



Linked Data for Tourism

Irem Önder, Marta Sabou, Adrian M.P. Brasoveanu



How many tourists arrive to the top 3 largest cities of Austria in 2012?

- **Information needs:**
- Which are the top 3 largest cities in Austria?
 - Hard coded: Vienna (population), Graz (population), Salzburg (population).... →(Wikipedia)
- Total arrivals for Austrian cities in 2012 (Vienna, Graz, Salzburg...) →(TourMIS)



Two data sources

TourMIS



Official statistics of the Austrian National Statistical Office (Annual data)
Accommodation: All forms of accommodation
Market/origin: Total foreign and domestic
Period: 2012

Arrivals							
State capitals	absolute	% p.y.	in %	Provinces	absolute	% p.y.	City share %
Vienna	5604522	7.2	60.7	Vienna	5604522	7.2	100.0
Salzburg	1388306	9.1	15.0	Salzburg (Province)	6269126	6.2	22.1
Innsbruck	805150	3.7	8.7	Tirol	9897584	3.3	8.1
Graz	508722	4.1	5.5	Styria	3400704	2.9	15.0
Linz	442701	4.9	4.8	Upper Austria	2553437	5.7	17.3
Klagenfurt	199777	-2.5	2.2	Carinthia	2823826	2.7	7.1
Bregenz	176941	0.9	1.9	Vorarlberg	2200874	7.1	8.0
St. Pölten	75997	5.1	0.8	Lower Austria	2475849	0.3	3.1
Eisenstadt	26369	-5.1	0.3	Burgenland	938125	1.3	2.8
Total	9228485	6.5	100.0	Austria	36164047	4.4	25.5

Bednights							
State capitals	absolute	% p.y.	in %	Provinces	absolute	% p.y.	City share %
Vienna	12262828	7.5	65.1	Vienna	12262828	7.5	100.0
Salzburg	2486516	8.4	13.2	Salzburg (Province)	25240409	5.4	9.9
Innsbruck	1441026	7.5	7.6	Tirol	44320231	3.8	3.3
Graz	943817	3.9	5.0	Styria	11161642	1.7	8.5
Linz	793315	6.9	4.2	Upper Austria	7237157	3.9	11.0
Klagenfurt	391091	-4.7	2.1	Carinthia	12627299	1.7	3.1
Bregenz	314583	1.5	1.7	Vorarlberg	8492888	6.6	3.7
St. Pölten	154840	4.3	0.8	Lower Austria	6735320	0.7	2.3
Eisenstadt	51845	-12.8	0.3	Burgenland	2938307	0.2	1.8
Total	18839861	6.9	100.0	Austria	131016081	4.0	14.4

Source: STATcube - Statistical database of STATISTIK AUSTRIA
Table: SA-J8



Wikipedia as Linked Data

WIKIPEDIA

English
The Free Encyclopedia
4 240 000+ articles

Español
La enciclopedia libre
1 020 000+ artículos

Русский
Свободная энциклопедия
1 000 000+ статей

Deutsch
Die freie Enzyklopädie
1 590 000+ Artikel

Italiano
L'enciclopedia libera
1 030 000+ voci

Polski
Wolna encyklopedia
970 000+ haseł

日本語
フリー百科事典
860 000+ 記事

Français
L'encyclopédie libre
1 390 000+ articles

Português
A enciclopédia livre
780 000+ artigos

中文
自由的百科全书
700 000+ 條目

English

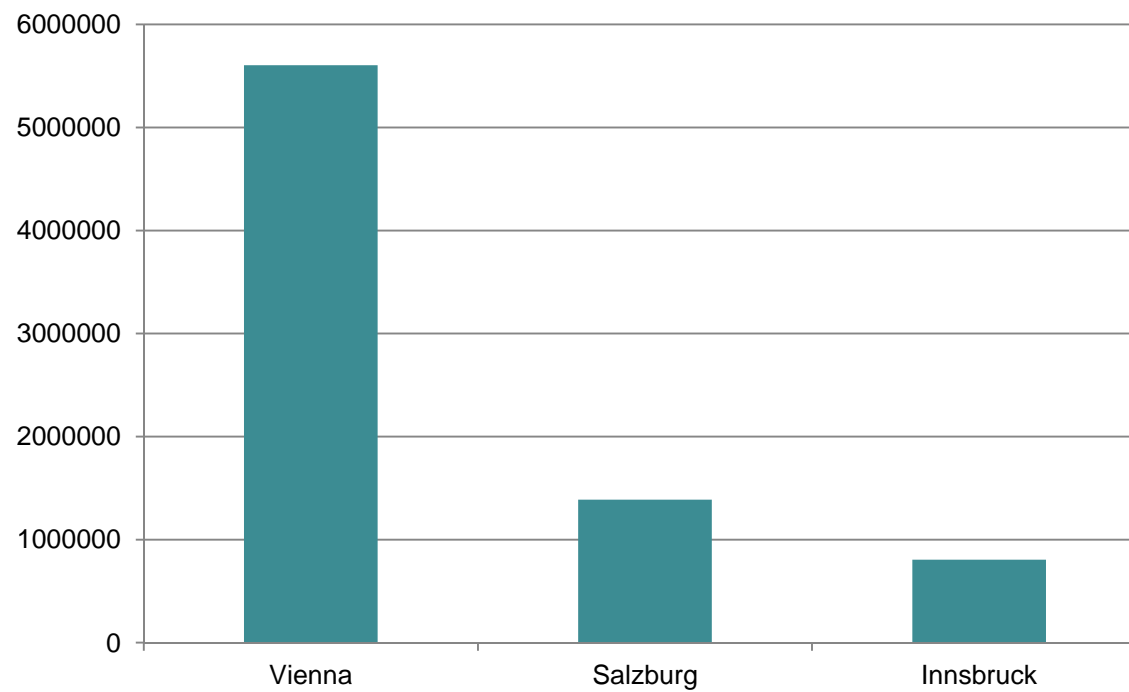
Vienna: city in Austria



Vienna: city in Austria



Top 3 Austrian Cities' Total Arrivals in 2012





Do the arrivals have similar trend with GDP of source markets?

