

Open eBusiness Ontology Usage: *Investigating Community Implementation of* **GoodRelations**

>> **LDOW2011**

Jamshaid Ashraf, Richard Cyganiak, Sean O'Riain, Maja Hadzic

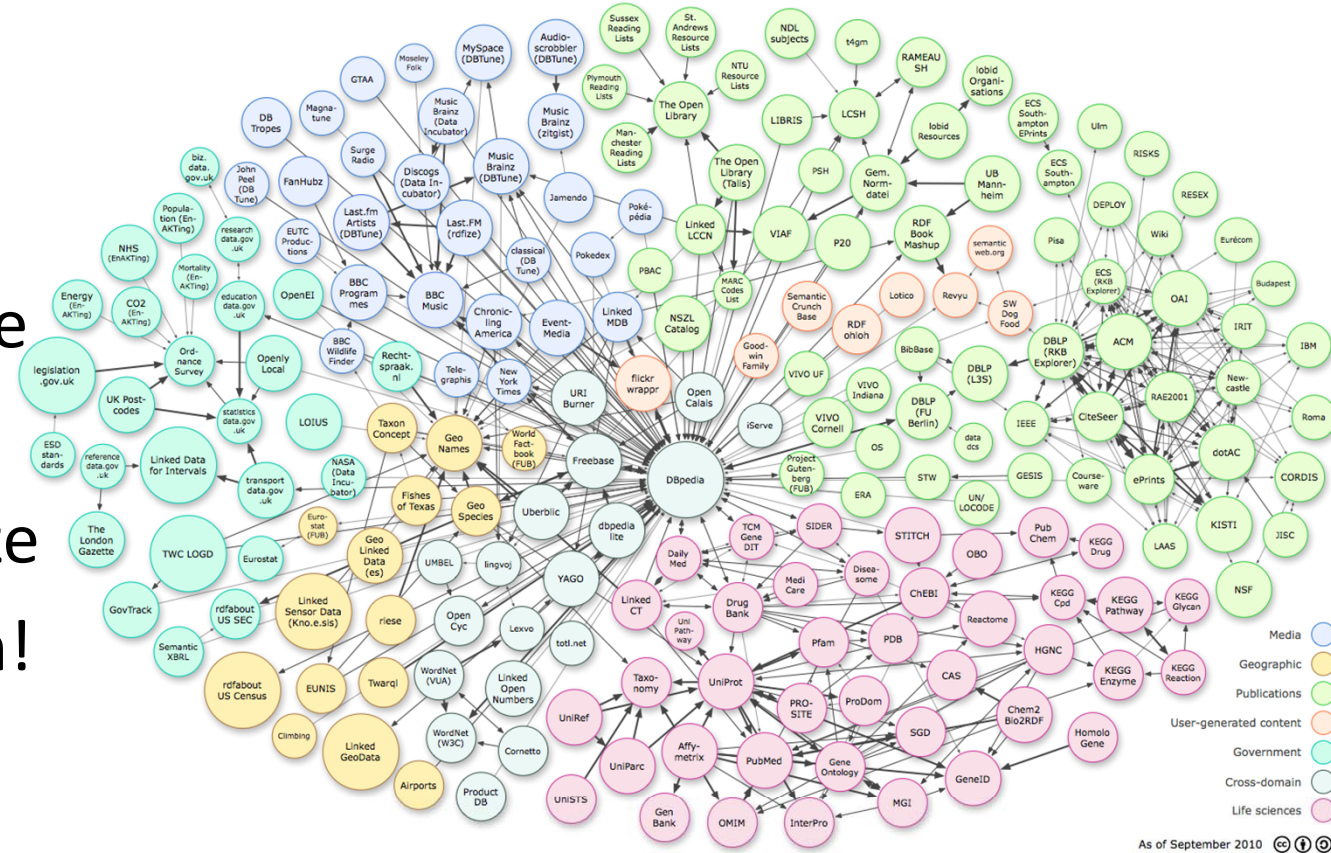
Building the Web of Linked Data

- Think
- Design
- Prototype
- Deploy
- Evangelize
- Adoption!



