Ontology Consumer Analysis Tool Onto*CAT*

Valerie Cross and Anindita Pal Computer Science and Systems Analysis Miami University, Oxford OH

> SEBIZ WORKSHOP University of Georgia November 6, 2006

> > 2006 SEIBIZ Workshop

Agenda

- Motivation
- Perspectives on Ontology Evaluation
- Some Current Approaches
- Ontology Consumer Analysis Tool
- Some Evaluations Using OntoCAT
- Summary
- Future Plans

Motivation

- Ontologies the "backbone of the Semantic Web"
- Development and deployment of ontology-based software solutions requires considerable time and effort
- Numerous existing ontologies in libraries available on the WWW
- Why reinvent the wheel? Reuse of ontologies important to SW success

What is ontology evaluation?

- Ontology evaluation key problem in the field of ontology development and reuse.
- Selection vs. Evaluation
 - Two separate tasks?
 - How related?
 - When does it occur?
 - Selection → Evaluation?
 Evaluation→Selection?
 - Ontology Selection: Ontology Evaluation on the Real Semantic Web (Sabou, Lopez, Motta, Uren EON 2006)

What kinds of selection criteria?

Popularity

- metrics account solely for the links between different ontologies.
- same principle as Web search engines, often use a modified version of the PageRank algorithm.
- Semantic data richness
 - determine richness of the ontology's conceptualization
- Topic coverage
 - level to which ontology covers a certain topic.
 - ontology concept labels compared to a set of query terms representing the domain.

What are we evaluating?

- From U.S. National Center for Ontology Research (NCOR) position paper at EON 2006:
 - well-defined ontology design techniques, i.e.,
 - quality of design
 - principled measurement methods, i.e.,
 - quality of evaluation
 - higher quality ontologies, i.e.,
 - quality of content

Earlier Approaches to Evaluating Ontologies

- One-T [Bouillon et al 2002] :
 - Ontology Group at Universidad Politécnica de Madrid (UPM)
 - Content for completeness, consistency and correctness
- OntoClean [Guarino and Welty 2002] :
 - The Ontology Group at the Italian National Research Council (CNR).
 - Methodologies to evaluate during its entire lifetime,
 - Formal analysis of taxonomies

Earlier Approaches to Evaluating Ontologies

- **ONTOMETRIC** [Lozano-Tello & Gómez-Pérez 2004]
 - Ontology Group at Universidad Politécnica de Madrid
 - method to quantify the suitability of ontologies for the users' systems,
 - uses a taxonomy of 160 ontology characteristics,
 - Content, language, development methodology, built by software tool, cost of use.
 - not fully automated, based on AHP (Saaty 1977)
 - drawback is its usability: complicated and time-consuming to specify characteristics of an ontology and assessing some characteristics is subjective.
- Application Use of ontology to assess application's performance, merits of
 - competency questions, use cases, scenarios

Consumer Perspective Approach

- Noy [2004] suggests for ontology re-use need more research from consumer perspective
 - Somewhat analogous to reviewing Table of Contents and Index, number of pages, etc. for the usefulness of book before deciding whether to check out or purchase.
 - ontology summarization, e-pinions for ontologies, views
- AKTiveRank [Alani and Brewster 2005]
 - AKT (Advanced Knowledge Technologies) consortium of British universities: <u>Southampton</u>, Edinburgh, Aberdeen, Sheffield and The Open University.
 - ranks ontologies retrieved by an ontology search engine based on set of query terms and measures
- OntoQA Analysis tool [Tartir 2005]
 - LSDIS (Large Scale Distributed Information Systems) Lab, University of Georgia
 - analyzes ontology schemas and their populations and describes them through a set of metrics.