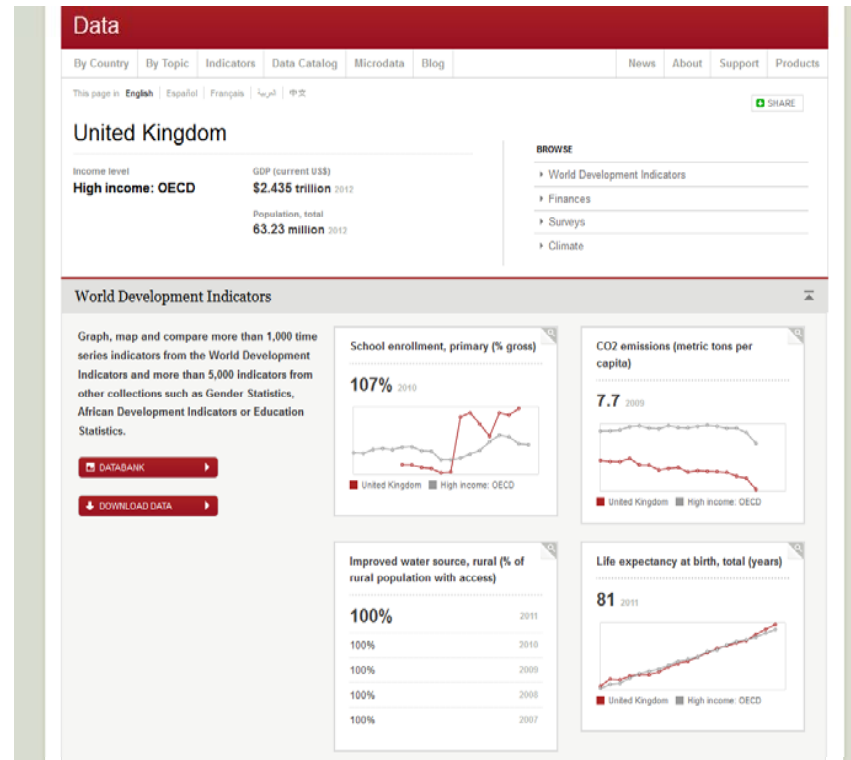
TourMIS

1,000 %

National tourism statistics of the European Travel Commission
Destination: Austria
Information: Arrivals in all paid forms of accommodation establishments
Period: 2012

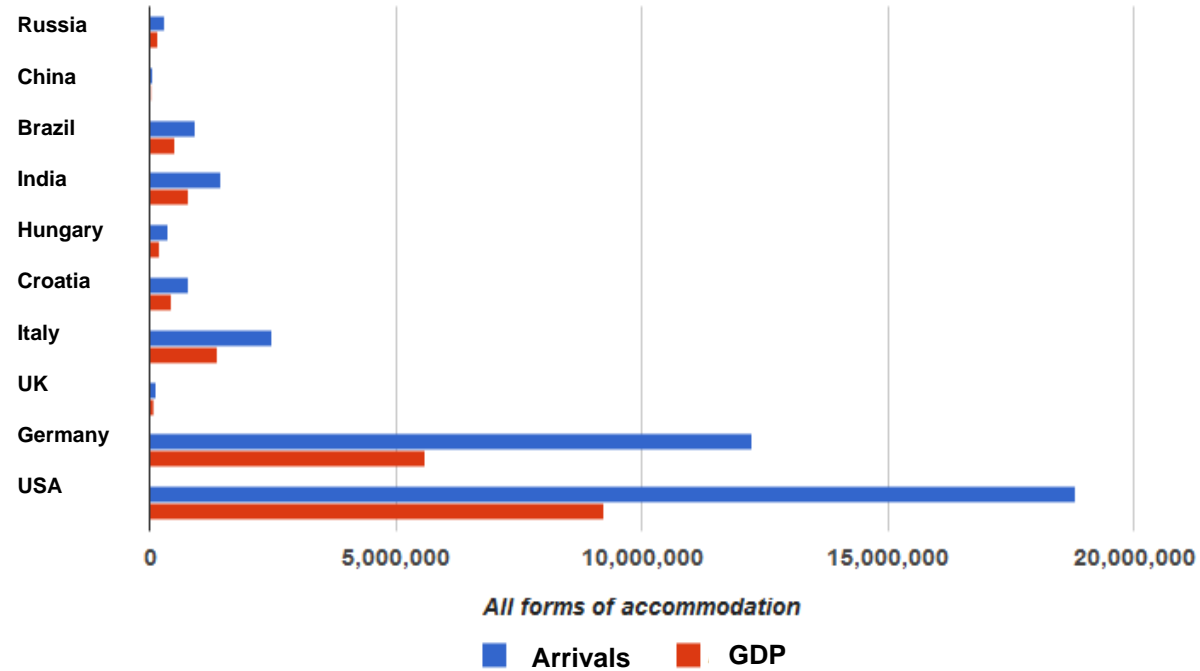
Market	absolute	+/-	% p.y.	guest mix share %	
				Foreign	Total
Austria	12013271	396108	3.4		33.2
Belgium	494014	5200	1.1	2.0	1.4
Bulgaria	68238	4245	6.6	0.3	0.2
Croatia	106129	947	0.9	0.4	0.3
Cyprus	8244	25	0.3	0.0	0.0
Czech Rep.	619287	15706	2.6	2.6	1.7
Denmark	316890	3877	1.2	1.3	0.9
Estonia	21179	4418	26.4	0.1	0.1
Finland	91363	4259	4.9	0.4	0.3
France	519519	-2439	-0.5	2.2	1.4
Germany	11411557	482169	4.4	47.3	31.6
Greece	53689	-10521	-16.4	0.2	0.1
Hungary	472793	5936	1.3	2.0	1.3
Iceland	8440	528	6.7	0.0	0.0
Ireland Rep	53210	-208	-0.4	0.2	0.1
Italy	1060105	-26876	-2.5	4.4	2.9
Latvia	21058	2686	14.6	0.1	0.1
Lithuania	26757	1341	5.3	0.1	0.1
Luxembourg	58229	1223	2.1	0.2	0.2
Malta	5884	7	0.1	0.0	0.0
Netherlands	1714513	69888	4.2	7.1	4.7
Norway	87230	2281	2.7	0.4	0.2
Poland	362870	-10055	-2.7	1.5	1.0
Portugal	29617	-4222	-12.5	0.1	0.1
Romania	265774	-9950	-3.6	1.1	0.7
Russia	476397	75939	19.0	2.0	1.3
Slovakia	152960	4881	3.3	0.6	0.4
Slovenia	122677	4933	4.2	0.5	0.3
Spain	311940	-14152	-4.3	1.3	0.9
Sweden	202297	10892	5.7	0.8	0.6
Switzerland	1275578	76624	6.4	5.3	3.5
Turkey	83899	12572	17.6	0.3	0.2
Ukraine	100000	10000	10.0	0.4	0.2