Building the Web of Linked Data

- Think
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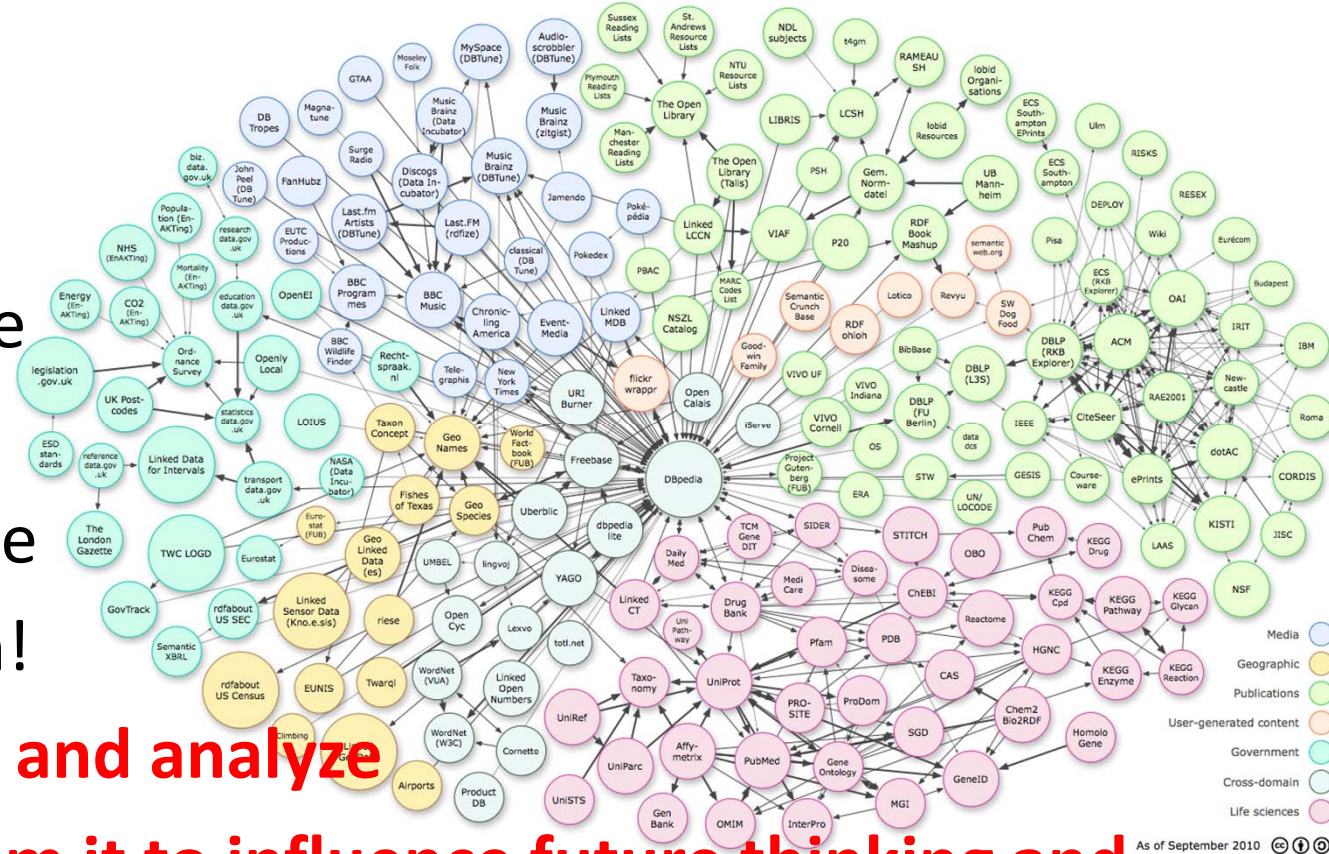


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Building the Web of Linked Data

- Think
- Design
- Prototype
- Deploy
- Evangelize
- Adoption!
- **Measure and analyze**
- **Learn from it to influence future thinking and design**





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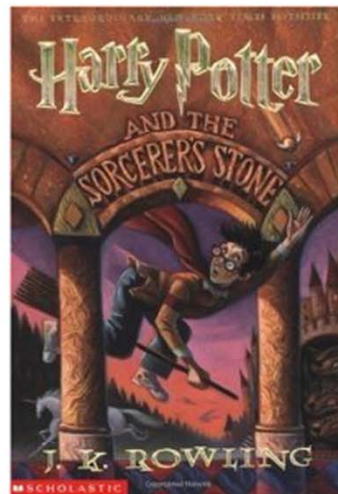
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How Best Buy is Using The Semantic Web

By **Richard MacManus** / July 1, 2010 6:00 AM / 7 Comments

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Yesterday we wrote about the increasing usage of **Semantic Web** is a Web of added meaning, which ultimately enables more intelligent web apps to be built. In this post we continue the

THURSDAY, DECEMBER 10, 2009

Online retail : How Best Buy is using Semantic Technology to define a new trend



Ping the Semantic Web

[http://](#)

These namespaces are used to describe namespaces in number of documents

Namespaces (1371 known namespaces)	Number of documents
http://xmlns.com/foaf/0.1/	1,322,132
http://purl.org/goodrelations/v1#	648,094
http://blogs.yandex.ru/schema/foaf/	584,804
http://www.w3.org/2002/07/owl#	533,909

Semantic SEO for Google with GoodRelations and RDFa

Breaking News: Google has just announced that they now support the GoodRelations vocabulary developed by Prof. Hepp for Google Rich Snippets.