AKTiveRank

- Ranks ontologies retrieved by search engine (EON 2005)
 - Class match: coverage of query terms
 - Centrality: more central a class
 - Density: degree of details
 - Semantic similarity measure: closeness of classes
 - Produces overall rank
- Extensions (2006 EON, Protégé Conference, ISWC)
 - Collect vocabulary for domain interest
 - Ranking based on number of class labels that match with terminology for domain of interest, parameterized partial vs. exact match
 - New Centrality using JUNG's "betweenness" measure Elinimated original Centrality measure since somewhat redundant with Density

Ontology Consumer Analysis Tool

- Envision as another tool that may be used to further analyze and compare after selecting set of ontologies that are potential candidates
- Currently working on methods to become more "Consumer oriented"
 - summarizations of and combinations of the various metrics
 - Visualization of various metrics to help consumer understand result comparisons

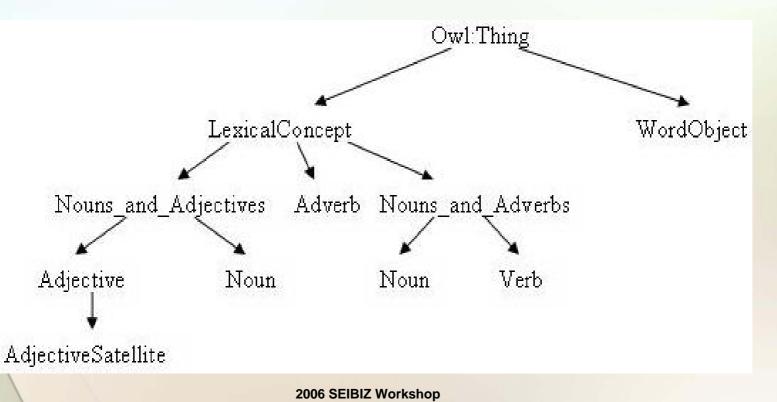
Ontology Consumer Analysis Tool

- plug-in for OWL Protégé
- very parameterized
 - Intensional and extensional
 - View metrics interested in
 - Size
 - Structure
 - User selectable root for analysis
 - User selectable relation for establishing extensional structure

WordNet

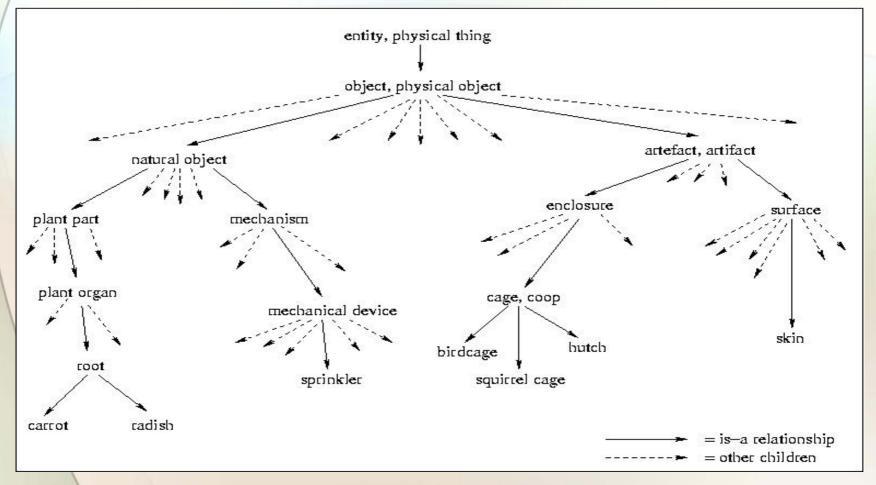
Princeton University
Terminological ontology of English
Organizes nouns, verbs, adjectives and adverbs into synonym sets

•Simple intensional structure: 10 classes



WordNet

- Complex extensional structure based on hypernymOf /hyponymOf
- Example Root Instance "entity, physical thing", one of the nine noun roots



Ontology Consumer Analysis Tool

- Metrics categorized into
 - Intensional: Measures on definition (classes)
 - Extensional: Measures actual occurrences (instances)
 - Size and Structural
- Summary
 - Hub Concepts
 - Concepts with maximum links in & out
 - Root Concepts

