

Multilingual FrameNet Tutorial

Alignments

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Aligning Lexical Entries

A barba de uesti dura	jun pien	縫邊逢反	bassar si
A baixar	fan ti	放低	bassar la testa
A baixar a cubera	Di teu	低頭	è s'è recònto
A baixar a cubera contentido		下	abasso
A baixo	fidia		seto d' a luma
A baixo da água cessa	yau tum	搖動	mover a luma
A balar a outro			
A balarse s. darse preca	tum liou	動了	darse preca
A balado	si siam c'ia	相撞	è moço
A balado			com balle
A balado			far bructo col uingho
A balado			Uingho

Portuguese-Chinese Dictionary by Ruggieri et al. (1580s)
 The first European-Chinese dictionary

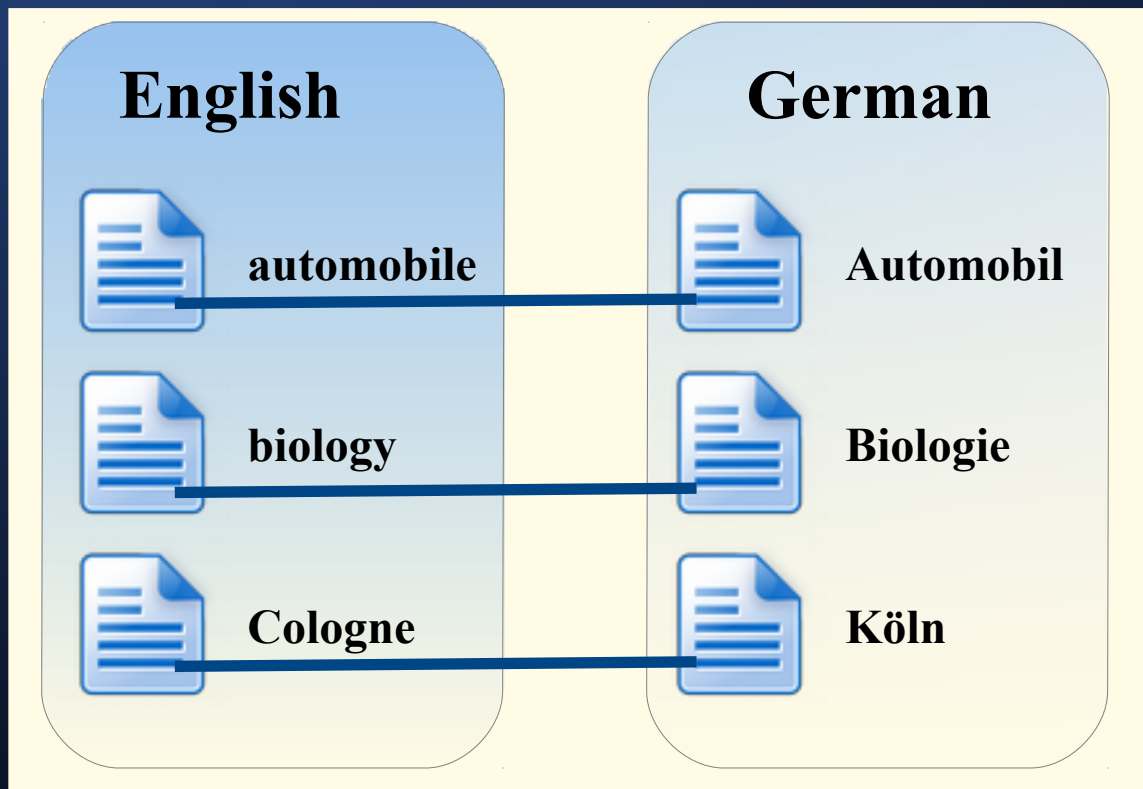
Contents

- **Simple Alignments**
- **Less Straightforward Connections**
- **Ecosystem of Resources**