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0 of 11 items (0%)

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Product properties: GoodRelations and hProduct

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A Product listing has a number of properties, which you can mark up using [microdata](#), [microformats](#), or [RDFa](#). The main [Products article](#) provides examples of Product listings marked up using the Google Product vocabulary and the microdata syntax. However, you can also mark up Products using [hProduct](#) (microformats) or [GoodRelations](#). For GoodRelations, use the Offering class to specify the item for sale and its attributes.

The table below lists provides hProduct and GoodRelations equivalents for the Google Product vocabulary. (For convenience, it also lists the Merchant Center equivalents, where available.) Note that not all properties have hProduct or GoodRelations equivalents. For example, while Product listings recognized by Google include Product details (details about the product itself, such as its name, brand, and model) plus either Offer or Offer-aggregate details, GoodRelations and hProduct do not follow the same structure.

To use GoodRelations markup, be sure to specify the appropriate namespaces at the beginning of each item or set of items, as follows:

- `xmlns:gr="http://purl.org/goodrelations/v1#"`: Specifies the GoodRelations namespace.
- `xmlns:foaf="http://xmlns.com/foaf/0.1/"`: [FOAF](#). Required to identify product images.
- `xmlns:v="http://rdf.data-vocabulary.org/#"`: Indicates that your content uses RDFa syntax.

For more detailed information, see the following:

- [Official hProduct spec from microformats](#)
- [Official GoodRelations spec](#)
- [Google Merchant Center](#)

Supported Product properties

Recommended articles

[Shopping and products](#)[Review ratings](#)[Rich snippets testing tool](#)[Videos: Facebook Share and RDFa](#)[Rich snippets \(microdata, microformats, and RDFa\)](#)

Help resources

[Search Engine Optimization](#)[Improve your site's performance in search \[PDF\]](#)[Third-party Sitemap Tools](#)[Tools for creating Sitemaps](#)[Webmaster Tools on YouTube](#)[See tips and tricks](#)[Video tutorial](#)[Tools for webmasters](#)[How Google Works](#)[Drooling Dog Bar B Q - Colfax, CA](#)

★★★★☆ 15 reviews - Price range: \$\$

Drooling Dog has some really good BBQ. I had the pulled pork sandwich, Drooling Dog BBQ is a great place to stop at on your way up the hill to Tahoe ...

[www.yelp.com/biz/drooling-dog-bar-b-q-colfax](#) - 75k - [Cached](#) - [Similar pages](#)

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Jay Myers, BestBuy.com



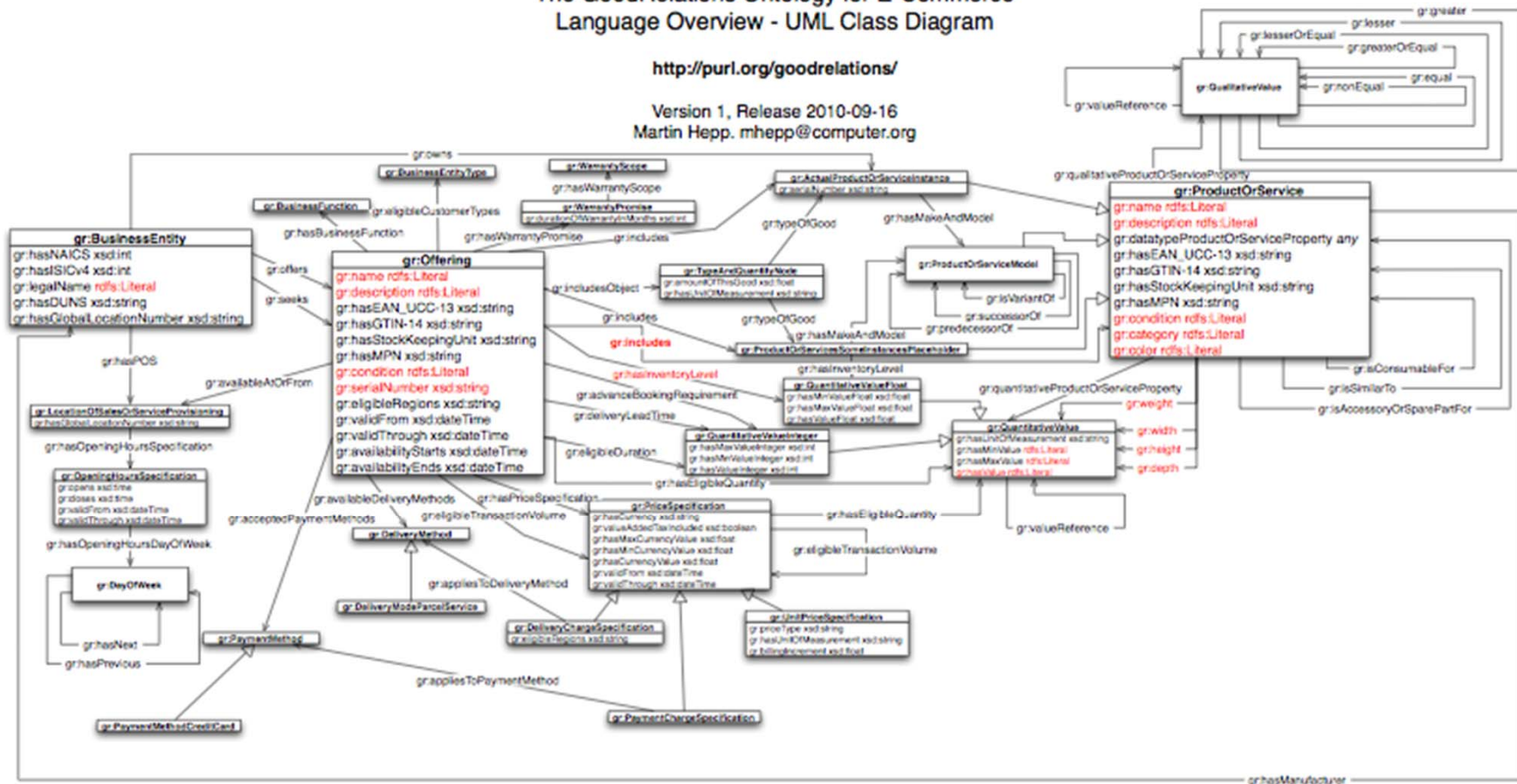
“The RDFa data is ‘also great for machines,’ said Myers, which has resulted in ‘a definite up tick in the amount of search traffic to these pages.’ At last week's SemTech conference, Myers said that it had resulted in **a 30% increase in search traffic**. He noted that Best Buy hadn't expected to see an SEO benefit, but it's been a boon to them since the company is ‘very reliant on search engines’ for product discovery and store locations.”