Onto CAT User Interface

vordnet171 Protégé 3.1.1 (file:\C:\Anindita\OWLProjects\wordnet\wordn	et171.pprj, OWL Files (.owl or .rdf))	
<u>File Edit Project QWL Code Window Tools H</u> elp		
		prote
🥌 OWLClasses 🛛 🔳 Properties 📄 🚍 Forms 🖌 🔶 Individuals 🖌 🔶 Metadata 🖌 Relation Up	dater Ontology Metrics	
Intensional Intensional ALL SIZE iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iCnt(Leaf)	Hub Concepts Intensional Extensional Intensional 10 ✓ # of Links Protege ID Depth Width # of Parents # of Children # of Propety	IC
iPer(RtoC) iPer(RtoP) Min/Max Property Depth Avg Min/Max IC @ depth Avg Total Avg Min/Max Width Win/Max Width		
Extensional ALL SIZE Min/Max Occu eCnt(Root) eAvg(Leaf)	Extensional 10 # of Links Protege ID Depth Width # of Parents # of Children	IC
eCht(Occu) eAvg(Occu(C)) eCht(Ceaf) Min/Max Leaf eCht(Ceaf) Min/Max Cecu(R)) eAvg(Occu(R)) Avg Min/Max		
IC @ depth Image: Avg Min/Max Total Avg Min/Max Min/Max Width @ Image: Avg		
Metrics Report 🔀 🔛		
	LexicalConcept # of Links Protege ID Depth Width # of Parents # of Children IC	

Ontology Analysis Tool

wordnet171 Protégé 3.1.1 (file:\C:\Ani	ndita\OWLProjects\wordnet\wordnet171.p
ile <u>E</u> dit <u>P</u> roject <u>O</u> VVL <u>C</u> ode <u>Wi</u> ndow Tool:	s <u>H</u> elp
]CB 488 244	?• • • • • • • • • • • • • •
OWLClasses Properties Forms Intensional ALL SIZE iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) i Per(RtoP) Min/Max Property IC @ depth Total Avg Min/Max	Individuals Metadata Relation Updater Image: Structural structura structural stru
Extensional ALL SIZE Min/Max Occu eCnt(Occu) eAvg(Occu(C)) Cocu(C)) eAvg(Occu(R)) Min/Max Occu(R) IC @ depth	STRUCTURAL eCnt(Root) eAvg(Leaf) eCnt(Leaf) Min/Max Leaf Depth Avg Min/Max Vvidth Avg Min/Max
Total Avg Min/Max Metrics Report S	Z Workshop

Onto CAT Buttons

- Metrics Button
 - Display result of selected metrics
- Report Button
 - Report result of selected to file



- Generate tree of hub concept to visualize
- Click hub for individual hub visualization

Onto Cat Selection Class/Extensional Relation

vordnet171 Protégé 3.1.1 (file:\C:\Anir	ndita\OWLProjects\wordnet\wordnet17	'1.pprj, OWL Files (.owl or .rdf))	
<u>File Edit Project OWL C</u> ode <u>Wi</u> ndow Tools	Help		
] C 2 % D î č č 🗸 🌾	?••₽ ₿ ₽ ₿ ■		<
🧶 OWLClasses 🔳 Properties 🗧 Forms 🔶	Individuals 🔶 Metadata Relation Updater	Ontology Metrics	
Intensional ALL SIZE		Hub Concepts Intensional Extensional Intensional 10	
SIZE iCnt(Cls) iCnt(Relation) iPer(PtoC) iPer(RtoC) Min/Max IC @ depth Cotal Avg Min/Max	STRUCTURAL iCnt(Root) iCnt(Leaf) Depth Avg Winth Avg Winth Vvidth Winth @	# of Links Proteoe ID Depth Cls and Relation Selector SELECT A CLS Adjective AdjectiveSatellite Adverb LexicalConcept Noun Nouns_and_Adjectives	Width # of Parents # of Children # of Propety 1.0 0.052 0.5 0.684 antonymOf 0.684 attributeRel 1.0 causedBy 1.0 entailsTo 1.0 groupWith 1.0 hypernymOf 1.0
Extensional ALL SIZE MinMax Occu eCnt(Occu) eAvg(Occu(C)) Cocu(C)) eAvg(Occu(R)) MinMax Occu(R)	□ STRUCTURAL ✓ eCnt(Root) ✓ eAvg(Leaf) ✓ eCnt(Leaf) ✓ Min/Max Leaf □ Depth □ Avg □ Avg Min/Max	Nouns_and_Verbs Verb WordObject	hyponymOf mHolonym pHolonym pMeronym participleOf pertainsTo eHelenum
IC @ depth Total Min/Max	☐ Width ☐ Avg ☐ Min/Max ☐ Width @		