World Bank





Arrivals and GDP of source markets



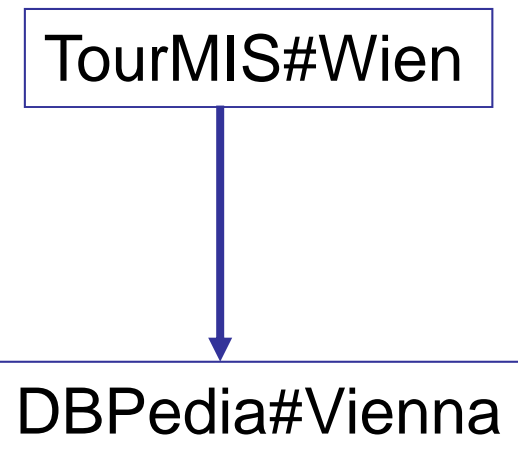


A set of technologies to say that:

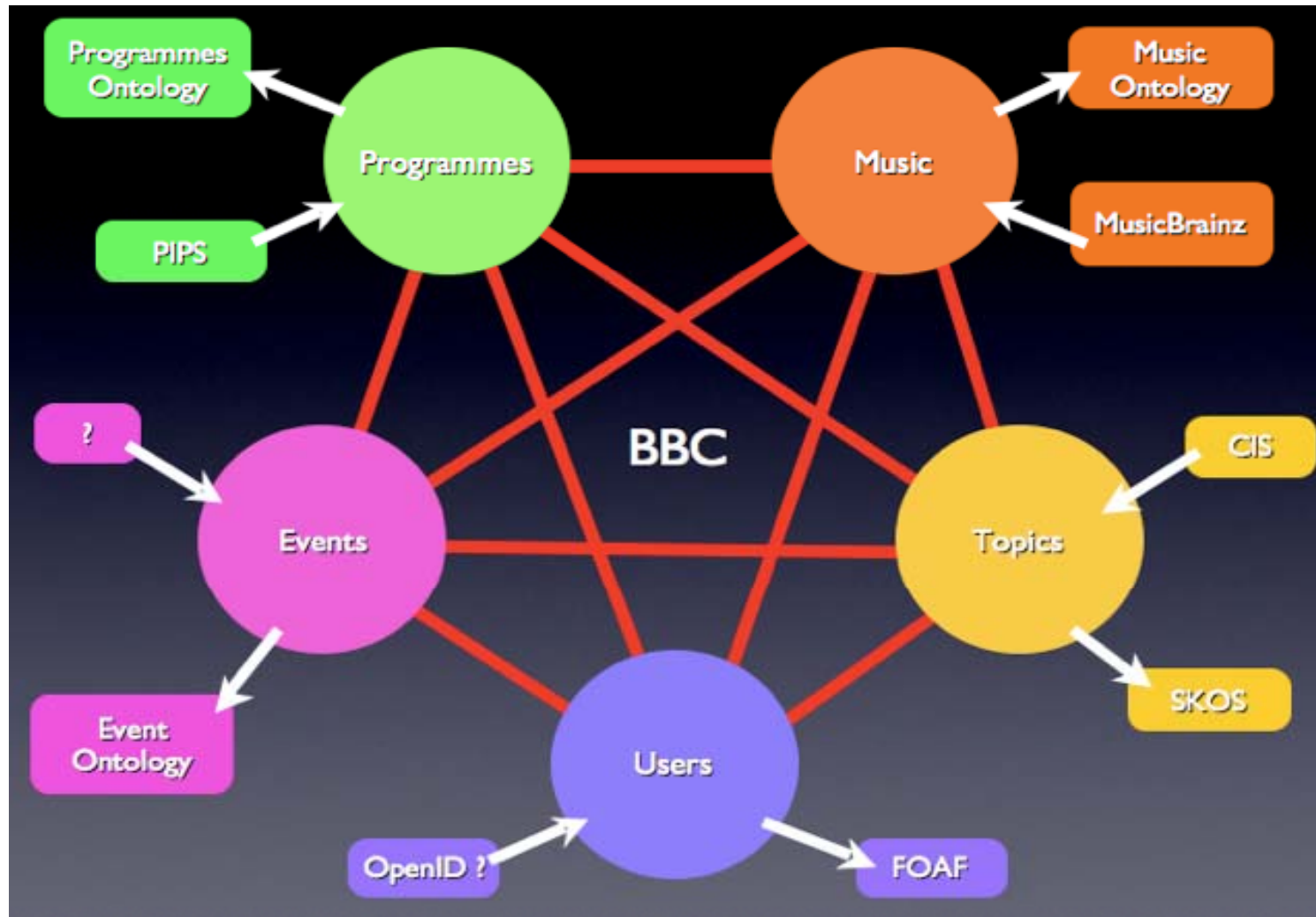
Entity in Database 1

“IS THE SAME AS”