But what exactly is being adopted?

The GoodRelations Ontology for E-Commerce Language Overview - UML Class Diagram

<http://purl.org/goodrelations/>

Version 1, Release 2010-09-16
Martin Hepp, mhepp@computer.org



Objectives

- Who is publishing GoodRelations data?
 - What's in the data?
 - What can you do with it?
 - Can we reason over GoodRelations data?
-
- How to do this kind of empirical analysis?



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Objectives

- Who is publishing GoodRelations data?
- What's in the data?
- What can you do with it?
- Can we reason over GoodRelations data?

- How to do this kind of sampling and analysis?

WORK IN PROGRESS



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Dataset

GoodRelations Dataset (GRDS)

- Collected via Sindice, Watson, Google, Linked Open Commerce, GR wiki
- 105 web sources (web sites)
- Published Company and/or product/service Offering



1	Bitmunk.com	28	www.bonvino.de	55	www.monsterclean.net	82	www.xtremeimpulse.com
2	abe.pc.pl	29	www.bunkersofa.com	56	www.msd-kilian.de	83	www.piccadillys.com
3	akw-fitness.de	30	www.buntegeschenke.de	57	www.oettl.it	84	www.sanderslaw.com
4	anonbrand.com	31	www.cisema.de	58	www.opvallendeplanten.nl	85	www.cardgameshop.com
5	atlanticlinux.ie	32	www.colibra.com	59	www.overstock.com	86	www.raabe.de
6	c-paintings.com	33	www.commercialloandirect.com	60	www.pdagroup.net	87	universum-shop.de
7	cf.mixcontrol.pl	34	www.corsetsandcurves.com.au	61	www.plushbeautybar.com	88	www.oreilly.com
8	fastbacklink.de	35	www.cyelite.com	62	www.praxis-kohn.de	89	www.sachse-stollen.de
9	iliumtechnologies.com	36	www.dowcipnie.com	63	www.saveonvideo.com	90	www.nirvanashop.com
10	internethq.com.au-	37	www.espacelibido.com	64	www.smart-infosys.at	91	www.piccadillys.com
11	lokool.com	38	www.ews-ingenieure.com	65	www.stalsoft.com	92	www.svanvit.se
12	michaellambertz.net	39	www.franz.com	66	www.starline.de	93	www.symbolontarot.nl
13	ontosolutions.com	40	www.gasparotto.biz	67	www.succenture.biz	94	www.globalautoimports.com.br
14	palimpsest-press.com	41	www.greatautodealersites.com	68	www.suitcase.com	95	www.econoclick.com.br
15	pharma2phork.org	42	www.heavy-liquid.com	69	www.synapse-fr.com	96	www.discountofficehomefurniture.com
16	pinpoint.benefits.com.au	43	www.hewettresearch.com	70	www.technicinvest.ro	97	www.kedaisouvenir.com
17	schwitzen.com	44	www.i-views.de	71	www.tenera.ch	98	www.golfhq.com
18	sd-kyber.com	45	www.inndata.at	72	www.totalinspection.biz	99	www.modernchair.com
19	slindi.com	46	www.intisgiftalpacas.com	73	www.tu-travelsolutions.de	100	connex-filter.eu
20	store.inspiredsilk.com	47	www.jarltech.de	74	www.voilesansfrontiere.com	101	www.probioticsmart.com
21	usclats-gites.com	48	www.karniyarik.com	75	www.wellenreiter-consult.de	102	BestBuy.com
22	vx.valex.com.au	49	www.kasztany.com	76	www.symbolontarot.nl	103	hagemann24.de
23	waffen-frank-shop.de	50	www.kica-jugendstil.com	77	www.svanvit.se	104	www.openlinksw.com
24	web.utamet.at	51	www.la-mousson.de	78	www.sponsorthisroundabout.com	105	www.jing-shop.com
25	www.3kbo.com	52	www.lis-og.com	79	hypotheebelgieconsultant.be		
26	www.akw-fitness.de	53	www.lovejoys-ltd.co.uk	80	www.peek-cloppenburg.de_Stores		
27	www.arizona-realestate-	54	www.mmmeeja.com	81	BestBuy.com_Store		