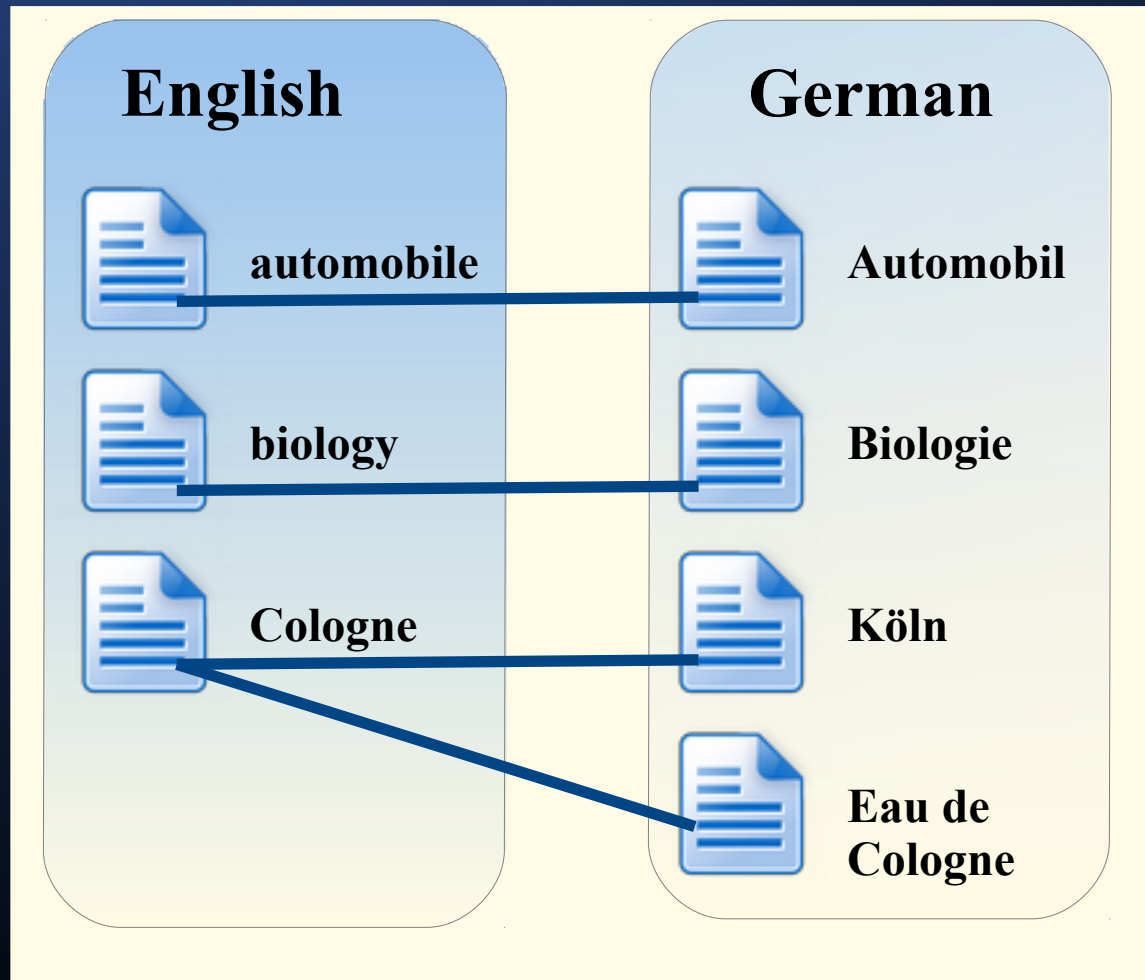
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