Entity in Database 2

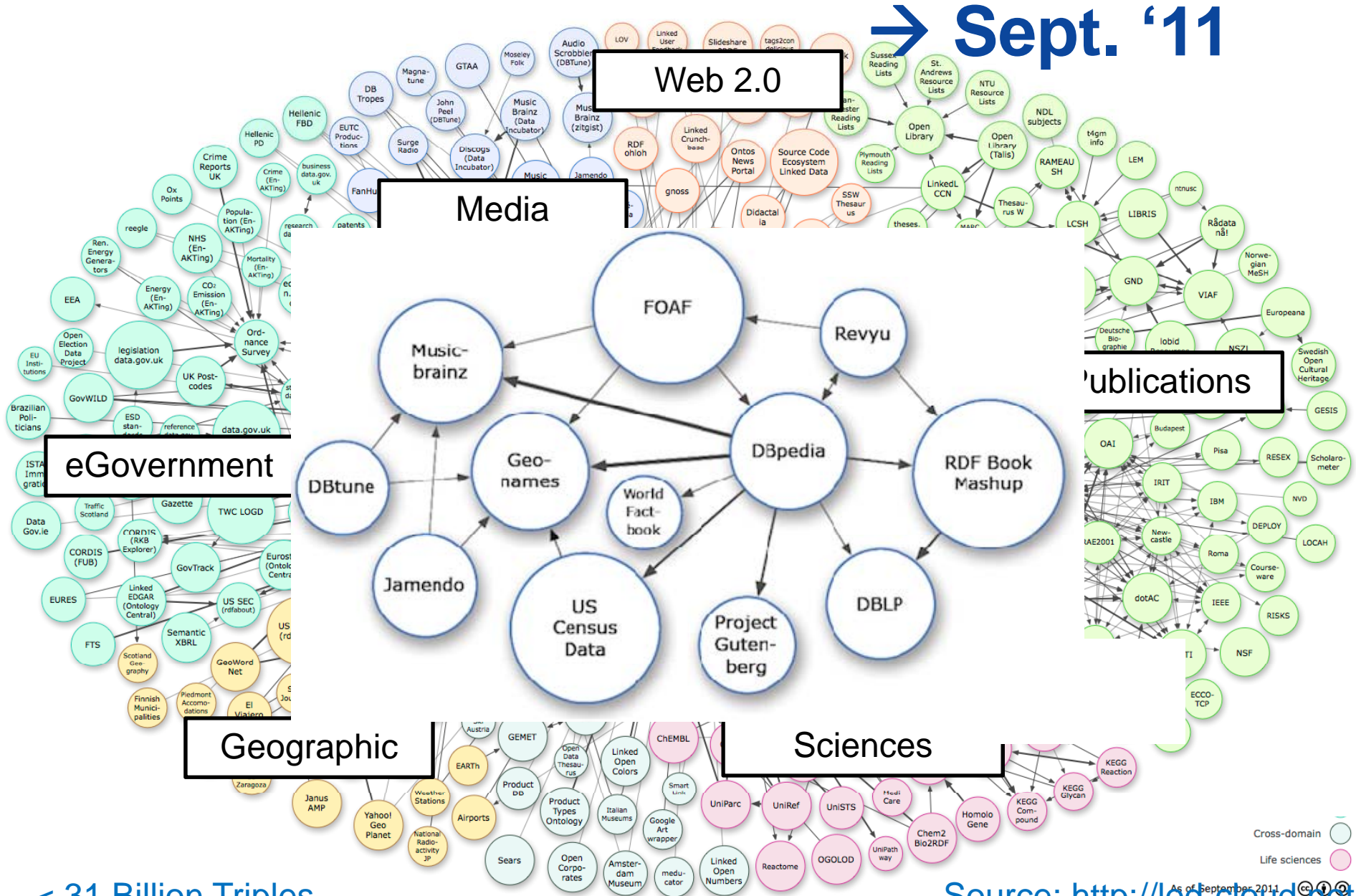


... so that machines can perform more intelligent tasks by THEMSELVES.





→ Sept. '11



< 31 Billion Triples

Source: <http://lod-cloud.net> As of September 2011

Legend:
 ○ Cross-domain
 ● Life sciences



Linked Data at MODUL (2012)



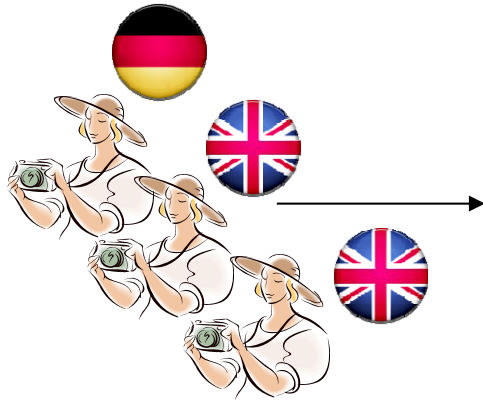


- **Types of decisions**
 - Predict future demand for tourism services
 - Benchmarking cities, regions, countries
 - Predicting new markets
 - Planning new infrastructure etc

- **Decisions involve:**
 - *Combining* tourism statistics from different sources thus benefiting from extended coverage
 - *Combining* tourism statistics with other types of indicators (e.g., sustainability indicators)



Source Markets



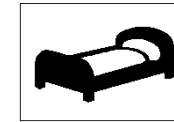
Arrivals



Destination



Capacity



Bednights



	UNWTO	Eurostat	WorldBank	TourMIS
Country	Y	Y	Y	N
Destination	N	N	N	Y
Year	Y	Y	Y	Y
Month	N	Y	N	Y
Access	xls/pdf	Xls/csv/pdf/ spss	Xml/xls/API	API

Open (but not yet Linked) Data



- Critical for supporting decision makers BUT hampered both at syntactic and semantic level
- Syntactic:
 - mostly open data, BUT
 - offered using different syntactic formats that require substantial effort for integration (e.g., especially when extracted from pdf files ..)
- Semantic:
 - Different geographic granularity
 - Measurements at different time intervals
 - Different ways to measure the same indicator
 - None of these differences are explicit in a machine format => need an analyst to understand and combine the data



- Arrivals, Bednights, Capacity indicators
- From **1985** onwards
- **154** EU destinations and **19** markets
- Annual and monthly measurements

```
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```