Analysis



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Who publishes and how?

- Large retailers: Best Buy, Overstock.com, O'Reilly, Suitcase.com
- E-commerce CMS packages with GoodRelations support
- ~~Third party RDFizers (Virtuoso Sponger, RDF Book Mashup)~~
- 90% RDFa



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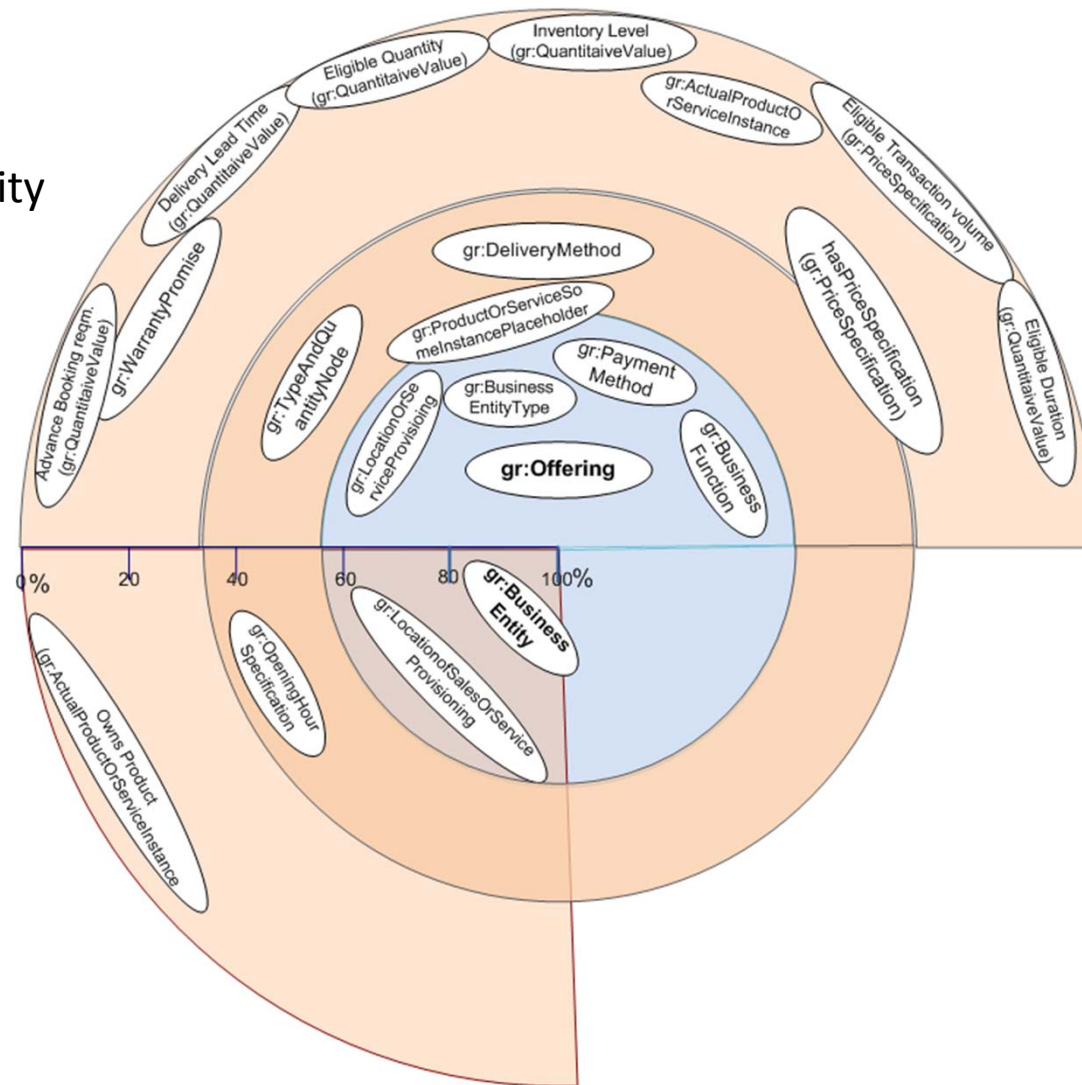
Vocabulary co-use