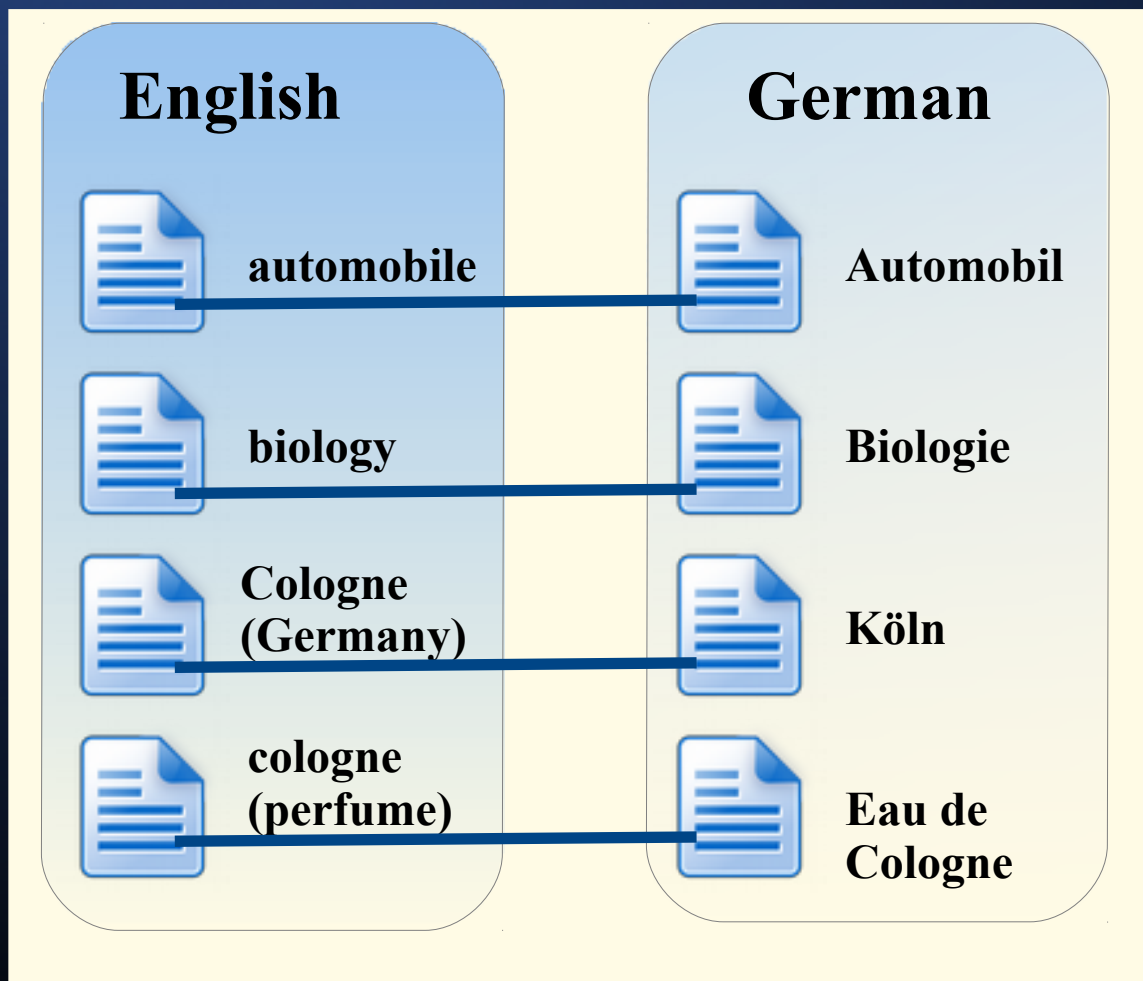
Perfect Alignments?