```
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```

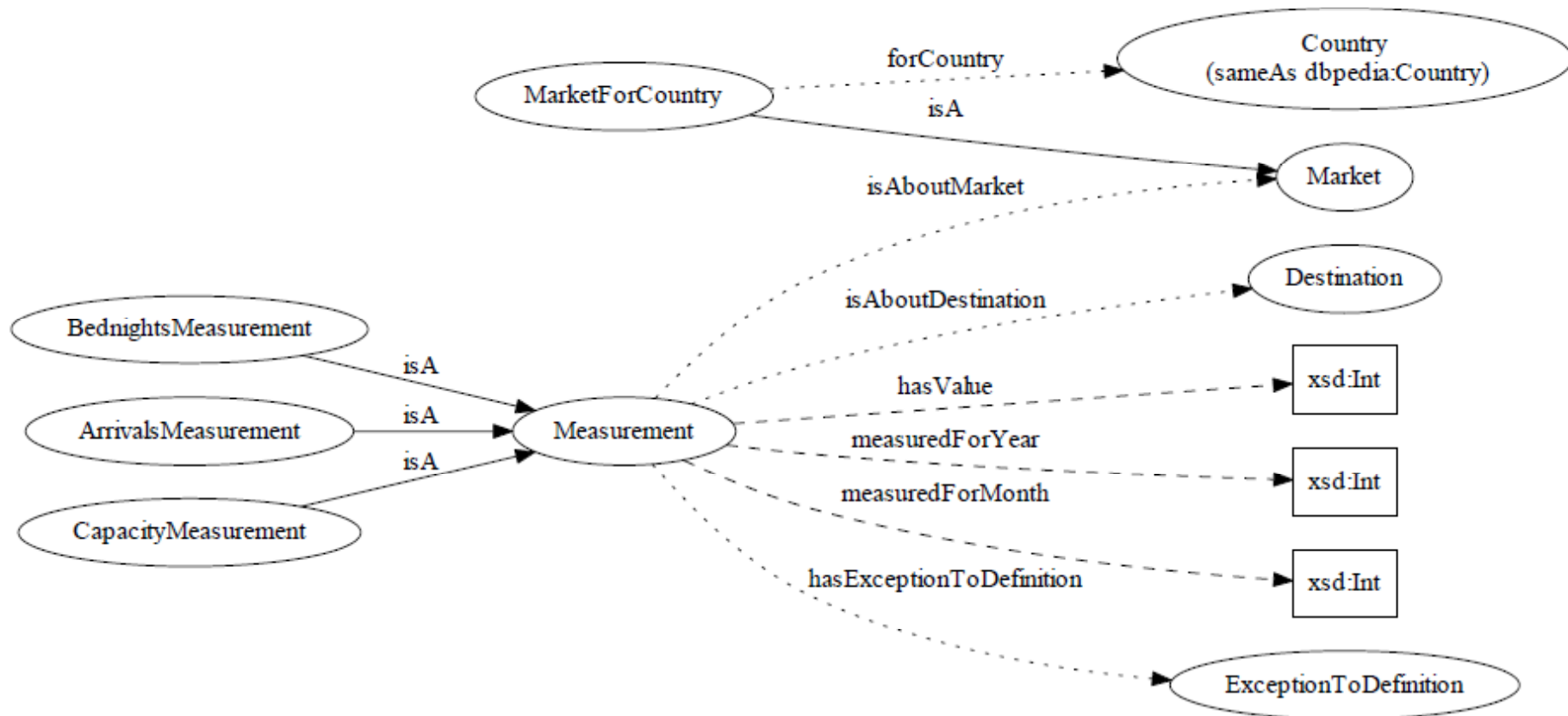
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  <market>AT</market>
```

```
  <year>2005</year>
```

```
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```

```
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```

