CYC just proved that modelling the human world knowledge is a non-feasible tasks.

BOTTLENECKS

1. Artificial Intelligence

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Final phase: **AI winter**

2. Semantic Web

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- The **World Wide Web** (**WWW**) is an information space where documents and other web resources are
    - described by hypertext mark up
    - interlinked by hypertext links,
    - identified by URIs, and
    - can be accessed via the Internet.
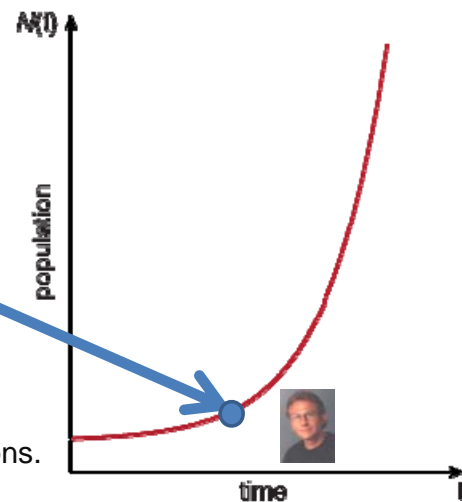- The World Wide Web was invented by Sir Tim Berners-Lee around 1989.

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2. Semantic Web

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- Growth of the **World Wide Web** (**WWW**)

- Semantic Web started in 1996 for two reasons.

2. Semantic Web

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- Helping the web to scale infinitely

Table 1. Some Ontology Definitions

Concept Hierachy	Attribute Definitions	Rules

Object[].
 Person :: Object.
 Employee :: Person.
 AcademicStaff :: Employee.
 Researcher :: AcademicStaff.
 Publication::Object.
	Person[
	 firstName =>> STRING;
	 lastName =>> STRING;
	 eMail =>> STRING;
	 ...
	 publication =>> Publication].
	 Employee[
	 affiliation =>> Organization;
	 ...].
		FORALL Person1, Publication1
		 Publication1:Publication
		 [author ->> Person1]
		 <->
		 Person1:Person
		 [publication ->> Publication1].

<html> <body>

        <h2>Welcome on my homepage</html>
        My name is Richard
        Benjamins.
        </body></html>

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2. Semantic Web

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- Solving the knowledge acquisition bottleneck and creating a brain for human kind.
- Vision semantic Web: *a brain of/for human kind*
    - Billions of humans put information on this global network
    - Through this the Web mirrows large fractions of the human knowledge
    - A new brain of humanity based on the knowledge of mankind.
    - Empowered by semantics computer can access and understand this knowledge.
- CYC works when the entire humanity is joining this task
for free.
- Like annotating content with structural info (html) it just
requires to annotate content with semantic information.

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2. Semantic Web: Google 1.0

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Semantic Web:

NO !

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2. Semantic Web: Google 1.0

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Google as a *Search Engine*:

- Statistical analysis of web resources is enough to provide a fast and excellent index system for the Web.
- Google does not need semantics for this!

Google | anna fensel

All   Images   Videos   Maps   News   More ▾   Search tools

About 29.400 results (0,55 seconds)

Images for anna fensel   Report images

More images for anna fensel

Anna Fensel
www.**anna.fensel.com/** ▾
Dr. **Anna Fensel** (previous name: Anna V. Zhdanova) is Senior Assistant Professor, Head of Research Unit at STI Innsbruck, University of Innsbruck, Austria.

Anna Fensel | STI Innsbruck
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Anna Fensel. Ass.-Prof. Dr. Anna. Fensel. University of Innsbruck Technikerstraße 21a. Innsbruck, Austria. Phone: +43 512 507 53720. Email: **anna.fensel@sti2.**

Anna Fensel - Google Scholar Citations
scholar.google.de/citations?user=R73gJDcAAAAJ&hl=en ▾

2. Semantic Web: Google 2.0

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Google as a *Query Answering Engine* [2012]

Semantic Web:

YES !

Google

2. Semantic Web: Google 2.0

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Google   when was dieter fensel born
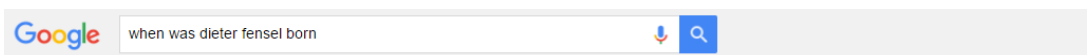
All   Images   News   Shopping   Videos   More ▾   Search tools

About 11.100 results (0,82 seconds)

Dieter Fensel / Date of birth

October 10, 1960 (age 55 years)

Feedback

Dieter Fensel - Wikipedia, the free encyclopedia
https://en.wikipedia.org/wiki/Dieter_Fensel ▾
Jump to **Biography** - Jump to: navigation, search. Dieter Fensel (born **10 October 1960**, in Nuremberg) is a German researcher in the field of formal languages and the semantic web.

when was dieter fensel born - Evi
https://www.evi.com/q/when_was_dieter_fensel_born ▾
when was dieter fensel born. Dieter Fensel was born on Monday October 10th 1960. wikipedia · About · Careers · Mobile. © 2016 Evi Technologies Ltd. The Evi ...

Dieter Fensel

Dieter Fensel is a German researcher in the field of formal languages and the semantic web. He is University Professor at the University of Innsbruck, where he directs the Semantic Technologies Institute ... Wikipedia

Born: October 10, 1960 (age 55), Nuremberg

Education: Free University of Berlin

People also search for: Rudi Studer, Frank van Harmelen, G. Antoniou

Books
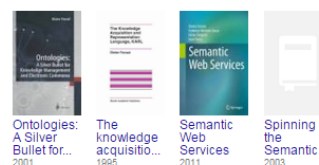
Ontologies: A Silver Bullet for... 2001

The knowledge acquisitio... 1995

Semantic Web Services 2011

Spinning the Semantic... 2003

2. Semantic Web: Google 2.0

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Google Knowledge Graph

- *"A huge knowledge graph of interconnected entities and their attributes".*

Amit Singhal, Senior Vice President at Google

- *"A knowledge based used by Google to enhance its search engine's results with semantic-search information gathered from a wide variety of sources"*

http://en.wikipedia.org/wiki/Knowledge_Graph

- Based on information derived from many sources including *Freebase*, *CIA World Factbook*, *Wikipedia*
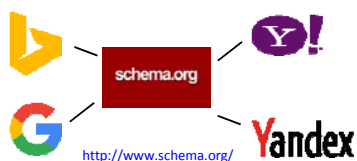
- Contains many billion facts and Objects:

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2. Semantic Web: Google 2.0

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Schema.org: created and recommended by the „big 4":

http://www.schema.org/

Embedded into HTML:

- Microdata
- RDFa
- JSON-LD

```
<div itemscope itemtype="http://schema.org/Movie">
  <h1 itemprop="name">Avatar</h1>
  <div itemprop="director" itemscope itemtype="http://schema.org/Person">
  Director: <span itemprop="name
(born
  </d    <div vocab="http://schema
  <sp      <h1 property="name">Ava
  <a       <div property="director
</div    Director: <span propert
         (born <time property="bir
           </div>
           <span property="genre">
           <a href="../movies/avat
         </div>
```

```json
<script type="application/ld+json">
{
  "@context": "http://schema.org/",
  "@type": "Movie",
  "name": "Avatar",
  "director":
    {
      "@type": "Person",
      "name": "James Cameron",
      "birthDate": "1954-08-16"
    },
  "genre": "Science fiction",
  "trailer": "../movies/avatar-theatrical-trailer.html"
}
</script>
```
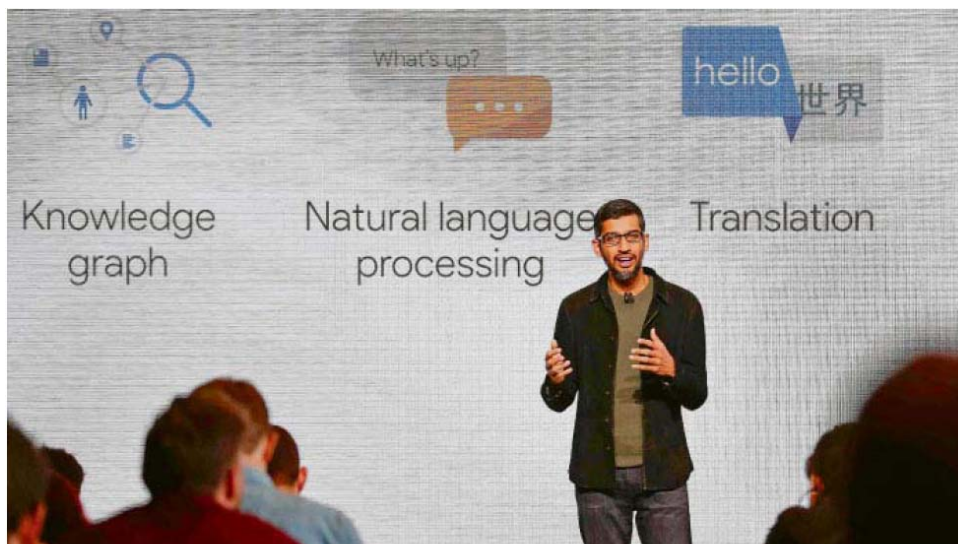
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2. Semantic Web: Google 2.0