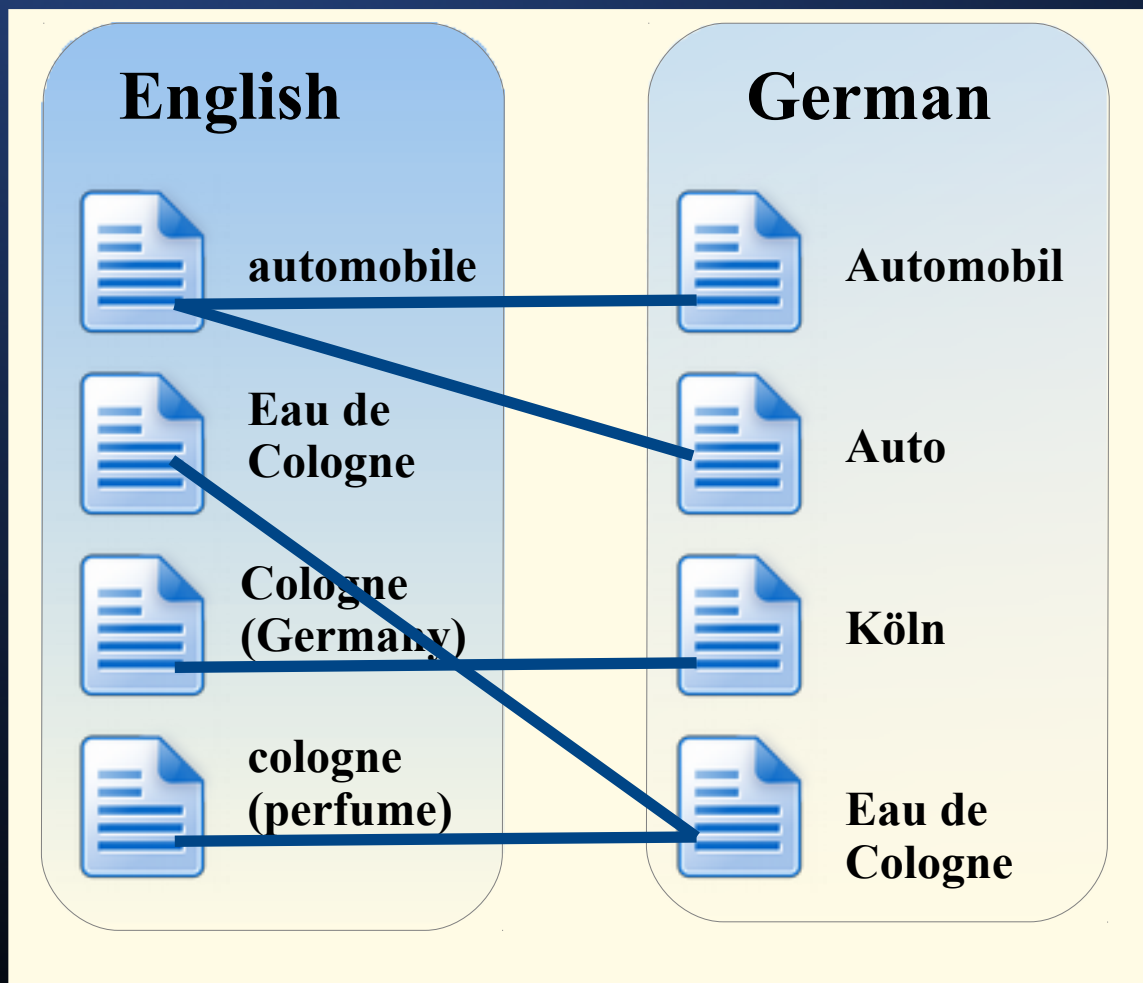
Perfect Alignments?