Prefixes and Namespaces used in GRDS

Prefix	Namespace URI	Data sources (%)
gr	http://purl.org/goodrelations/v1#	100
vCard	http://www.w3.org/2006/vcard/ns# http://www.w3.org/2001/vcard-rdf/3.0 (deprecated namespace)	88.57
dcterm	http://purl.org/dc/terms/	34.29
dc	http://purl.org/dc/elements/1.1/	
foaf	http://xmlns.com/foaf/0.1/	25.71
commerce	http://search.yahoo.com/searchmonkey/commerce/	14.29
media	http://search.yahoo.com/searchmonkey/media/	
use	http://search.yahoo.com/searchmonkey-datatype/use/	
currency	http://search.yahoo.com/searchmonkey-datatype/currency/	
v	http://rdf.data-vocabulary.org	3.81
og	http://opengraphprotocol.org/schema/	0.95
rev	http://purl.org/stuff/rev#	0.95
frbr	http://vocab.org/frbr/core#	0.95
geo	http://www.w3.org/2003/01/geo/wgs84_pos#	0.95

Concept Coverage

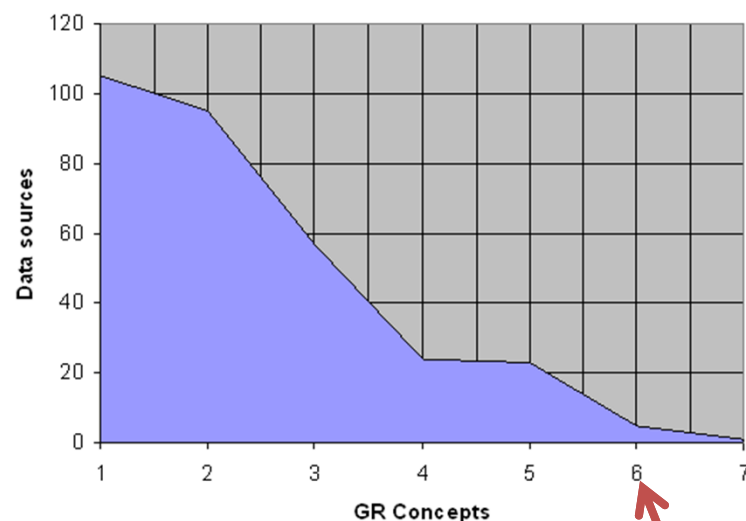
- Offering
- BusinessEntity



Findings...

GRDS data coverage

Query Coverage over GRDS



```

1 PREFIX gr:<http://purl.org/goodrelations/v1#>
2 SELECT distinct ?g
3 WHERE{
4   GRAPH ?g{
5     ?BE    a gr:BusinessEntity.
6     ?OFF   a gr:Offering.
7     ?OFF   gr:hasPriceSpecification ?PS.
8     ?OFF   gr:includesObject ?TQN.
9     ?TQN   gr:typeOfGood ?PoSIP.
10    ?PoSIP a gr:ProductOrServicesSomeInstancesPlaceholder.
11    ?PoSIP gr:hasMakeAndModel ?PoSM.
12  }
13 }
14

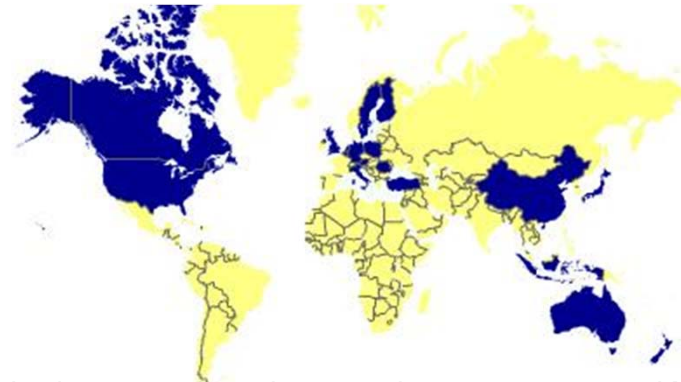
```

1	BusinessEntity(BE)					
2	BE	:Offering(OFF)				
3	BE	OFF	:TypeAndQuantityNode(TQN)			
4	BE	OFF	TQN	:PriceSpecification(PS)		
5	BE	OFF	TQN	PS	:ProductOrServicesSomeInstancesPlaceholder(PoSIP)	
6	BE	OFF	TQN	PS	PoSIP	:ProductOrServiceModel(PoSM)
7	BE	OFF	TQN	PS	ActualProductOrServiceInstance	