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In der Manier des Apple-Gründers: *Googles Vorstandschef Sundar Pichai bei der Produktvorstellung in San Francisco*   Foto Reuters

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2. Semantic Web: Google 2.0

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Rich Snippets

Recipes

Guacamole - wie sie am besten schmeckt - Rezept ...
www.ichkoche.at › Rezepte ▾
★★★★☆ Bewertung: 3,8 - 230 Rezensionen - 15 Min.
Jede Hausfrau in Mexiko hat ihr eigenes Rezept. Allerdings sind sich alle einig - Avocados und Limette sind zwingend, sonst ist es keine Guacamole.

Guacamole (Avocadocreme) - Rezept - ichkoche.at
www.ichkoche.at › Rezepte ▾
★★★★☆ Bewertung: 3,8 - 139 Rezensionen - 15 Min.
Für die Guacamole Zwiebel und Knoblauchzehe schälen und sehr fein hacken. Korianderblättchen von den Stielen zupfen und fein hacken, Chilischote.

Hotels

Booking.com: Hotel Alpendomizil Neuhaus - Mayrhofen ...
www.booking.com/hotel/at/alpendomizil-neuhaus.de.html ▾
★★★★☆ Bewertung: 8,9/10 - 453 Rezensionen
Das Alpendomizil Neuhaus liegt im Herzen von Mayrhofen und genießt eine ruhige ... Ich bin zu 5 mal in dem Hotel gewesen und fand es immer wieder schön.

Hotel Alpendomizil Neuhaus in Mayrhofen/Zillertal ...
www.holidaycheck.de › Europa › Österreich › Tirol › Mayrhofen/Zillertal ▾
★★★★☆ Bewertung: 5,4/6 - 206 Rezensionen
Hotel Alpendomizil Neuhaus ✓✓✓ Jetzt 206 Bewertungen und 144 Bilder vergleichen ... HolidayCheck mit Tiefpreisgarantie Ihre Mayrhofen/Zillertal Reise buchen.

Alpendomizil Neuhaus Hotel & Spa, Mayrhofen, Tirol ...
www.tui.com › Österreich › Tirol › Mayrhofen ▾
★★★★☆ Bewertung: 5,4/6 - 204 Abstimmungsergebnisse
Jetzt mit TUI buchen: Alpendomizil Neuhaus Hotel & Spa in Mayrhofen günstig und sicher beim Marktführer buchen - Alpendomizil Neuhaus Hotel & Spa!

Products

Lenovo ThinkPad X1 Yoga - Full Review and Benchmarks
www.laptopmag.com/.../lenovo-thinkpad-x1-yoga ▾ Diese Seite übersetzen
★★★★☆ Bewertung: 4 - Bewertung von Andrew E. Freedman
10.03.2016 - The Lenovo ThinkPad X1 Yoga is a sleek business 2-in-1 that will last a full workday whether you're banging out spreadsheets or drawing on ...

Lenovo ThinkPad X1 Yoga 20FQ0040GE - Notebookcheck ...
www.notebookcheck.com › ... › Externe Tests ▾
★★★★☆ Bewertung: 78 % - 5 Abstimmungsergebnisse
Diese Seite liefert Infos aller Art, vor allem Testberichte, für das Notebook-Modell Lenovo ThinkPad X1 Yoga 20FQ0040GE der Serie ThinkPad X1.

Lenovo ThinkPad X1 Yoga 2-in-1 Review | Digital Trends
www.digitaltrends.com › ... › Laptop Reviews ▾ Diese Seite übersetzen
★★★★☆ Bewertung: 8/10 - Bewertung von Matt Smith
29.03.2016 - Lenovo's X1 series has always been among its most impressive. The new model is lighter and more versatile than ever before. But is that ...

2016   **18**

2. Semantic Web: Google 2.0

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Advertisement that makes Google rich (Google adwords)

Google 1.0
The historical Web

Direct ecommerce that will make Google even richer (Google hotelads, limited Offers, places, maps, etc.)

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2. Semantic Web: Google 3.0

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„**Headless Web**"[1]

– Web without visual interface
– Web not rendered in web browser
– Search engine shows answer → no link to website needed

➔ Design is becoming obsolet

➔ Data of high quality, proberly structured, and semantically annotated are needed to remain visible

➔ It will most likely a significant new service layer on top of the current Web that was invened 25 years ago.

➔ *In five years from now young people may not know what a Web site is!*

[1] https://paul.kinlan.me/the-headless-web/

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2. Semantic Web: Google 2.0

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Intelligent personal Assistents

Bildreferenzen:
https://d.ibtimes.co.uk/en/full/1481562/apples-siri-can-beatbox.jpg
https://www.smartlounge.eu/wp-content/uploads/2015/08/cortana.png
http://c.mobilegeeks.de/wp-content/uploads/2012/12/google-now-google-search-jelly-bean.jpg

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2. Semantic Web: Microsoft / Apple

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• **Cortana** is an intelligent personal assistant created by Microsoft using semantic annotations.
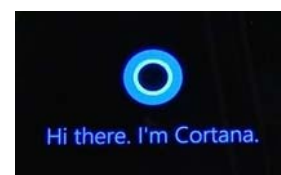
• **Siri** (**S**peech **I**nterpretation and **R**ecognition **I**nterface) is a computer program that works as an intelligent personal assistantand knowledge navigator, part of Apple Inc.'s iOS. The feature uses a natural language user interface to answer questions, make recommendations, and perform actions by delegating requests to a set of Web services.
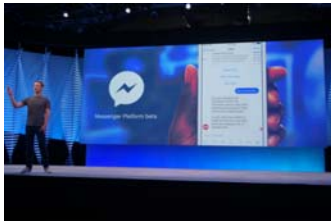
2. Semantic Web: Facebook

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- **Facebook** uses OpenGraph for semantic annotations and is just releasing a chatbot.
- The Graph API is the core of Facebook Platform, enabling developers to read from and write data into Facebook.
- The Graph API presents a view of the Facebook social graph, uniformly representing objects in the graph (e.g., people, photos, events, and pages) and the connections between them (e.g., friend relationships, shared content, and photo tags).

- Facebook will now allow businesses to deliver automated customer support, e-commerce guidance, content and interactive experiences through chatbots.

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2. Semantic Web: There are many more

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- **Google Now** is an intelligent personal assistant developed by Google. https://www.google.com/intl/en-GB /landing/now/

- **Viv** is intelligent personal assistant software created by the makers of Siri. http://viv.ai/

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2. Semantic Web: There are many more

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- **Amazon Echo** (known in-development as Doppler or Project D and shortened and referred to as Echo) is a voice-enabled wireless speaker developed by Amazon.com. https://www.amazon.com/Amazon-Echo-Bluetooth-Speaker-with-WiFi-Alexa/dp/B00X4WHP5E?ie=UTF8&*Version*=1&*entries*=0
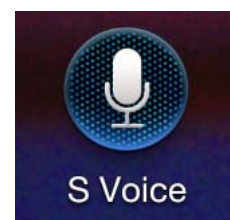
2. Semantic Web: There are many more

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- **Braina** (Brain Artificial) is an intelligent personal assistant, human language interface and automation software for Windows PC that allows to interact with a computer using voice commands. https://www.brainasoft.com/braina/
- **S Voice** is an intelligent personal assistant and knowledge navigator which is only available as a built-in application for the Samsung Galaxy. https://en.wikipedia.org/wiki/S_Voice