2006 SEIBIZ Workshop

Onto CAT Intensional Report

cepts

Intensional Extensional

ALL SIZE	
iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoP) Min/Max Property	iCnt(Root) iCnt(Leaf) iPer(LtoC) Depth Avg Min/Max
IC @ depth 2 Total Avg Min/Max	Vidth Avg Min/Max Width @ 2
ALL SIZE Cont(Occu) Cont(Occu(C)) Min/Max Occu(C)) Althorematical Avg(Occu(C)) Althorematical Avg(Occu(R)) Cont(Occu(R)) Cont(Occu(R	STRUCTURAL ✓ eCrt(Root) ✓ eAvg(Leaf) ✓ eCrt(Leaf) ✓ Min/Max Leaf Depth Avg Min/Max
C @ depth Total MinMax	Width Avg Min/Max Width @
Metrics Report 🔯 S	3

SIZE METRICS	Entire Ontology	LexicalConcept
Total Class	9	7
Total Properties	19	15
# of Direct Properties	0	3
Total Relations	18	14
Direct # of Relations	0	2
Min # of Property	3	3
Cls with Min Property	LexicalConcept, Adverb	Adverb
Max # of Property	11	11
Cls with Max Property	Noun	Noun
Average Properties	2.11	2.14
Average Relation	2.0	2.0
% R to P	0.94	0.93

STRUCTURAL METRICS	Entire Ontology	LexicalConcept				
Total # of Roots	2	3 AdverbNouns_and_Adjectives Nou				
Roots	LexicalConcept WordObject					
Total # of Leaves	6	5				
% L to C	0.66	0.57				
Min Depth	1	1				
Leaf Cls at Min Depth	WordObject	Adverb				
Max Depth	4	3				
Leaf Cls at Max Depth	AdjectiveSatellite	AdjectiveSatellite				
Average Depth	2.66	2.0				
Width @ 2	3	4				
Min Width	1	1				
Depth of Min Width	4	3				
Max Width	4	4				
Depth of Max Width	3	2				
Average Width	2.5	2.66				
2						
IC @ 2	1.8690	2.6666				
Min IC2	0.3690	0.6666				