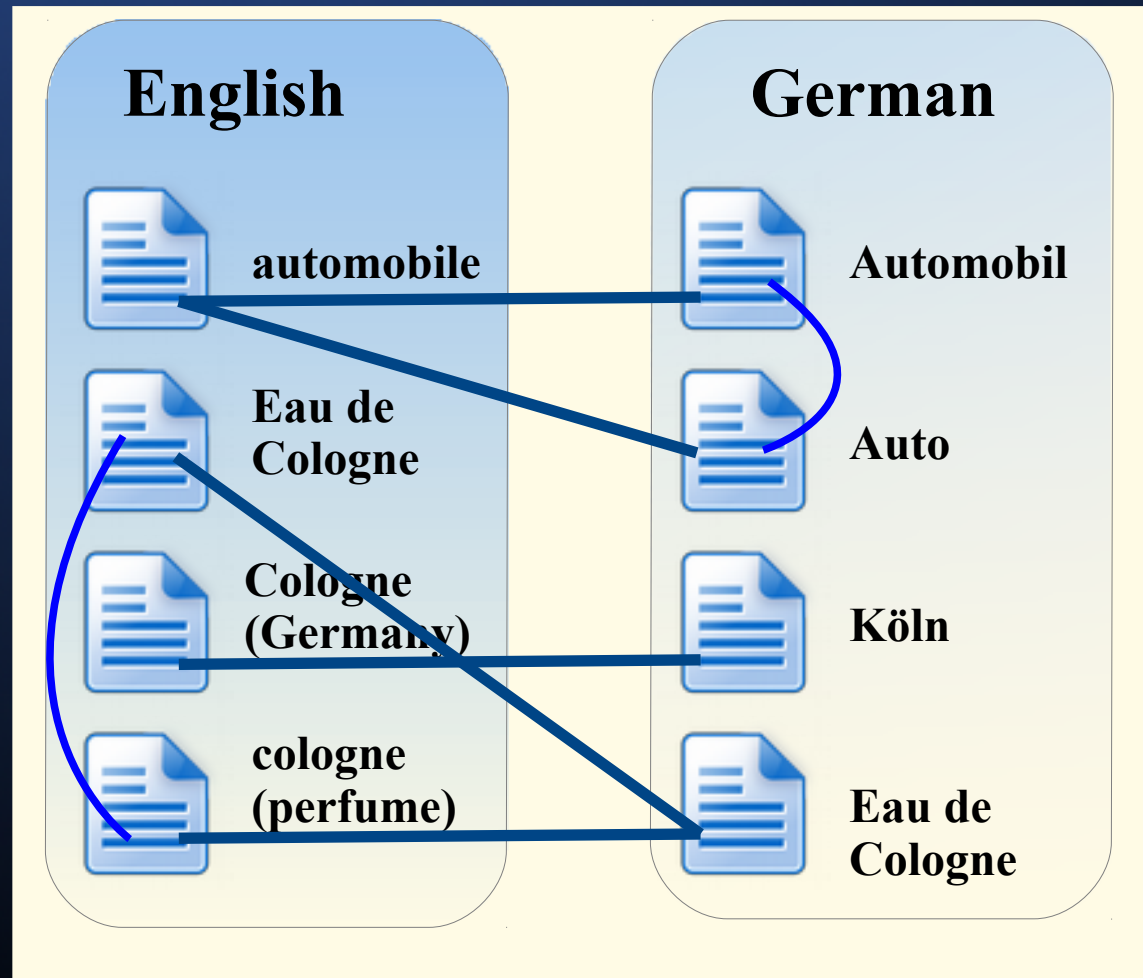
Sense Alignments



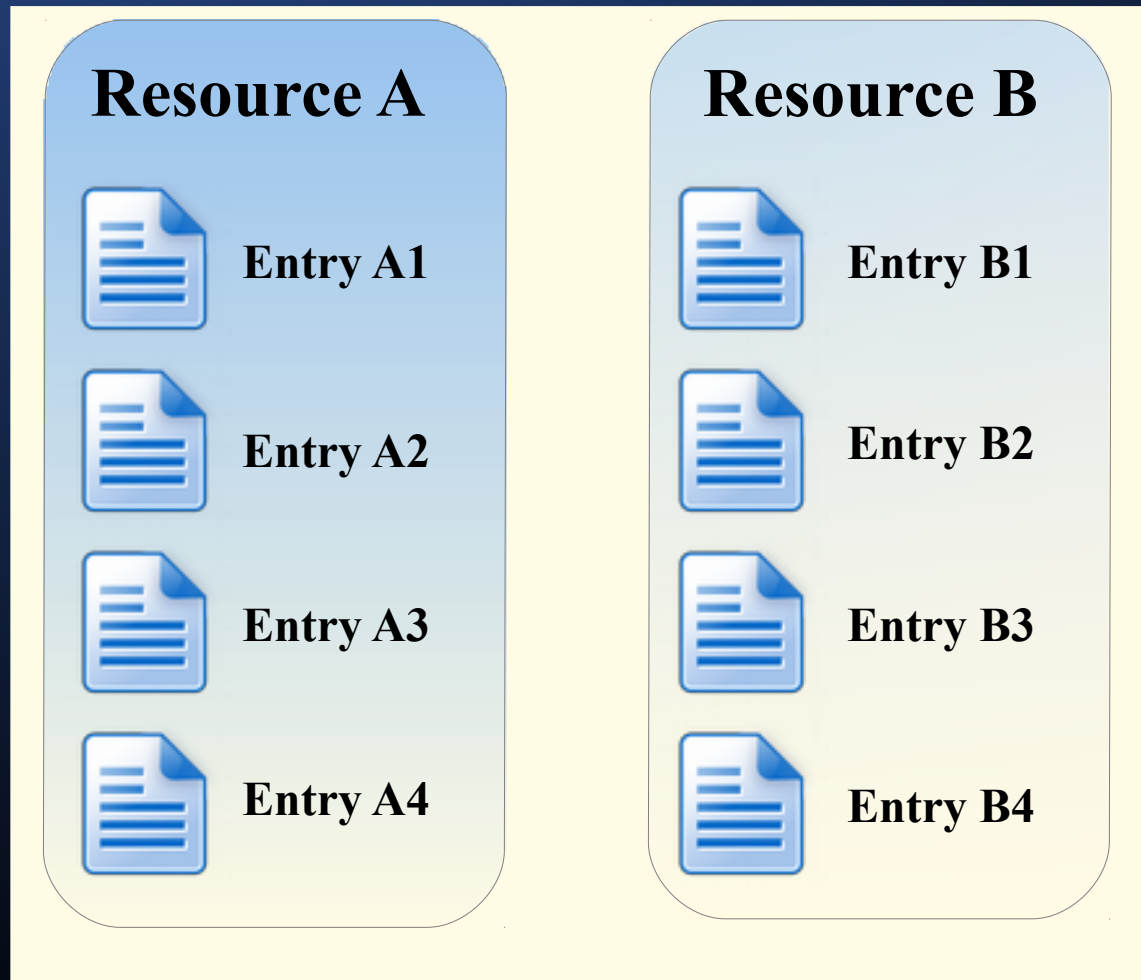