2. Semantic Web: There are many more

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- **Voice Mate** formerly called *Quick Voice* and later on as *Q Voice* is an intelligent personal assistant and knowledge navigator which is only available as a built-in application for the LG Optimus. http://www.lg.com/us/mobile-phones/VS985/Userguide/388.html
- **BlackBerry® Assistant** allows you to manage your email, contacts, calendar and other BlackBerry 10 features through voice and text commands. http://demos.blackberry.com/blackberry-passport/na/ca/gen/how-to/apps/blackberry-assistant/using-blackberry-assistant/index.html
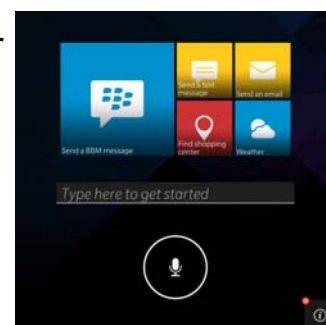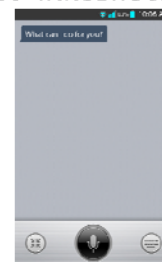
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2. Semantic Web: Google 3.0

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- Google as an *Oracle*:
  - Why waiting for a user query
  - Why not simply predict what he needs in a certain moment.
  - Google Now: You can use Now cards to get the right information at just the right time without even searching for it. By using it you no longer enter the web but you are completely in the knowledge graph cards content and in booking opportunities (google flight search, Google hotel search, Google Local) of Google.

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2. Semantic Web: Google 3.0

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- Assume you arrive in London and your connection flight is cancelled plus it was the last one this day.
- Your phone rings and
  - offer you a hotel room at the airport with a special offer
  - Informed your bussiness contacts about your delay
  - Selected a flight for tomorrow
  - Offer to book a table in a restaurant nearby that fits your food preferences and budget
- What does it need to know
  - Your location
  - Your flight bookings
  - Your preferences
  - Your emails and appointments
  - Airport information
  - Hotel information

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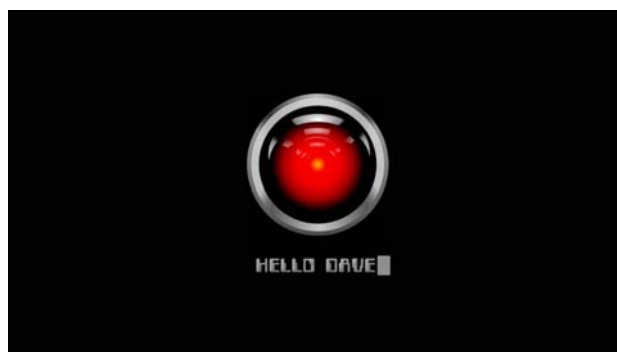
2. Semantic Web: Google 3.0

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- Google as an *Oracle*

- Upps! Artifcial Intilligence works!
- Internet-based acquisition of billions of quintillion bytes of data bypassed the knowledge acquisition bottleneck
- Big Data will make computers soon significantly more intelligent than any human ever was or will be.

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3. Big Data

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3. Big Data

- Every day, we create 2.5 quintillion* bytes of data — so much that 90% of the data in the world today has been created in the last two years alone. These data come from everywhere: sensors used to gather climate information, posts to social media sites, digital pictures and videos, purchase transaction records, and cell phone GPS signals to name a few. These data are **big data.****

* 10^{30}
** http://www-01.ibm.com/software/data/bigdata

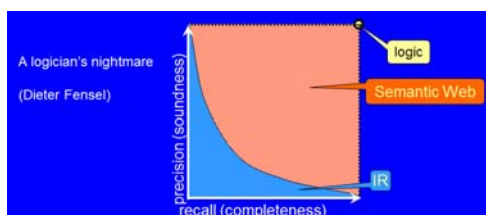12/7/2016 www.sti-innsbruck.at **32**

3. Big Data: Reasoning

- Performing deductive inference with a given set of axioms at the Web scale is practically impossible
  - Too manyRDF triples to process
  - Too much processing power is needed
  - Too much time is needed

- LarKC contributes to an 'infinitely scalable' Semantic Web reasoning platform by
  - Giving up on 100% correctness and completeness (trading quality for size)
  - Include heuristic search and logic reasoning into a new process
  - Massive parallelization (cluster computing)

3. Big Data: Reasoning
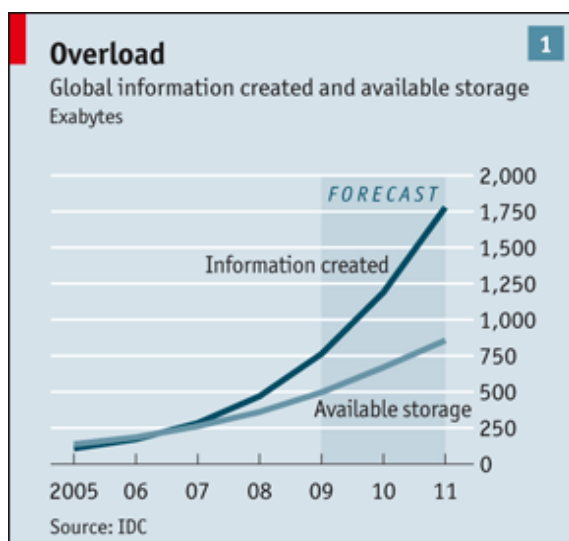
- Volumes of Data Exceed the Availale Storage Volume Globally:
- There is a need to throw the data away due to the limited storage space.

3. Big Data: Reasoning

Data Stream Processing for Big Data
- Logical reasoning in real time on multiple, heterogeneous, gigantic and inevitably noisy data streams in order to support the decision process…
  -- S. Ceri, E. Della Valle, F. van Harmelen and H. Stuckenschmidt, 2010

window

Query engine
takes stream subsets for query answering

Extremely large **input streams**

Registered Continuous Query

streams of answer
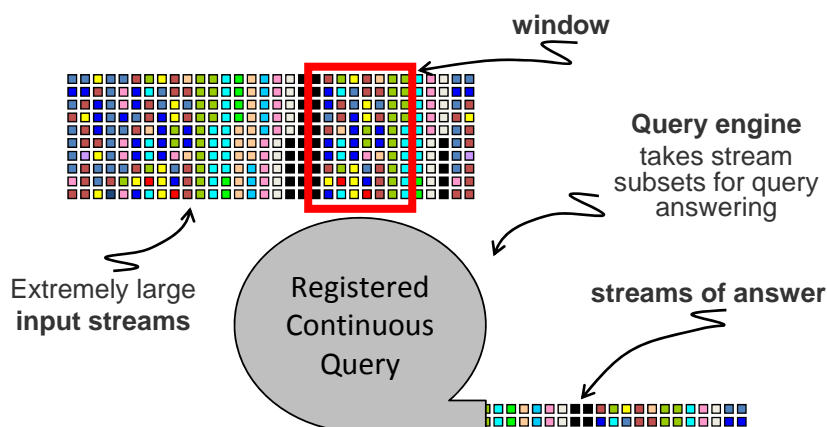
Picture taken from Emanuele Della Valle "Challenges, Approaches, and Solutions in Stream Reasoning", Semantic Days 2012

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3. Big Data: Artificial Intelligence 2.0

Key of intelligence:
- data/information/knowledge and
- fast heuristic goal processing

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3. Big Data: Artificial Intelligence 2.0

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- Data:
  - Nearly 7 billion humans create a steady flow of textual, visuel, and audio information that more and more can be understood by the global computer network.
  - Trillions of sensors with exponential groth complement this information. Each thing (car, phone, fridge, heading, smart meter, video cameras, …) creates additional data that soon outrange the human input.
  - More and more this information is augmented with machine processable semantics.
  - Obviously the knowledge acquisition bottleneck has become just a minor annectote.
- Processing power
  - Obvioulsy the computational power increases dramatically every year.
  - A recent smart phone would have been a super computer at the end of the last century.
  - Processing big data leads to the design of new processors oriented on fast heuristic processing of large amounts of data using neural network principles also applied by our brain.

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4. Tourismus: Why is it important?