```
</data>
```





Berlin | TourMISLOD

tourmislo.d.modul.ac.at/tourmis/page/resource/Berlin


- `rdfs:label` Berlin
- `owl:sameAs`
 - `<http://dbpedia.org/resource/Berlin>`
 - `<http://sws.geonames.org/2950159/>`
- `rdf:type`
 - `to:Destination`

About: Berlin

dbpedia.org

About: Berlin

An Entity of Type : [administrative region](#), from Named Graph : <http://dbpedia.org>, within Data Space : dbpedia.org



Berlin is the capital city of Germany and one of the 16 states of Germany. With a population of 3.5 million people, Berlin is Germany's largest city and is the second most populous city proper and the eighth most populous urban area in the European Union. Located in northeastern Germany, it is the center of the Berlin-Brandenburg Metropolitan Region, which has 5.9 million residents from over 190 nations. Located in the European Plains, Berlin is influenced by a temperate seasonal climate.

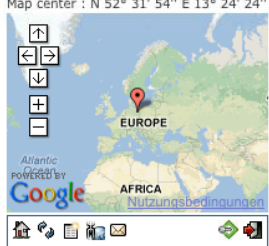
Property	Value
<code>dbpedia-owl:PopulatedPlace/areaTotal</code>	■ 891.85
<code>dbpedia-owl:abstract</code>	■ Berlin és la capital i la ciutat més gran berlinesos. Té una densitat de 3.845 h Està voltada pel land de Brandenburg federats alemanys. Documentada des Prússia, de l'imperi alemany, de la Re Mundial, la ciutat es dividiria en el Ber Oest, que es convertia en un enclavar mentre Bonn es convertia en la capita la ciutat recobrava el seu estatus de c un important centre de cultura, política principalment el sector serveis, incl de comunicació, serveis mediambient

Berlin, Germany

www.geonames.org/2950159/berlin.html

GeoNames Home | Postal Codes | Download / Webservice | About

Map center : N 52° 31' 54" E 13° 24' 24"



displaying Geonames Id : 2950159
[refresh](#) to display all features in area
[GeoNames](#) [Wikipedia](#)

Berlin 74 m
[BER, Beirlin, Beirlin, Berlino, Berliin, Berliin, B...](#)
Germany » Berlin » Berlin, Stadt » Berlin » Bezirk Mitte
capital of a political entity
population : 3426354
N 52° 31' 27" E 13° 24' 37"
52.52437 / 13.41053
GeoNameId : 2950159

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[perma link](#) [geotree](#) [semantic web](#) [rdf](#)
[part of](#) [contains](#)

Name	country	feature	km to center
1 P Berlin	Germany	capital of a political entity	0 km

Export : [csv](#) [png](#)

aBednightsMeasurement_BER_2005_8_AT | TourMISLOD

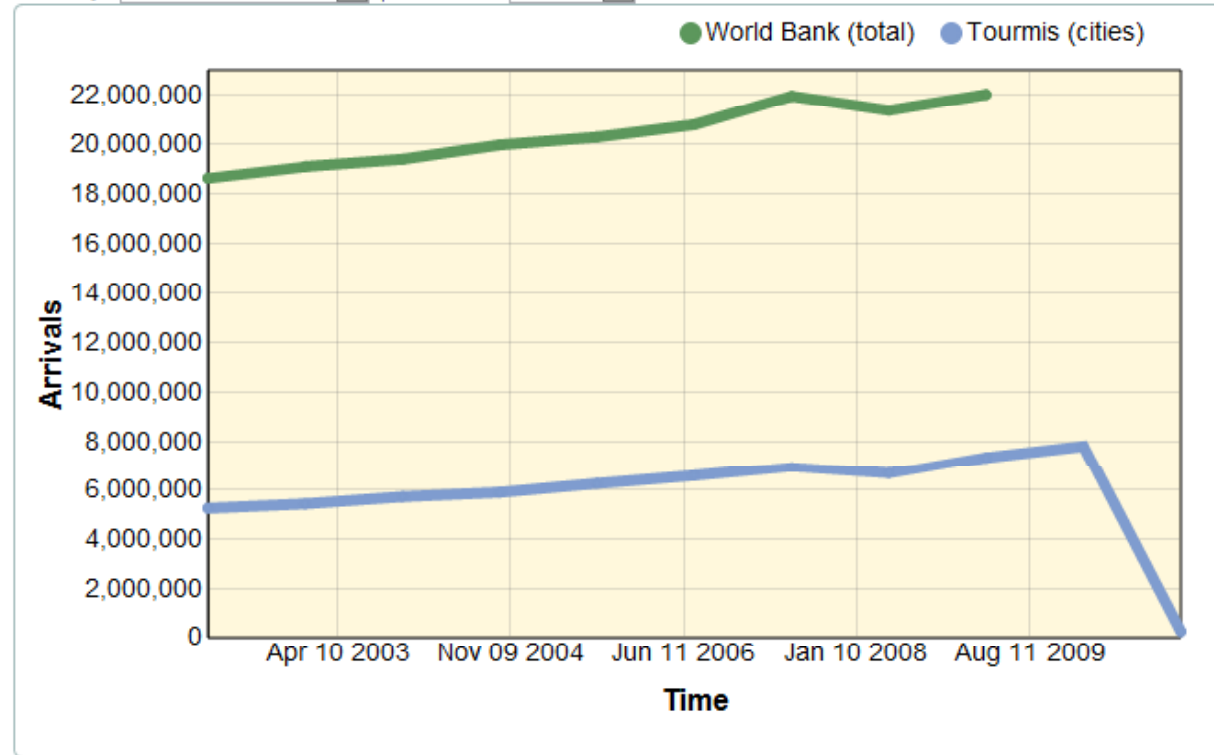
aBednightsMeasurement_BER_2005_8_AT at TourMISLOD
http://tourmislod.modul.ac.at/tourmis/resource/aBednightsMeasurement_BER_2005_8_AT

Property	Value
sesame:directType	▪ to:BednightsMeasurement
to:hasValue	▪ 13901