Sense Alignments



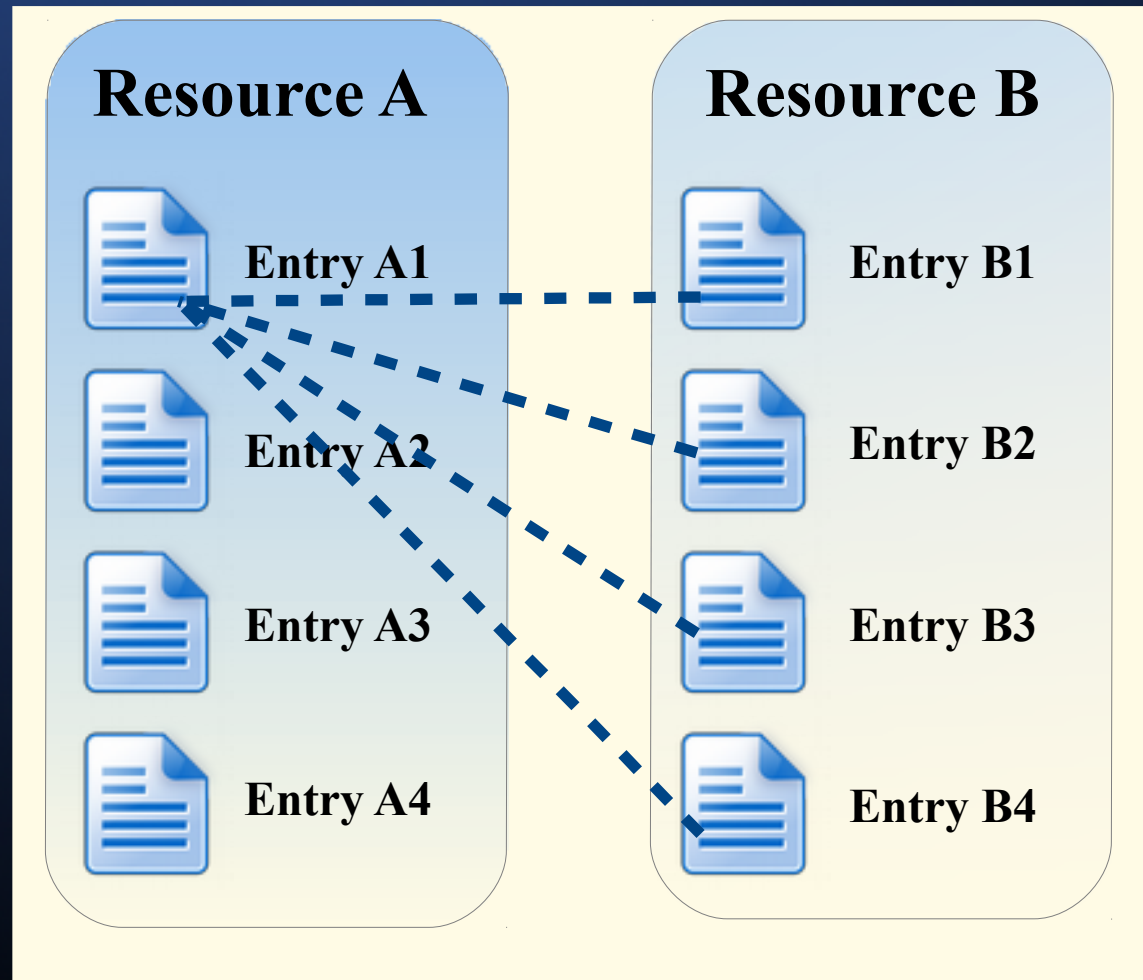
Sense Alignments: Implied Synonyms



Algorithms: Computing