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Tourism from an economic point of view
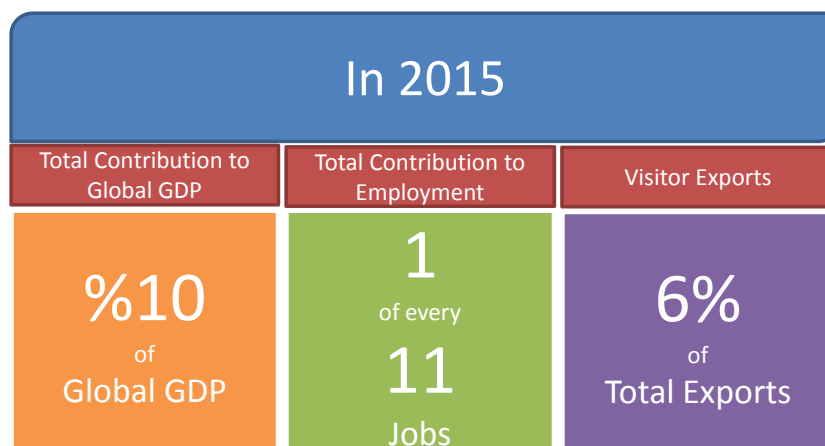
In 2015

Total Contribution to Global GDP	Total Contribution to Employment	Visitor Exports
%10 of Global GDP	1 of every 11 Jobs	6% of Total Exports

World Travel & Tourism Council, The Economic Impact of Travel & Tourism - World, March 2016

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4.1 Tourismus: Global Economic Impact

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WORLD: TOTAL CONTRIBUTION OF TRAVEL & TOURISM TO GDP
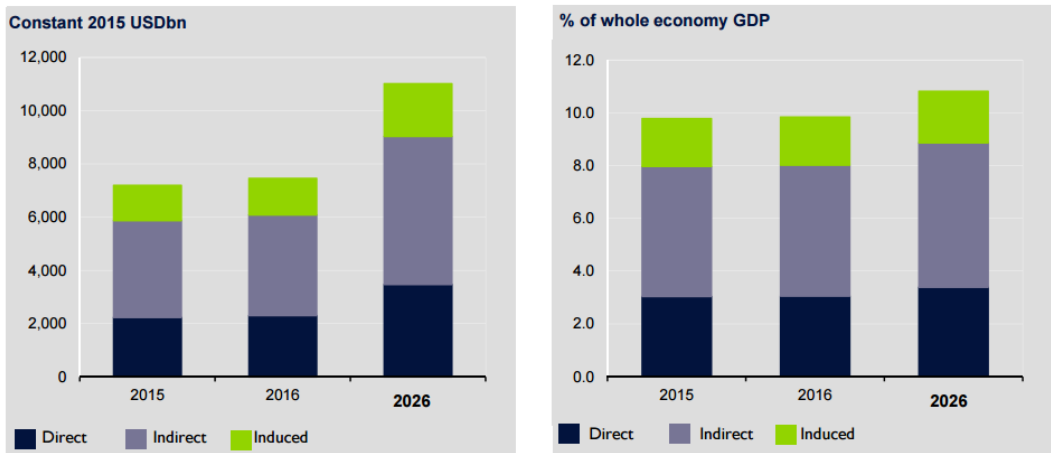
The total contribution of tourism to GDP was 7.17 trillion USD (10% of total GDP) in 2015 and expected to rise to 11 trillion USD (11% of expected total GDP) in 2026.

World Travel & Tourism Council, The Economic Impact of Travel & Tourism - World, March 2016

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4.1 Tourismus: Global Economic Impact

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WORLD: TOTAL CONTRIBUTION OF TRAVEL & TOURISM TO EMPLOYMENT

The total contribution of tourism to employment was 283.6 million jobs (9.5% of total employment) in 2015 and expected to rise to 370.2 million jobs (11% of expected total employment) in 2026.

World Travel & Tourism Council, The Economic Impact of Travel & Tourism - World, March 2016
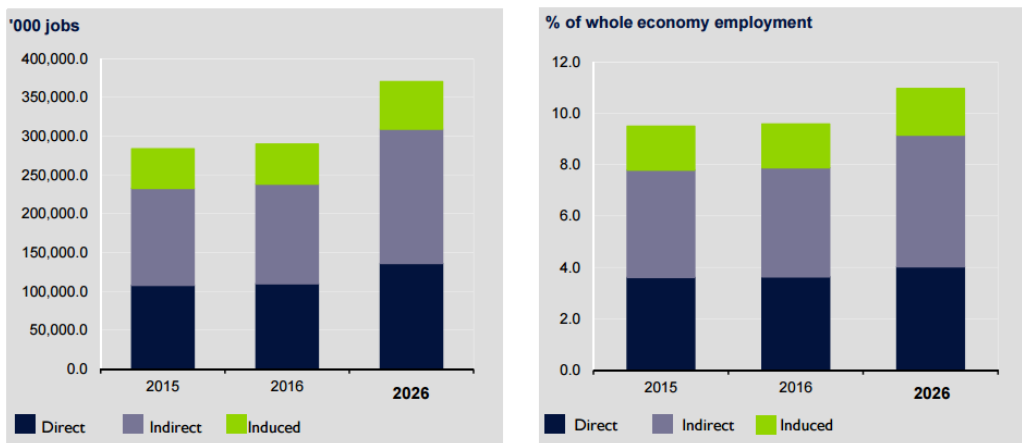
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07.12.2016

## 4.2 Tourismus: Trends and Figures

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- UNTWO Tourism Highlights 2016 report shows:
    - International tourist arrivals will increase about 3.3% every year until 2030.

    - Europe received 607.7 million international tourists which represents the 51% percent of international tourist arrivals in 2015. Europe is predicted to recieve 744 million international tourists in 2016, however this would represent only %41 of the international tourist arrivals.

    - Europe received 450.7 billion USD from international tourist expenditures in 2015, which represents 740 USD per arrival.

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4.3 eTourism: Online Direct Sales – Website

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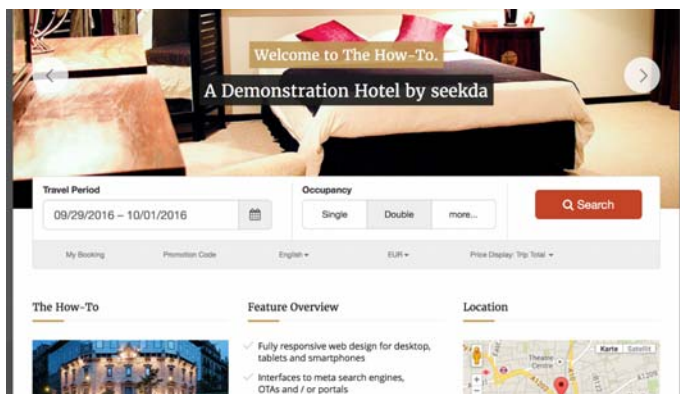
- Integration of booking engines in the website will increase the conversion of visitors into guests.
- Normally there is no commission on this type of bookings
- It strengthens the own hotel brand
- Image shows an example of an integration with the seekda.com IBE

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4.3 eTourism: Online Indirect Sales – OTAs
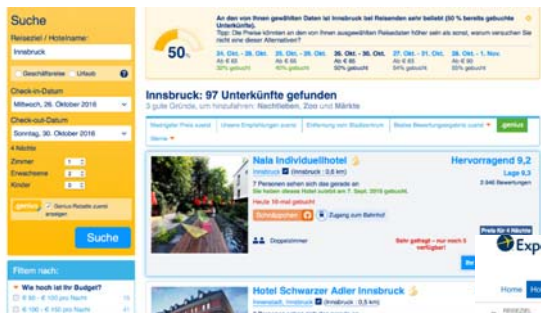
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- Example of Online Travel Agencies: booking.com, expedia.com
- Disadvantage for the Hotel: High Commission, OTA uses hotel brand for marketing
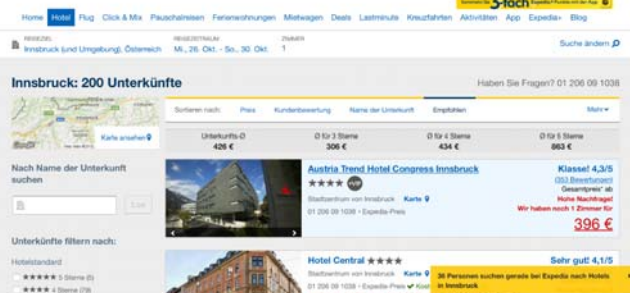
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4.3 eTourism: Online Indirect Sales – Meta