Onto CAT Extensional Report

Intensional ✓ ALL SIZE iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) i Per(RtoP) Min/Max Property Depth Avg Min/Max Vidth Avg Vidth Q Min/Max Vidth Avg Min/Max Vidth Q	Hub Concepts Intensional Extension Extensional SIZE METRICS # of Direct Occurrence # of Direct Occurrence Total CIs Occurrence Total Relation Occurrence # of Occurrence for Min CIs Occurrence Min CIs Occurrence	C Entire Ontology 0 251690 289078 19339	LexicalConcept 0 111223	
 ✓ ALL SIZE iCnt(Cls) iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoC) iPer(RtoC) iPer(RtoP) Min/Max Property IC @ depth 2 Avg Min/Max VMidth Avg Min/Max Extensional 	SIZE METRICS # of Direct Occurrence Total CIs Occurrence Total Relation Occurrence # of Occurrence for Min CIs Occurrence	0 251690 289078 19339	0	
SIZE iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoP) Min/Max Property Depth IC @ depth 2 Total Avg Min/Max Width Vvidth 2	SIZE METRICS # of Direct Occurrence Total CIs Occurrence Total Relation Occurrence # of Occurrence for Min CIs Occurrence	0 251690 289078 19339	0	
iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoP) Min/Max Property Depth IC @ depth Avg IC @ depth Avg Min/Max Width Avg Min/Max Extensional Extensional	# of Direct Occurrence Total Cls Occurrence Total Relation Occurrence # of Occurrence for Min Cls Occurrence	0 251690 289078 19339	0	
iCnt(Cls) iCnt(Property) iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoP) Min/Max Property Depth IC @ depth Avg IC @ depth Avg Min/Max Width Avg Min/Max Extensional Extensional	Total Cls Occurrence Total Relation Occurrence # of Occurrence for Min Cls Occurrence	0 251690 289078 19339	la la companya da companya	
iCnt(Relation) iPer(PtoC) iPer(RtoC) iPer(RtoP) Min/Max Property Depth IC @ depth 2 Total Avg Min/Max Win/Max Extensional	Total Cls Occurrence Total Relation Occurrence # of Occurrence for Min Cls Occurrence	289078 19339	111223	
i Crtt(Relation) i Per(PtoC) i Per(RtoC) i Per(RtoP) Min/Max Property Depth IC @ depth 2 Total Avg Min/Max Width Avg Width Vidth Avg Win/Max	# of Occurrence for Min Cls Occurrence	19339		
iPer(RtoC) iPer(RtoP) Min/Max Property Depth IC @ depth Avg Total Avg Min/Max Win/Max	Min Cls Occurrence		274547	
Min/Max Property Depth Avg Min/Max Ut C @ depth 2 Avg Min/Max Wt Avg Min/Max Min/Max Extensional		0	19339	
Avg Min/Max C @ depth 2 Total Avg Min/Max Width Avg Min/Max Extensional	1995 - \$227.50 % - 87	V	0	
Image: C @ depth 2 Image: C @ depth 2	Cls with Min Occurrence	LexicalConcept, Nouns_and_Verk	Nouns_and_Adjectives,Nouns_ar	
Total Avg Min/Max Wicth @ 2	CIS WILL WILL OCCUT ENCE	•		
Total Avg Width @ 2	Max Cls Occurrence	140470	75804	
	Cls with Max Occurrence	WordObject	Noun	
	Average Cls Occurrence	27965.88	15889.0	
	Min Relation Occurrence	0	0	
	Relation with Min Occurrence	pHolonym, sHolonym, mHolonym	antonymOf, pHolonym, sHolonym,	
✓ SIZE Min/Max Occu eCnt(Root) ✓ eAvg(Leaf)	Max Relation Occurrence	140470	140470	
eCnt(Occu)				
eCnt(Occu(C)) eAvg(Occu(R)) Depth	STRUCTURAL METRICS	Entire Ontology	LexicalConcept	
	Total Root	366	366	
	Total Leaf	69410	69410	
Width	Average LeaveshyponymOf	0.78	0.78	
C @ depth	Min Leaves	1	1	
Total Avg Width @	Root Cls with Min Leaves	c100001742	c100001742	
	Max Leaves	56006	56006	
Metrics Report 🔯 🔛	Root Cls with Max Leaves	c202155096,c201947728,c20135	52 c202155096,c201947728,c201352	

Onto CAT Root Summary for WordNet Nouns

Root Occurrence in <CIs>

Root ID	# of Leaf	Avg Depth	Max Depth	Min Depth	Avg Width	Max Width	Level at Max	Min Width	Level at Min
c100023182	527	5.63	12	1	55.23	124	4	1	0,12
c100022634	7146	5.12	10	1	711 36	4389	5	1	0
c100020595	2367	5.18	11	1	264.66	518	3	1	0
c100022113	4718	5.15	11	1	535.66	1668	5	1	0
c100021905	B21	4.33	8	1	125.11	448	4	1	0
c100001742	56006	7.33	17	1	3891.61	15406	7	1	0,17
c100016840	3312	6.47	12	2	337.61	1074	7	1	0
c100016993	7993	6.61	13	2	764.92	2163	6	1	0
c100025413	1156	5.16	10	1	141.36	399	4	1	0,10

E-COMMERCE ONTOLOGIES

- Standardized vocabulary of product and services terminology referred to as Product and Service Categorization Standards (PSCS)
- Example PSCS developed into intensional ontologies
 - UNSPSC
 - hierarchical classification of all products and services for use throughout the global marketplace.
 - In between coarse taxonomies for customs purposes and expressive descriptive languages for products and services
 - eCl@ss,
 - offers a standard for information exchange between suppliers and their customers.
 - Both important horizontal standards since cover a broad range of industries

Previous Study (Hepp 2005)

Previous study "to assess the quality and maturity of products and services categorization standard" proposed metrics target four aspects:

- size, growth, and maintenance volume,
- degree of balance among segments, hierarchical order, and the breadth of coverage,
- size and expressiveness of the property library,
- specificity of property assignment in class-wise property lists.