Use Cases

Finding a Company (Business Entity)

- Find a company with a specific name
- Find a company in a particular location
- Find a company in a particular line of business (or service)



Map build using GRDS based on vCard **country-name** and **locality**

Use of location related attributes in GRDS

RDF Terms	Data sources (%)	RDF Terms	Data sources (%)
:BusinessEntity	100	vCard:Address	99.5
:legalName	93.34	vCard:country-name	99.5
:hasISICv4	0.95	vCard:locality	99.5
:hasNAICS	0.0	vCard:street-address	85.3
:hasDUNS	0.0	vCard:postal-code	85.3
:hasGlobalLocationNumber	0.0		

```

1 PREFIX gr:<http://purl.org/goodrelations/v1#>
2 SELECT distinct ?name ?gin ?naics ?duns ?isics
3 WHERE {
4   GRAPH ?g{
5     ?be a gr:BusinessEntity.
6     ?be gr:legalName ?name.
7     OPTIONAL {?be gr:hasNAICS ?naics }.
8     OPTIONAL {?be gr:hasISICv4 ?isics}.
9     OPTIONAL {?be gr:hasDUNS ?duns }.
10    OPTIONAL {?be gr:hasGlobalLocationNumber ?gin }.
11  }
12 }
13

```

Use Cases

Finding an Offer (:Offering)

Find offering of a specific price range
 Find offering of a specific product and the available quantity
 Find delivery, warranty and payment charges of particular offering



:Offering

data properties

object properties

RDF Terms	Data sources (%)	RDF Terms	Data sources (%)
:Offering	100		
:validFrom	82.86	rdfs:comment	77.14
:validThrough	82.86	rdfs:label	8.57
:eligibleRegions	82.86	v:name	0.95
:hasStockKeepingUnit	2.86	v:description	0.95
:hasEAN_UCC-13	1.90	v:price	0.95
:name	0.95	v:category	0.95
:description	0.95	dc:title	0.95
:availabilityStarts	0.95	dc:contributor	0.95
:hasGTIN-14	0.0	dc:date	0.95
:hasMPN	0.0	dc:description	0.95
:condition	0.0	dc:type	0.95
:serialNumber	0.0	dc:duration	0.95
:availabilityEnds	0.0		

RDF Term	% of Data sources	RDF Term	% of Data sources
:Offering	100		
:eligibleCustomerTypes	80.95	:hasWarrantyPromise	2.86
:hasBusinessFunction	77.14	:hasInventoryLevel	0
:availableAtOrFrom	70.48	:advanceBookingRequirement	0
:acceptedPaymentMethods	60.95	:deliveryLeadTime	0
:includesObject	56.19	:eligibleDuration	0
:availableDeliveryMethods	47.62	:eligibleQuantity	0
:hasPriceSpecification	30.48	:eligibleTransactionVolume	0
:includes	3.8	:hasEligibleQuantity	0

Use Cases

Finding a specific product (Product Find-ability)

- Find a particular product (e.g. TV or Shoes)
- Find a product with specific requirement (e.g. TV set of 24 inches, HD resolution)

C1

97% only textual
description of product

```
1 PREFIX gr:<http://purl.org/goodrelations/v1#>
2 SELECT distinct ?pro ?price ?curr
3 WHERE{
4   {?pro a gr:ProductOrServicesSomeInstancesPlaceholder.}
5   UNION
6   {?pro a gr:ActualProductOrServiceInstance.}
7   {?pro rdfs:comment ?content.}
8   UNION
9   {?pro rdfs:label ?content.}
10  FILTER REGEX(?content, "Cup", "i")
11  ?temp gr:typeOfGood ?pro.
12  ?off gr:includesObject ?temp.
13  ?off gr:hasPriceSpecification ?ps.
14  ?ps a gr:UnitPriceSpecification.
15  ?ps gr:hasCurrency ?curr.
16  ?ps gr:hasCurrencyValue ?price.
17 }LIMIT 100
18
```

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The Product Types Ontology: Good identifiers for product
types based on Wikipedia

<http://www.productontology.org/>
On this page: [Usage](#) [Examples](#) [Facebook](#) [OGP](#) [RDF/XML](#) [Dump](#) [FAQs](#) [Caching Policy](#) [License](#) [Contact](#)
This service provides GoodRelations-compatible OWL DL class definitions for ca. 300,000 types of product or services that have an entry in the English Wikipedia, e.g.