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- Metasearch engines like Google, Tripadvisor or Trivago offer new ways to get bookings and website traffic
- It will increase website conversions and direct bookings
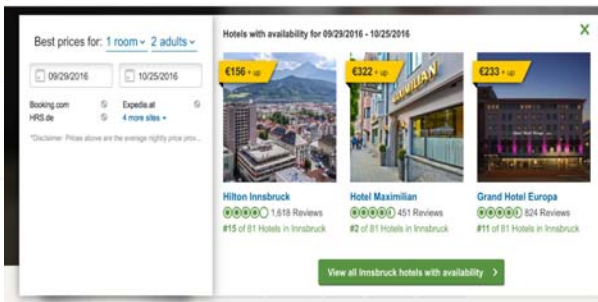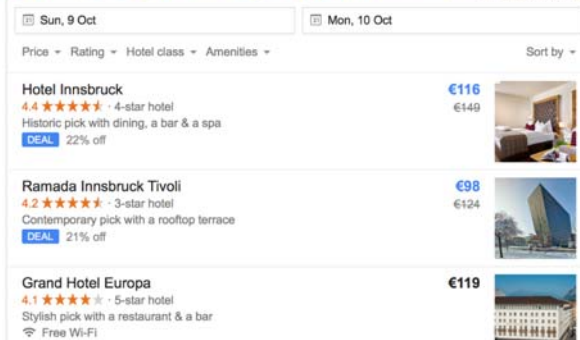
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4.3 eTourismus: Customer Journey

Inspiration and Discovery	Booking	Anticipation	Experience	Post-Experience
Visit travel sites, read reviews, read brochures, research on wikipedia for possible destinations	Book the travel. Online or through a travel agency	Between booking and travel time, share your iterinary, expectations from your trip with your friends (e.g. on social media)	Be informed about the activities around you, about wetter etc. Share your experience	Give feedback about your experience, post pictures, write blog posts etc.

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5. The Role of Semantics in Tourisms

The Hotelier of today has to deal with many different communication channels:

HOTEL RECEPTION

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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer

HOTEL RECEPTION

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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone

HOTEL RECEPTION

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5. The Role of Semantics in Tourisms

STI · INNSBRUCK

The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email

HOTEL RECEPTION

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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
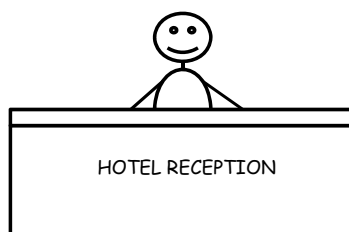

HOTEL RECEPTION

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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
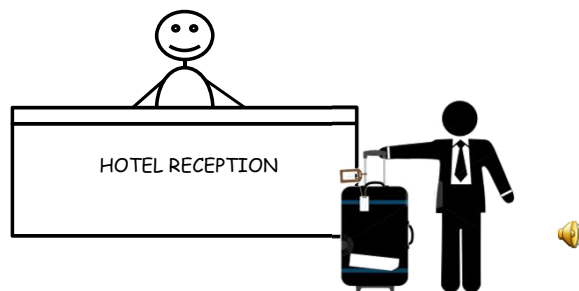- fax
- hotel website

5. The Role of Semantics in Tourisms

STI · INNSBRUCK

The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites

5. The Role of Semantics in Tourisms

STI · INNSBRUCK

The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites

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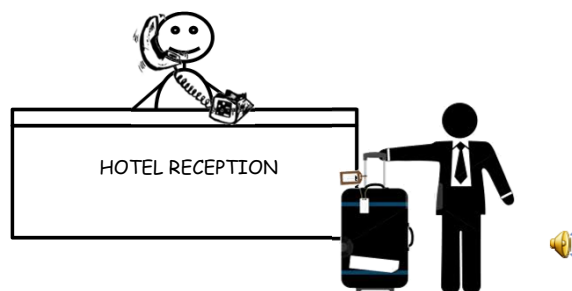
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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites
- social network sites

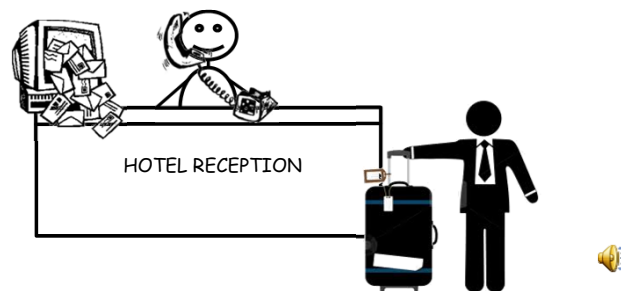12/7/2016   www.sti-innsbruck.at   **54**

5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites
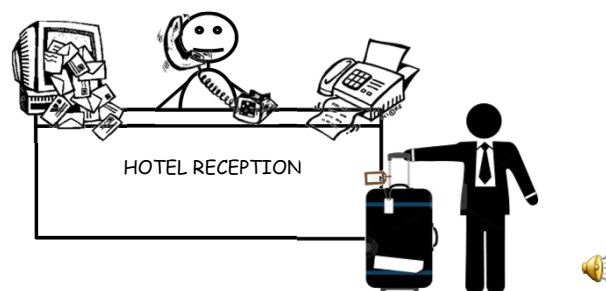- social network sites
- blogs

5. The Role of Semantics in Tourisms

STI · INNSBRUCK

The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites
- social network sites
- blogs
- fora & destination sites

5. The Role of Semantics in Tourisms

STI · INNSBRUCK

The Hotelier of today has to deal with many different communication channels:

- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites
- social network sites
- blogs
- fora & destination sites
- chat
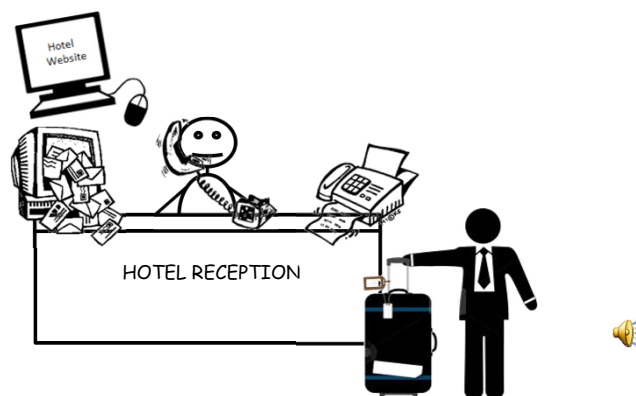

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5. The Role of Semantics in Tourisms

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The Hotelier of today has to deal with many different communication channels:

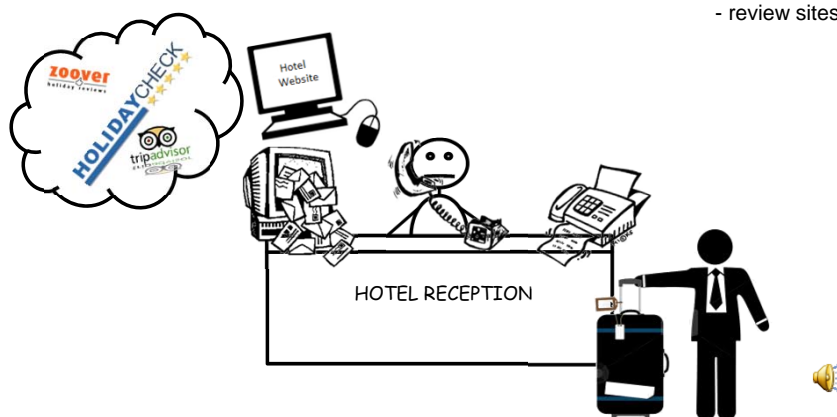- walk-in customer
- telephone
- email
- fax
- hotel website
- review sites
- booking sites
- social network sites
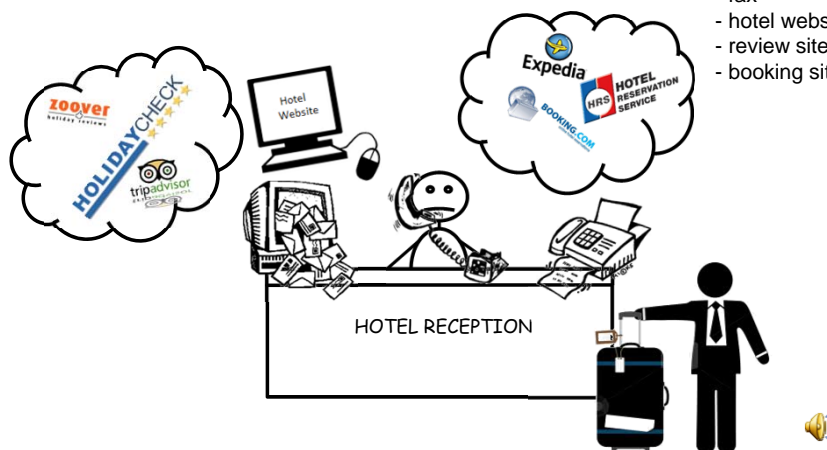- blogs
- fora & destination sites
- chat
- video & photo sharing
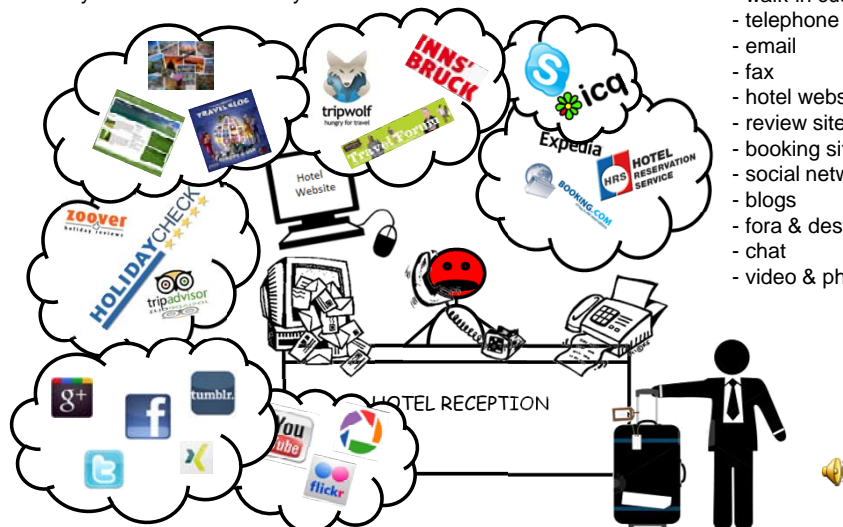
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5. The Role of Semantics in Tourisms

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The Hotelier doesn't only have to deal with an overwhelming number of communication channels, but also has to pay up to **18%** sales commissions to the booking sites!

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5. The Role of Semantics in Tourisms

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5.1 The Role of Semantics in Tourisms

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Online Marketing with Onlim

5.1 On-line marketing with Onlim

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- Content Marketing Challenges
  - Difficult to create relevant content and scale production and dissemination for all channels
  - A lot of manual work and knowledge is necessary
  - Many different tools for each task that are not well integrated
  - Measurement of success factors and KPIs not obvious
  - Content marketing is shifting towards automation, social media, messengers and artificial assistants

5.1 Multi-channel online communication

STI · INNSBRUCK

- Solve the content marketing challenges by mechanizing important aspects of online communication, and therefore offer a **scalable, cost-sensitive, and effective** online dissemination solution.
- Introduce a layer on top of the various internet based communication channels that is domain specific and *not* channel specific.

Information model
defines the type of information items in the domain

Channel model
describes the various channels, the interaction pattern, and their target groups

Weaver
mappings of information items to channels

Communication Patterns
reusable templates for management of communication
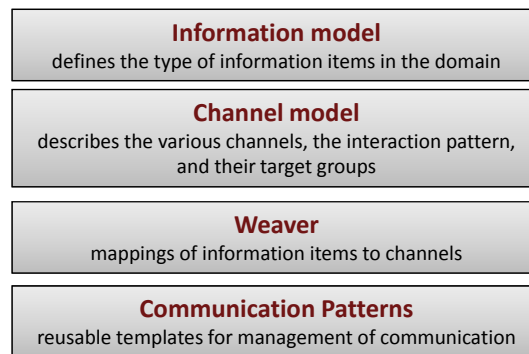
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5.1 The pillars of online communication

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Information Model

Branch specific concepts

Distribute content

Weaver

Collect feedback + statistics

Communication Patterns

Channel Model

Web/Blog

Social Web

Web 3.0/Mobile/Other

Press releases + Ads
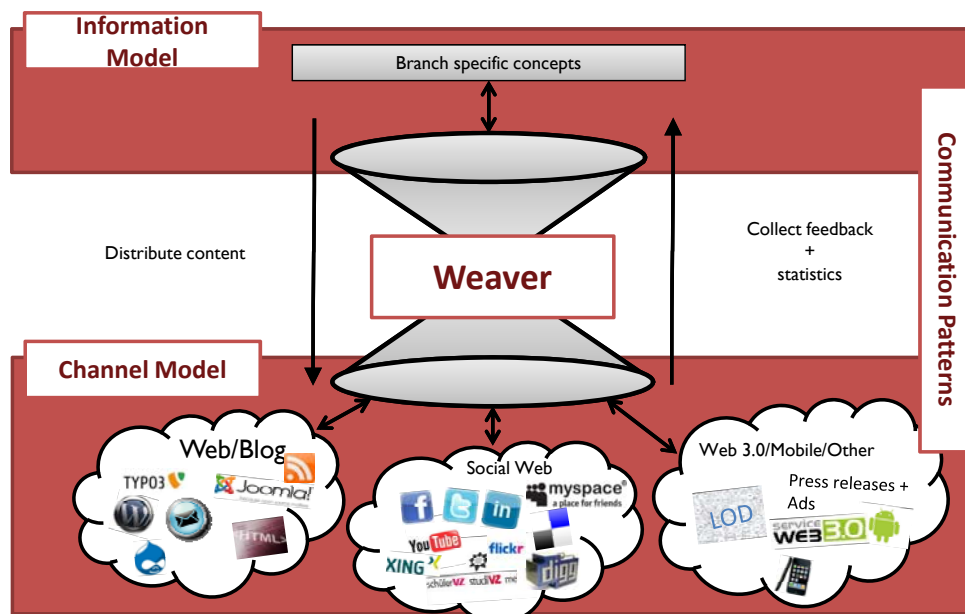
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5.1 On-line marketing with Onlim

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Semantically-aware architecture

- Concepts in the architecture are semantically modelled using ontologies and vocabularies
    - Information model
    - Channel model
- Specifically, information sources are annotated using schema.org
    - It provides a collection of shared vocabularies
    - Different domains, such as creative works, places, products, organizations, lodging businesses, events, restaurants, touristic attractions…
    - Example: (http://schema.org/Event)

ONLIM

5.1 On-line marketing with Onlim – Solution

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- **Onlim** offers content creation and semi automated post suggestions out of multiple content sources.
- We use semantics, rules and learning algorithms to manage content, adapt it and analyze aggregated feedback matching key performance indicators.
- **Onlim** optimizes the time consuming task of finding good content and semi-automatically creates posts that match demands of our customers target audience and boost their sales.
- As a spin-off of the University of Innsbruck **Onlim**´s technology is based on state of the art research in Semantic Technology and Rule Based Systems

ONLIM

5.1 On-line marketing: Content Generation

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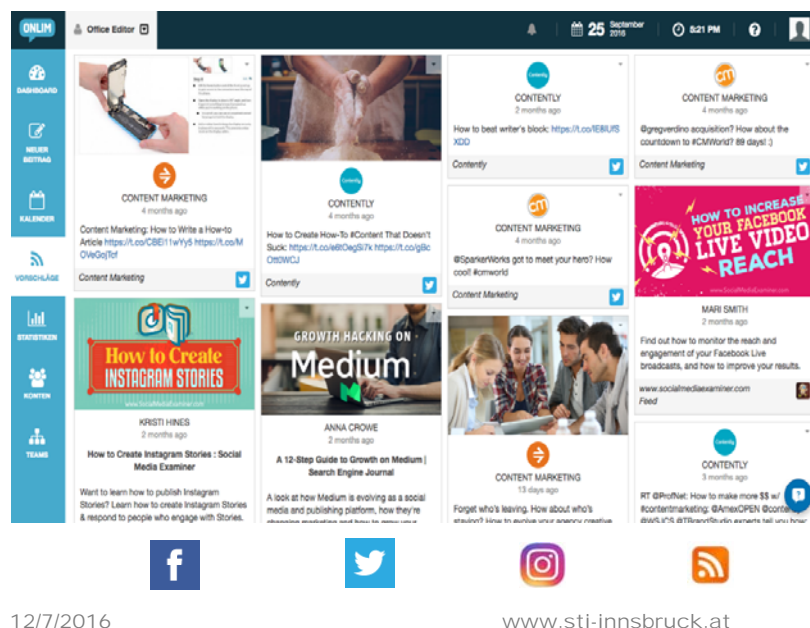
- Choose your favorite incoming channels (RSS, Twitter, Facebook, Instagram)
- Select and curate suggested posts based on semantics, rules and filtering tools
- Create your own content for social media channels on one single dashboard
- Create structured content (events, services, offers) for chatbots and artificial assistants
- Schedule your posts in advance and work together with your team