Example metrics

- "size of segments" corresponds to OntoCAT's iCnt(C)(cj-root), the number of classes for a root class.
- "size" corresponds to OntoCAT's iCnt(C), the number of classes for the entire intensional ontology.
- *"property list size"* corresponds to iCnt(P), the number of properties defined for the entire intensional ontology

OntoCAT intensional metrics UNSPSC

Size	owl:Thing	Apparel_and_ Luggage_and_ Personal_Care_ Products	Building_and_ Construction_and_ Maintenance_ Services
Total #Cls [iCnt(C)]	16500	254	87
Total #Property [iCnt(P)]	2	2	2
Total Roots [iCnt(Roots)]	al Roots [iCnt(Roots)] 56		1
		Clothing, Footwear, Luggage_and_handbags _ and_ packs_and_cases, Personal_ care_products, Sewing_supplies _and_ accessories	Building_ construction_ and_ support_ and_ maintenance_ and_ repair_ services
Total Leaves [iCnt(leaves)]	14317	219	70
Average Leaves [iAv(leaves)]	0.86	0.86	0.80
Max Depth [iMaxDepth]	4	3	3
Max Width [iMaxWidth]	14317	219	70
Depth of iMaxWidth	4	3	3
Average Width [iAvWidth]	4125	84.66	29

RDF/RDF(S) version of UNSPSC is developed by Michel Klein and was obtained from http://www.cs.vu.nl/~mcaklein/unspsc

OntoCAT Root summary for the UNSPSC ontology.

Concept Name	Iotal Class es	Total Leaf	Max Dept h	Min Depth	Avg Depfh	Max Width	Level @ max	Min Width	leve 1@ min	Avg Width
Laboratory_and_Measuring _and_Observing_and_Testin g_Equipment	1103	1008	3.00	3	3	1008	3	3	1	367.66
Structures_and_Building_an d_Construction_and_Manuf acturing_Components_and_ Supplies	596	615	3.00	3	3	615	3	L	1	232
Chemicals_including_Bio_ Chemicals_and_Gas_ Materials	614	508	3.00	3	3	508	3	14	1	204.66
Drugs_and_Phamaceutical_ Products	611	514	3.00	3	3	514	3	15	1	203.66
Commercial_and_Military_a nd_Private_Vekicles_and_th eir_Accessories_and_Comp onents	496	417	3.00	3	3	417	3	10	1	165.33
Communications_and_Com puter_Equipment_and_Perip herals_and_Components_an d_Supplies	416	369	3.00	3	3	369	3	3	1	138.66
Industrial_Manufacturing_a nd_Processing_ Machinery_and_Accessories	395	342	3.00	3	3	342	3	13	1	131.66
Distribution_and_Conditioni ng_Systems_and_Equipmen t_and_Components	340	312	3.00	3	3	312	3	4	1	113.33
Power_Generation_and_Dist ribution_Machinery_and_Ac cessories	305	275	3.00	3	3	275	3	S	1	101.66
Farming_and_Fishing_and_ Forestry_and_Wildlife_Cont racting_Services	280	237	3.00	3	3	237	3	8	1	9333
Industrial_Production_and_ Manufacturing_Services	279	236	3.00	3	3	236	3	9	1	93
Politics_and_Civic_Affairs_ Services	279	241	3.00	3	3	24]	3	8	1	93
Domestic_Appliances_and_ Supplies_and_Consumer_El ectronic_Products	275	246	3.00	3	3	246	3	7	1	91.66

OntoCAT intensional metrics ecl@ss

Size	owl:Thing	Structural	owl:Thing
Total #Cls [iCnt(C)]	76975	Total Roots [iCnt(Roots)]	25684
Total #Property [iCnt(P)]	5527	Total Leaves [iCnt(leaves)]	51317
Total #Relation [iCnt(R)]	2293	Average Leaves [iAv(leaves)]	0.66
% R to P [Per(R of P)]	0.41	Average Depth [iAvDepth]	3.4
Max #Property [iMaxTotal(P to C)]	5527	Width @ 1 [iWidth(depth _k)]	25684
		Max Depth [iMaxDepth]	5
	-	Min Depth [iMinDepth]	1
		Max Width [iMaxWidth]	26162
	_	Depth of iMaxWidth	2
		Min Width [iMinWidth]	4533
		Depth of iMinWidth	3