to:isAboutDestination	▪ tr:Berlin
to:isAboutMarket	▪ tr:marketForAustria
to:measuredForMonth	▪ 8
to:measuredForYear	▪ 2005
rdf:type	▪ to:BednightsMeasurement ▪ to:Measurement ▪ rdfs:Resource ▪ owl:Thing

This page shows information obtained from the SPARQL endpoint at <http://tourmislod.modul.ac.at/openrdf-sesame/repositories/tester4>.
[As Turtle](#) | [As RDF/XML](#) | [Browse in Disco](#) | [Browse in Tabulator](#) | [Browse in OpenLink Browser](#)

- ~1 million triples
- Data subset contains:
 - 1586 Arrivals measurements, 1985-2012, all destinations, annual values, total market
 - 9989 Bednights measurements, in 2005, all destinations, all markets, monthly values
 - 107 Capacity measurements, 2007, all destinations, annual

Country: Austria | Indicator: Arrivals



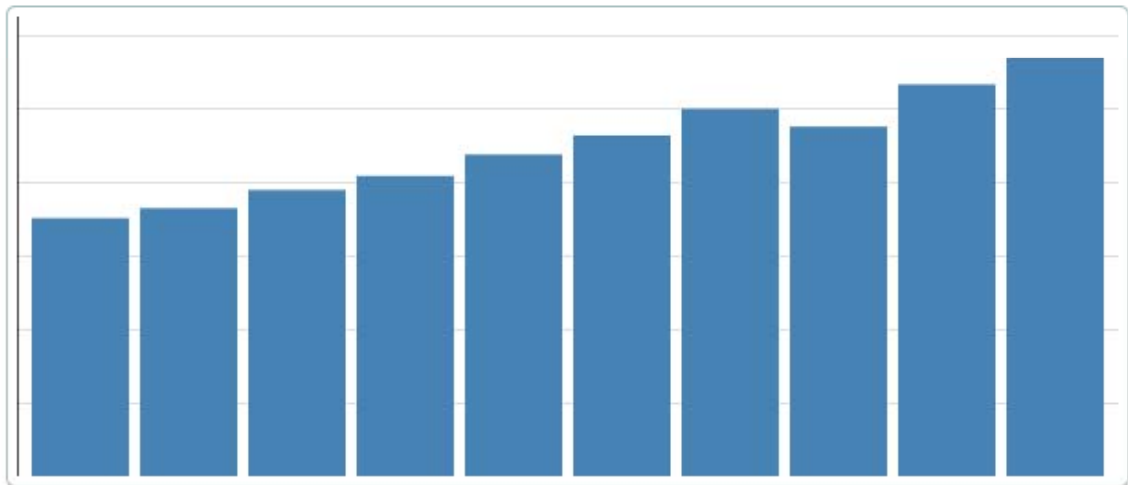
AUSTRIA

URI: <http://dbpedia.org/resource/Austria>
 code: http://dbpedia.org/resource/ISO_3166-1:AT
 population: 8414638
 area: 83855

TourMIS data - click on city to see arrivals

Vienna

short code: VIE
 Linz
 Bregenz
 Innsbruck
 Graz

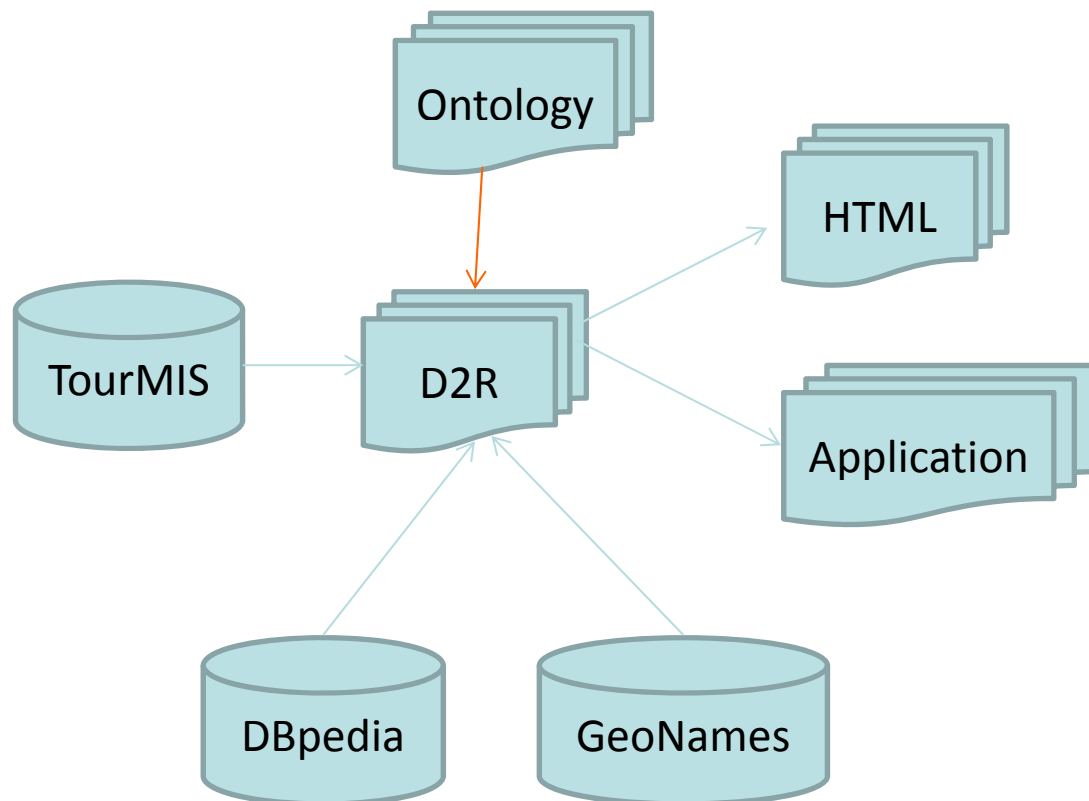




- A data access infrastructure to solve syntactic differences and foster data integration (done)
 - Links allow easy integration of data from DBpedia
- Links allow harvesting new (missing data)
 - e.g., get destination's country from Dbpedia (done)
 - Harvest additional details
- Semantics allow for a formal specification of measurement details and therefore help solve semantics differences (work in progress)



Exposing Tourism Indicators as High Quality Linked Data (**ETIHQ**)

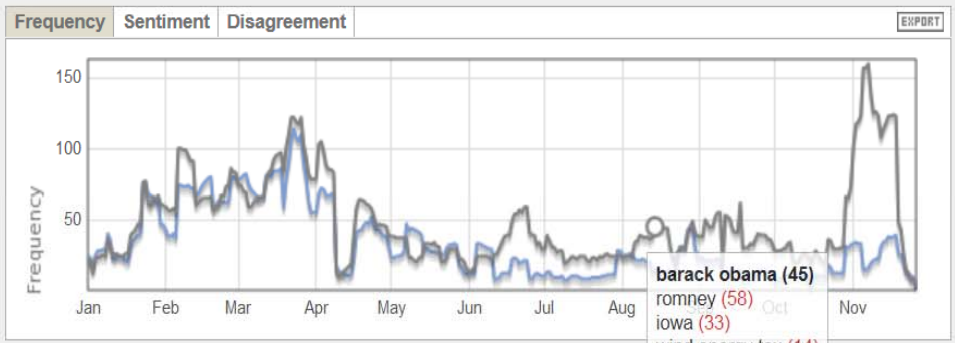


- More sophisticated ontology
- Simplified publishing
- More Data
- More Links
- Improved dashboard



TOPICS

- General**
- Adaptation 773
 - Climate Change 19010
 - Climate Policy 482
 - Climate Science 978
 - Mitigation 524
- World Summits**
- Cancun (COP16) 253
 - Copenhagen (COP15) 1106
 - Durban (COP17) 1107
 - Qatar (COP18) 469
 - UNCSO (Rio+20) 1433
- Renewable Energy**
- Tourism**
- Custom**
- barack obama 2288
 - coal 7729
 - natural gas 4362
 - obama 6102
 - pipeline 2602
- + Add new Category



Document Summary Extended Quote Select Date

9.0 HIS VICTORY SPEECH | GUARDIAN ENVIRONMENT NETWORK

Will Barack Obama seize the moment on climate change? | Environment | guardian.co.uk

www.guardian.co.uk/environment/2012/nov/12/barack-obama-seize-moment-climate-...

Published in: UK • Text refers to: Chicago • Date: 2012-11-12