ONLIM

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5.1 On-line marketing: Content Dissemination

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Live   Plan   Vision

- Connect your social media accounts to Onlim for efficient social media marketing
- Save time with one single dashboard for all your connected channels
- Benefit from growing number of channels including bots and artificial assistants
- Open new sales channels towards conversational commerce

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5.1 On-line marketing: Content management

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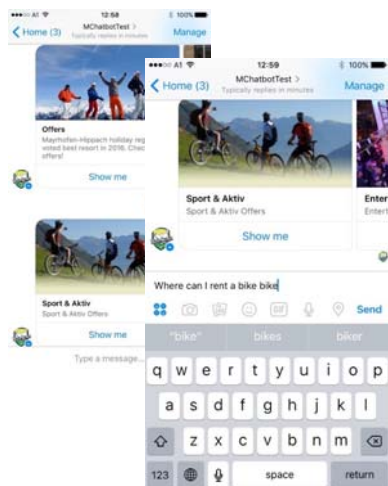
For Bots Owners

- Get structured content via API from Onlim into your existing bot or let Onlim build your new bot

- Select the suitable content from content providers available in Onlim

- Target your audience with relevant structured content based on semantic technologies

- Create micromoments for more awareness and revenue

ONLIM

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5.2 Semantics for online Sales

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- On-line sales: schema.org used for direct booking enabling
- *Automated Direct Booking* of touristic products and services like
  – accommodations,
  – wellness offers,
  – Transportation,
  – restaurant reservations
  – Etc.

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5.2 Automated Direct Booking (ADB): Why

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Hotels become invisible on the web!
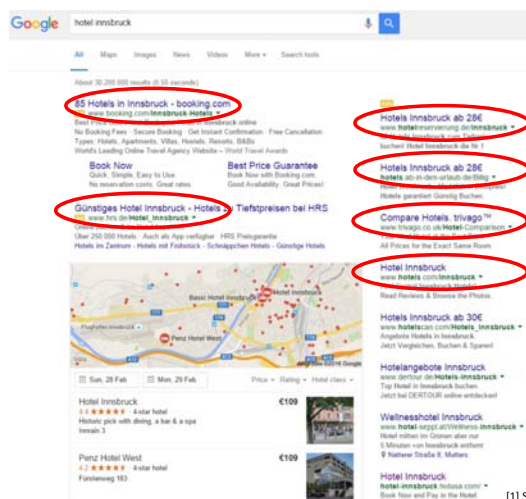
Search: „Hotel Innsbruck"

Search results from:
- Booking.com
- HRS
- Trivago
- „Ab in den Urlaub"
- …

OTAs dominate results

Hotelwebsites disappear

➔ Directbookings stagnate [1]

[1] Schegg, Fux (2012): http://www.etourism-monitor.ch/sites/default/files/downloads/distribution_survey_d-a-ch_scheggfux_2012_eng.pdf

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5.2 Automated Direct Booking (ADB): Why

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Search engines „eat the web" ➔ „Headless Web"[1]

- Search engines become „answer engines"
- Web without visual interface
  - Web not rendered in web browser
  - Search engine shows answer ➔ no link to website needed

➔ Design is becoming obsolet
➔ High quality data & Structured data needed to be represented

[1] https://paul.kinlan.me/the-headless-web/

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5.2 Automated Direct Booking (ADB): What

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Booking solution based on Linked Open Data

- Become independent from OTAs

- Increase direct bookings

- Eliminate need for API integration

- Decentralize booking (every DMO can run own booking platform)

- Regain data sovereignty (customer data, booking data)

➔ securing business' livelihood

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5.2 Automated Direct Booking (ADB): How

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Annotating hotel's websites with schema.org
- **Static Data:**
  - Data that rarely or never change: hotel name, address, description, phone number, email address, geolocation, …
  - ➔ Master data

- **Dynamic Data:**
  - Data that changes more frequently: offers, quota, availability, prices
  - ➔ Bookable content

- **Active Data:**
  - (Web)service definitions data: Web service addresses, parameter, return value
  - ➔ Execution of a booking that changes the data set

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5.2 Automated Direct Booking (ADB)

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Static data: Hotel's/Business' core data. Mostly unchangable → static

Usage in Tourism:

LocalBusiness
name
address
email
telephone
desctiption
openingHours

Hotel
audience
availableLanguage
currenciesAccepted
petsAllowed
starRating

Restaurant
serversCuisine
starRating

SkiResort
currenciesAccepted
openinHours

TaxiService
areaServed

BarOrPub
accepteReservations
menu

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5.2 Automated Direct Booking (ADB)

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Static data example: JSON-LD

```
1.{
2.    "@context": "http://schema.org/",
3.    "@type": "Hotel",
4.    "@id": "http://www.landgasthof-adler.at",
5.    "name": "Landgasthof Adler",
6.    "currenciesAccepted": "EUR",
7.    "openingHours": "We-Mo 10:00-20:00",
8.    "paymentAccepted": "Cash, credit card",
9.    "priceRange": "€5 - €35",
10.    "address": {
11.        "@type": "PostalAddress",
12.        "addressCountry": "Austria",
13.        "addressLocality": "Hinterhornbach",
14.        "addressRegion": "Tirol",
15.        "postalCode": "6642",
16.        "streetAddress": "Hinterhornbach 17"
17.    },
18.    "email": "office@landgasthof-adler.at",
19.    "telephone": "+435632318",
20.    "description": "Landgasthof Adler, Tiroler Wirtshaus, Hinterhornbach. Tiroler spezialitäten und Zimmer im Herzen der Allgäuer Alp
21.    "url": "http://www.landgasthof-adler.at",
22.    "image": "http://www.landgasthof-adler.at/wp-content/uploads/2014/07/Terrasse.jpg",
23.    "petsAllowed": "True",
24.    "audience":"Families, Hikers, Bikers, all audiences",
25.    "availableLanguage": "Deutsch, English, Francais, Italiano",
26.    "aggregateRating": {
27.        "@type": "AggregateRating",
28.        "ratingValue": "5",
```

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5.2 Automated Direct Booking (ADB)

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Dynamic data: frequently changing data – time dependent

Usage in tourism	Example: JSON-LD

Usage in tourism

Hotel

Offer

availability

availabilityStarts

availabilityEnds

price

checkinTime

checkoutTime

Example: JSON-LD

```
93.      …
94.      "checkinTime":"15:00",
95.      "checkoutTime":"11::00",
96.      "makesOffer": {
97.          "@type": "Offer",
98.          "availability": "InStock",
99.          "name": "Enzian Room",
100.         "itemOffered": {
101.             "@type": ["HotelRoom", "Product"],
102.             "bed": {
103.                 "@type": "BedDetails",
104.                 "numberOfBeds": 1
105.             },
106.             "description": "Double Room with Shower",
107.             "name": "Enzian Room",
108.             "numberOfRooms": 1,
109.             "occupancy": {
110.                 "@type": "QuantitativeValue",
111.                 "maxValue": 2,
112.                 "minValue": 1
113.             }
114.         },
115.         "price":"123â‚¬",
116.         "availability":"InStock",
117.         "availabilityStarts": "2016-10-01",
118.         "availabilityEnds": "2016-10-31"
119.     },
```

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5.2 Automated Direct Booking (ADB)

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Active data: data used to take action on products or services like reseving, buying, renting, calling, paying