Wikipedia Entry	Class Identifier	Representation
Apple	http://www.productontology.org/id/Apple	[RDF/XML] [N3/Turtle] [HTML]
Laser_printer	http://www.productontology.org/id/Laser_printer	[RDF/XML] [N3/Turtle] [HTML]
Manure_spreader	http://www.productontology.org/id/Manure_spreader	[RDF/XML] [N3/Turtle] [HTML]
Racing_bicycle	http://www.productontology.org/id/Racing_bicycle	[RDF/XML] [N3/Turtle] [HTML]
Soldering_iron	http://www.productontology.org/id/Soldering_iron	[RDF/XML] [N3/Turtle] [HTML]
Sweet_potato	http://www.productontology.org/id/Sweet_potato	[RDF/XML] [N3/Turtle] [HTML]

GoodRelations is a standardized vocabulary (also known as "scheme", "data dictionary", or "ontology") for product, price, and company data that can (1) be embedded into existing static and dynamic Web pages and that (2) can be processed by other systems, and other novel applications.



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C1

Remove this

this fuzzy picture is to show that product description is not in structured format as we didn't find any data source using product ontology

>>> Productontology (www.productontology.org) from H. Martin is a solution toward semantic product description
CBS; 24.03.2011

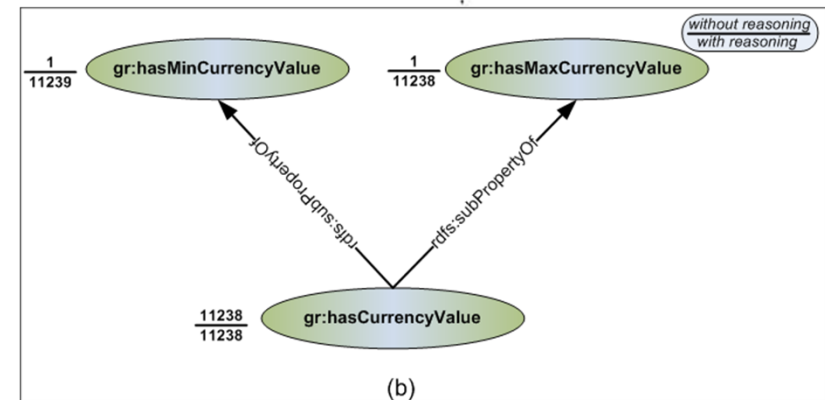
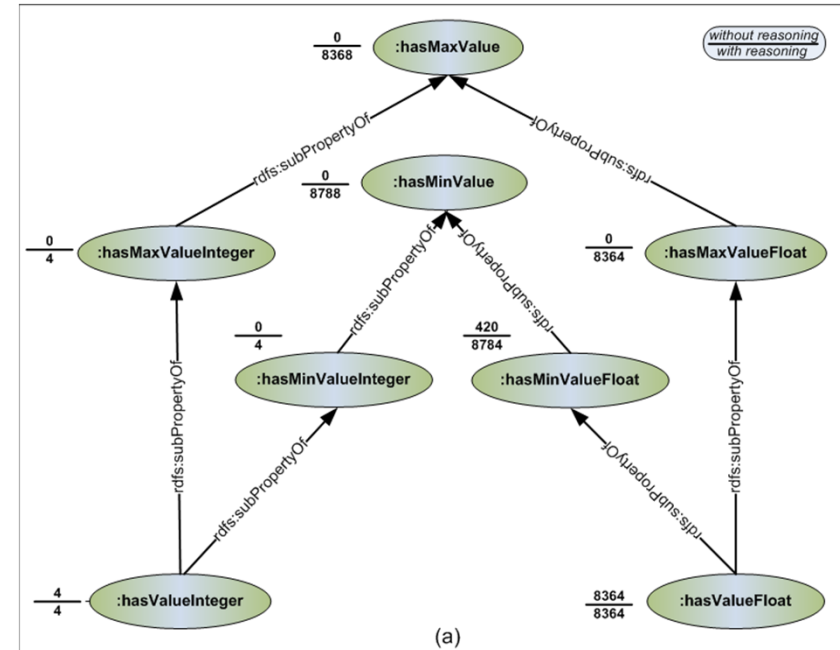
Reasoning

- (a) Quantitative value data properties
- (b) Currency value data properties

Axioms in GRO and applicable rule sets

	Axioms	Count	Applicable Rule sets
Class	SubClassOf	13	RDFS
	DisjointClasses	91	OWL2RL
Object Property	SubPropertyOf	4	RDFS
	InverseOf	6	pD*, OWL2RL
	TransitiveProperty	7	pD*, OWL2RL
	SymmetricProperty	2	pD*, OWL2RL
Data Property	SubPropertyOf	13	RDFS

- Few OWL-inconsistencies
- Subclass inference ✓
- Subproperty inference, inverse, transitive, symmetric ✗



What did we learn?

- Small part of the ontology widely used
- Main limitation: lack of detailed product model data



What did we learn?

- Adoption driven by a major consumer who can create incentives
- Key adopters: major retailers, e-shop software packages

Future work

- Make dataset available
- Instance data quality, consistency
- Recommendations
- Towards a framework for vocabulary/ontology usage analysis

Thanks!

Questions.....



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