<u>Used http://www.heppnetz.de/eclassowl as input to OntoCAT</u>

OntoCAT ecl@ss Root Summary

	lotal		Max	Min	Avg		Level @	Min	level @	Avg
Concept Name		Total Leaf		Depth		Width	max	Width	min	Width
C_AAG961003-tax	10623	5038	4	1	3.94	5292	3	20	1	2655.75
C_AAB572002-tax	5317	2181	4	1	3.8	2624	3	35	1	1329.25
C_AAB072002-tax	3983	1669	4	1	3.82	1973	3	19	1	995.75
C_AAD302002-tax	3585	1317	4	1	3.71	1756	3	37	1	896.25
C_AAF876003-tax	2927	1315	4	1	3.88	1444	3	20	1	731.75
C_AAC473002-tax	2653	1186	4	1	3.88	1320	3	7	1	663.25
C_AAC350002-tax	2431	1024	4	1	3.82	1192	3	24	1	607.75
C_AAB315002-tax	2127	850	4	1	3.77	1041	3	23	1	531.75
C_AAA183002-tax	2065	832	4	1	3.79	1019	3	14	1	516.25
C_AAA862002-tax	1927	739	4	1	3.73	932	3	32	1	481.75
C_AAA647002-tax	1603	589	4	1	3.68	763	3	39	1	400.75
C_AAD111002-tax	1519	580	4	1	3.74	750	3	10	1	379.75
C_AAF397003-tax	1451	499	4	1	3.62	680	3	46	1	362.75
C_AAT090003-tax	1239	445	4	1	3.64	577	3	43	1	309.75
C_AAD025002-tax	1041	318	4	1	3.57	502	3	19	1	260.25
C_AAW154003-tax	1007	417	4	1	3.79	490	3	14	1	251.75
C_AKJ313002-tax	977	403	4	1	3.79	477	3	12	1	244.25
C_AAD640002-tax	879	329	4	1	3.7	420	3	20	1	219.75
C_AKK397002-tax	863	286	4	1	3.62	416	3	16	1	215.75
C_AAC286002-tax	701	253	4	1	3.68	339	3	12	1	175.25
C_AAN560003-tax	515	214	4	1	3.8	253	3	5	1	128.75
C_AKJ644002-tax	509	121	4	1	3.41	242	3	13	1	127.25
C_AAE587002-tax	493	189	4	1	3.73	240	3	7	1	123.25
C_AAD170002-tax	451	175	4	1	3.74	221	3	5	1	112.75
C_AAC168002-tax	405	131	4	1	3.58	191	3	12	1	101.25

Comparisons

Both defined as intensional ontologies

UNSPSC

- 16500 classes and only two properties.
- 56 root classes and 14317 leaves, Percent leaves 88%
- more wide than deep with an average depth of 4 and average width of 4125
- a uniform maximum and minimum depth of 3.
- root classes have all leaves at the same level
- maximum width occurs at the maximum depth, equivalent to the number of leaves for the root class.

ecl@ass

- 76975 classes and 5527 properties
- 25684 root classes and 51317 leaves, Percent leaves 66%
- more wide than deep with an average depth of 3.4 and average width of 20526
- Unlike UNSPCS maximum width occurs not at the greatest depth but at depth 3 for all roots.
- Like UNPSCS, the minimum width varies and always occurs at depth 1 for each root.

Summary

- Many flavors of ontology evaluation or selection
 - Creating "candidate" set of ontologies for reuse with initial evaluation
 - Detailed analysis of "candidate" set using metric analysis
- OntoCat one of numerous tools to address needs of ontology evaluation
 - Structural and size analysis
 - Both intensional and extensional
 - Root selection parameters
 - Root and hub summaries
 - Initial experiment with hub visualizations
- Experiments on numerous domains:
 - WordNet
 - UMLS vocabularies
 - E-commerce ontologies UNSPSC and ecl@ss

Possible Future Work

- Interface with "candidate" selection approaches before perform detailed analysis
- Comparison metrics/charts/visualization for multiple ontologies for "candidates"
- Visualization to help consumers "see" ontology for reuse and comparison
 - Hubs visualization Improvement
 - Individual hub visualization
 - Top-level summary / visualization
 - Bottom-up level summary / visualization
- Combine and aggregate analysis results to provide consumers with summaries characterizing each ontology