Usage in tourism

Action

actionStatus

startTime

endTime

result

ReserveAction

scheduledTime

BuyAction

seller

price
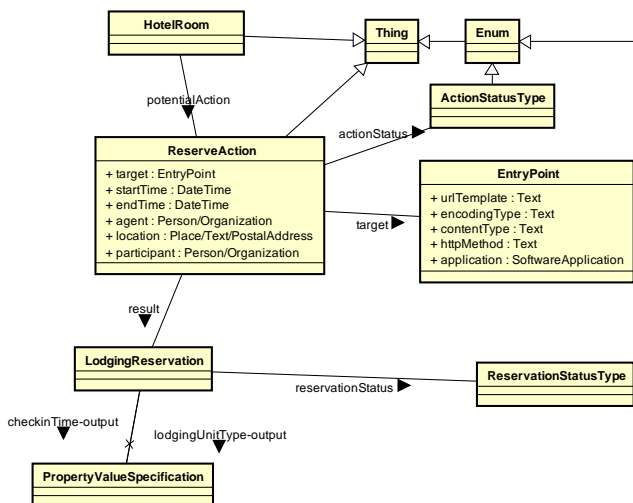
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5.2 Automated Direct Booking (ADB): How

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- **Crawling**
- **Caching**
- **Aggregating**
- **Reasoning**
- **Publishing**

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5.2 Automated Direct Booking (ADB): How

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5.2 Automated Direct Booking (ADB): How

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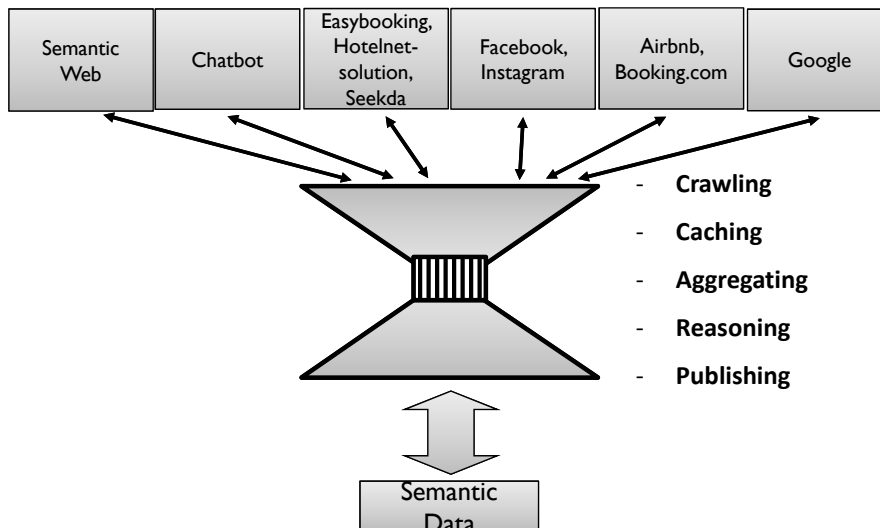
- Accommodations and Offers
- Events
- Mayrhofen Region (POI)
- Press releases Articles
- Ski Areas
- TVB Mayrhofen
- Infrastructure
  - Means of transport (bus, train, taxi,…)
  - Banks
  - Gastronomy (cafe, bakery, restaurant, night club,…)
  - Medical services (pharmacy, hospitals, doctors,…)
  - Swimming pools
  - Cars (renting, repair)
  - Shops (supermarkets, clothing, drugstore,…)
  - Body care (hairdresser, wellness,…)
  - Ski & Snowboard (renting, school)
  - Sport (bike guides, fitness,…)

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5.2 Automated Direct Booking (ADB): How

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5.3 Data analytics in tourism

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- Tourism industry is highly complex
- A unique mix of public and private organisations and partnerships
- Big data offers the potential for a substantial shift:
    - Enhance business
    - Enhance travel experience

| Public data | Proprietary data |
| Open data | Closed data |

- Data-driven tactical decisions
- Still difficult to replace strategic planning.

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5.3 Data analytics in tourism

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Applications

Demand and sales forecasting	Revenue management, dynamic pricing
Inventory management	Collective behaviors, tourism flows
Multi-channel campaign optimisation	Segmentation

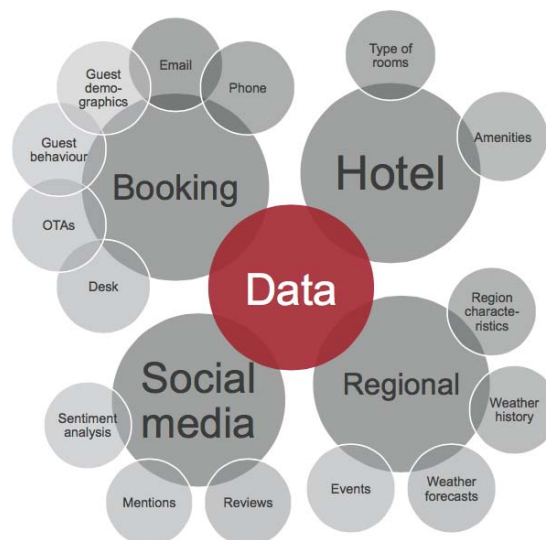12/7/2016   www.sti-innsbruck.at   **84**

5.3 Data analytics in tourism

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Example:

Dynamic pricing

- Determine the price of a perishable product according to demand factors.
- Use own data, pricing rates of competition.
- Add additional data sources: social media weather, events...
- Provide reliable public data.

6. Summary

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- AI started around 60 years ago.
  - First brake throughs were expectedmin the range of 5-10 years.
  - Instead 30 years later AI seemed to be failed due to the knowledge acquisition bottleneck.
- The web and other big data sources radically changed this and companies such as Google promote semantics and AI in general.
- We will see soon a world were the physical world and the virtual world are merging in a new type of Universe.
  - Nothing in the physical world will work without connection the the virtual world
  - With robots, cars, drones, sensors the virtual world will become evident part of the so-called real world.
- Semantics will be a corner stone for integrating heterogenious pieces of large scal networks, obviously requiring customization and embedding.

6. Summary

- We took the vertical tourisms as an case as it is an important business area in Europe.
- Semantics is required
  - to interact with potential customers on multiple places
  - to implement eCommerce based on a data ecomomy using linked open data
  - to provide integrated and customized products and services
  - to ensure proper resource allocation through fair pricing

6. Summary

- Semantics is required to interact with potential customers on multiple places:
  - Web sites
  - Social media channels
  - Chat bots
  - Headless web (various assistant systems)

6. Summary

- Semantics is required to implement eCommerce based on a data ecomomy using linked open data:
  - Static data: name, address, and description of service provider
  - Dynamic data: room offers, price, contingent defining touristic services
  - Active data: booking engine interaction data
  - Booking agent crawls and stores hotel data
  - Booking agent provides access for „intelligent personal assistents" (Siri, Cortana, Google Now, Viv …), chatbots (Facebook M, Slackbot …)
- Complex API integrations of web sides become replaces by an open data economy where everybody can access these data and provide services on top of them.

6. Summary

- Semantics is required to provide integrated and customized products and services: ***Touristic Service Packaging*** aims to combine touristic services in a package, for marketing and booking purposes.

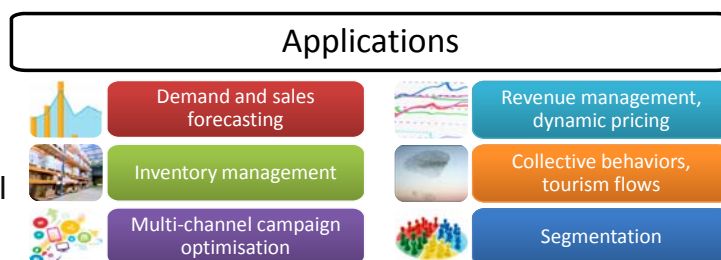Combine *accomodation*, *event*, and *transport*

6. Summary

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- Semantics is required to ensure proper resource allocation through fair pricing based on data analytics:

  - make emerge private data that is relevant for policy makers (e.g., regional planners) and citizens.

Applications	
Demand and sales forecasting	Revenue management, dynamic pricing
Inventory management	Collective behaviors, tourism flows
Multi-channel campaign optimisation	Segmentation

  - Better predict number of customers and optimize resource allocation to optimized pricing.

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Questions?