« * William Becker for Yale Environment 360 , part of the Guardian Environment Network. Barack Obama mentioned the threat of a warming planet in his victory speech in Chicago. ... President Obama sent an encouraging signal in his victory speech in Chicago when he said, "We want our children to live in an America that isn't burdened by debt... More from Guardian Environment Network on. ... The Guardian Environment Network brings together the world's best websites focusing on green topics. »

Tag Cloud

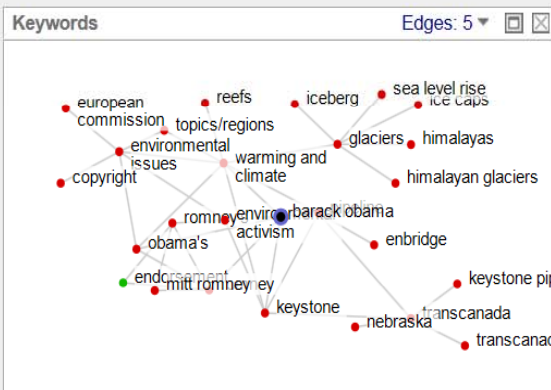
development, efficiency, effort, election, electricity, emission, discussion, disaster, environment, environmentalist, ets, europe, european, event, evidence, executive, expansion, fact, failure, family, farm, farmer, fear, field, fight, figure, fire, firm, fish, flood, fossil, france, front, fuel, fund, future, gas, gases, generation, george, german, ger...

ASSOCIATIONS

- barack obama 2288
- romney 2060
 - keystone 1529
 - warming and climate 727
 - romney's 2060
 - obama's 6102
 - endorsement 242
 - environmental issues 1046
 - harper 777
 - pipeline 2602
 - bloomberg's 966
 - mitt romney 1431
 - mayor bloomberg 90
 - peter hannam 122
 - gasoline prices 683
 - calderon 61

Document View Sentence View Source Statistic

Date	Duration	Source	Count	Average Sentiment
01/23	307	www.guardian.co.uk north american summit romney and barack evolution and climate	137	-3.3
02/06	280	www.thenation.com cozy halt climate both president	106	-5.4
01/03	300	www.enn.com casualties leicester brian jackson	73	+1.6
01/16	301	blogs.telegraph.co.uk daily telegraph jimmy warming wins converts	56	-5.3
01/16	301	www.smh.com.au growing inequality including the british european country	54	-4.2
01/23	294	ens-newswire.com japan's nuclear crisis monk gulf oil	54	-18.1



Linked Tourism Data Project

Cities

Markets

Year:

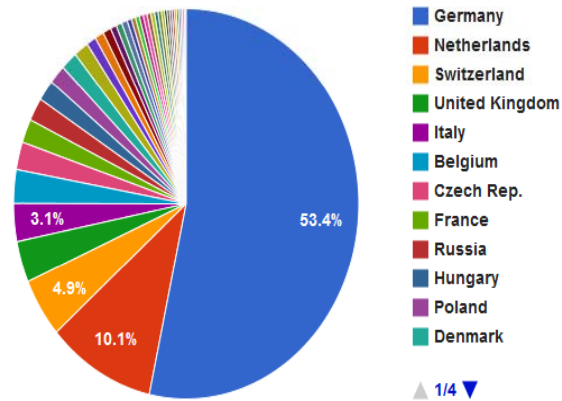
Data source:

- TourMIS
- World Bank
- UNWTO

Indicators:

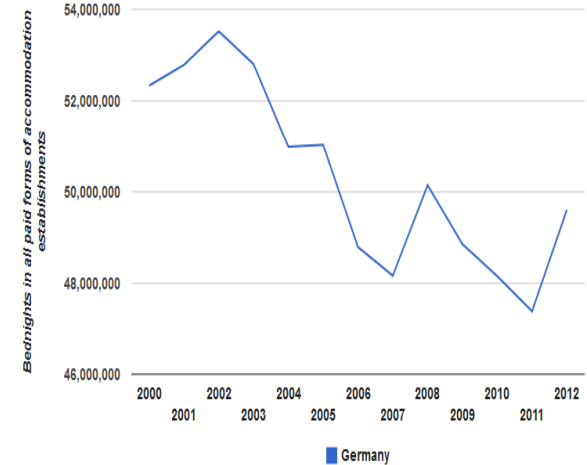
- Bednights
- Arrivals
- Capacity
- Occupancy
- GDP
- Unemployment rate
- Inflation

Average length of stay of a market in all ETC destinations - Bednights (preferred definition) 2012

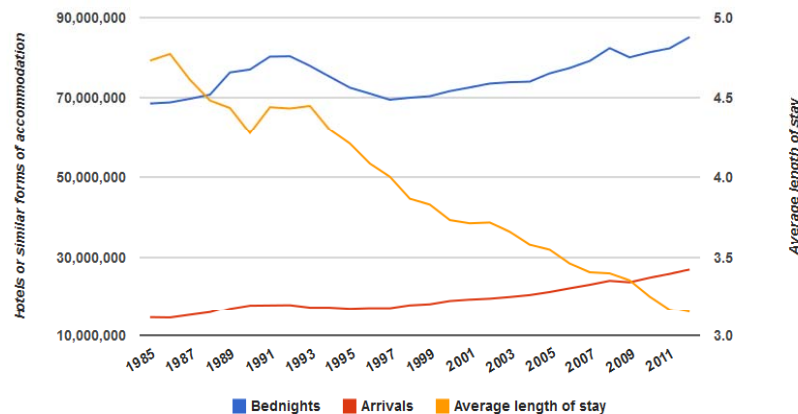


2 destinations included as benchmark: Belgium (NA), Flanders and Brussels (NA).

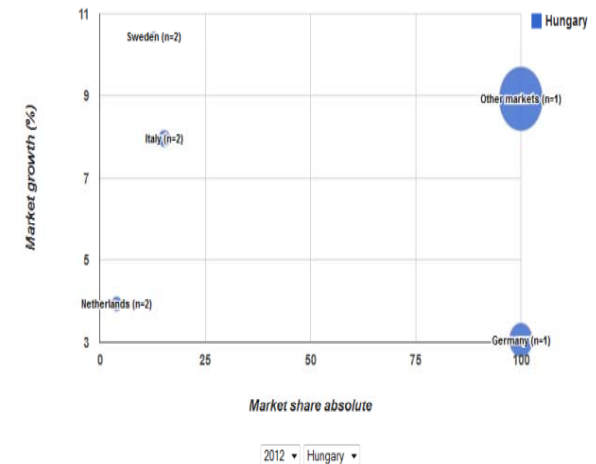
Austria 2000 - 2012



Austria 1985 - 2012 Total foreign and domestic



Comparison between market growth rate, market share and importance rate of countries in Europe





- Linked Data: Interlinked (intelligent) data
- TourMISLOD - first tourism L(O)D



Thank you for your attention!

Questions????

irem.onder@modul.ac.at

marta.sabou@modul.ac.at