Similarity Scores

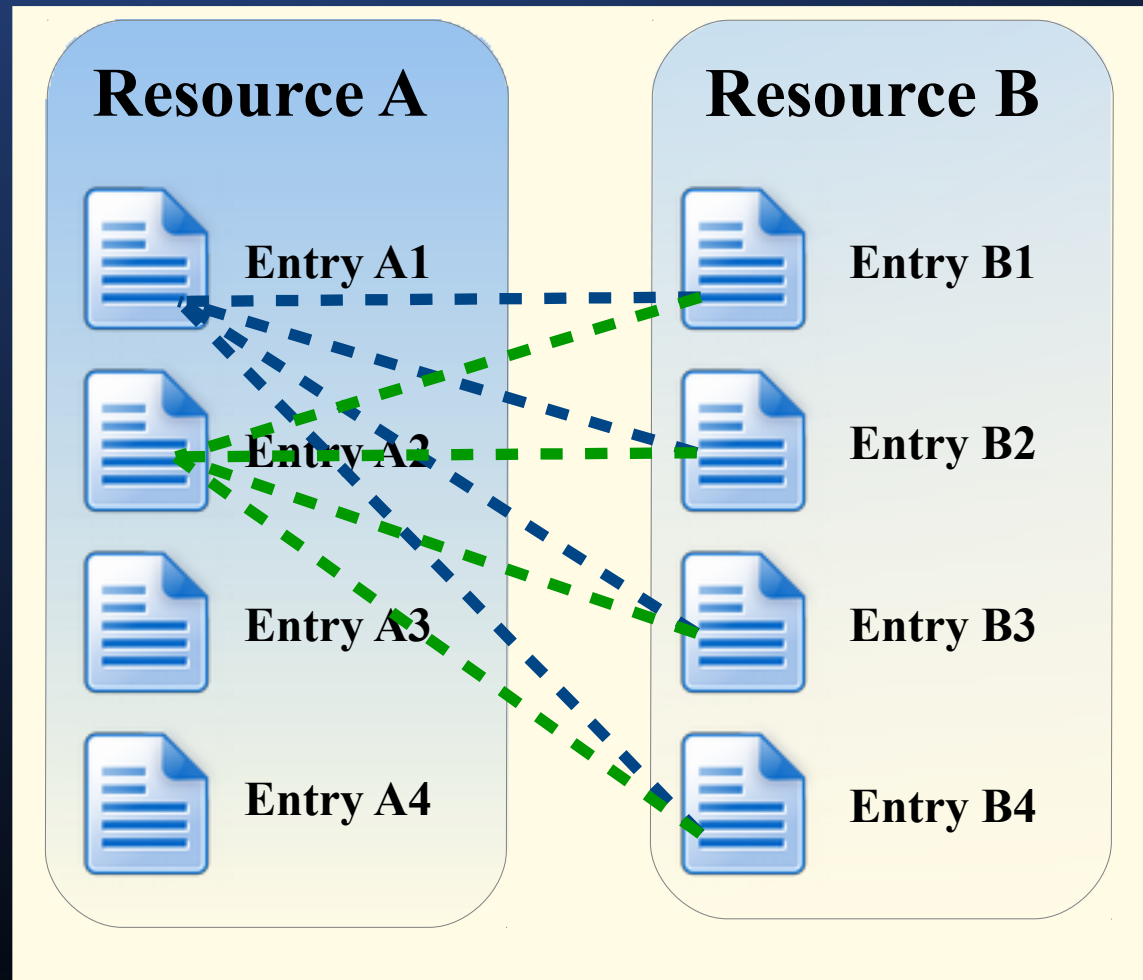


Algorithms: Computing Similarity Scores



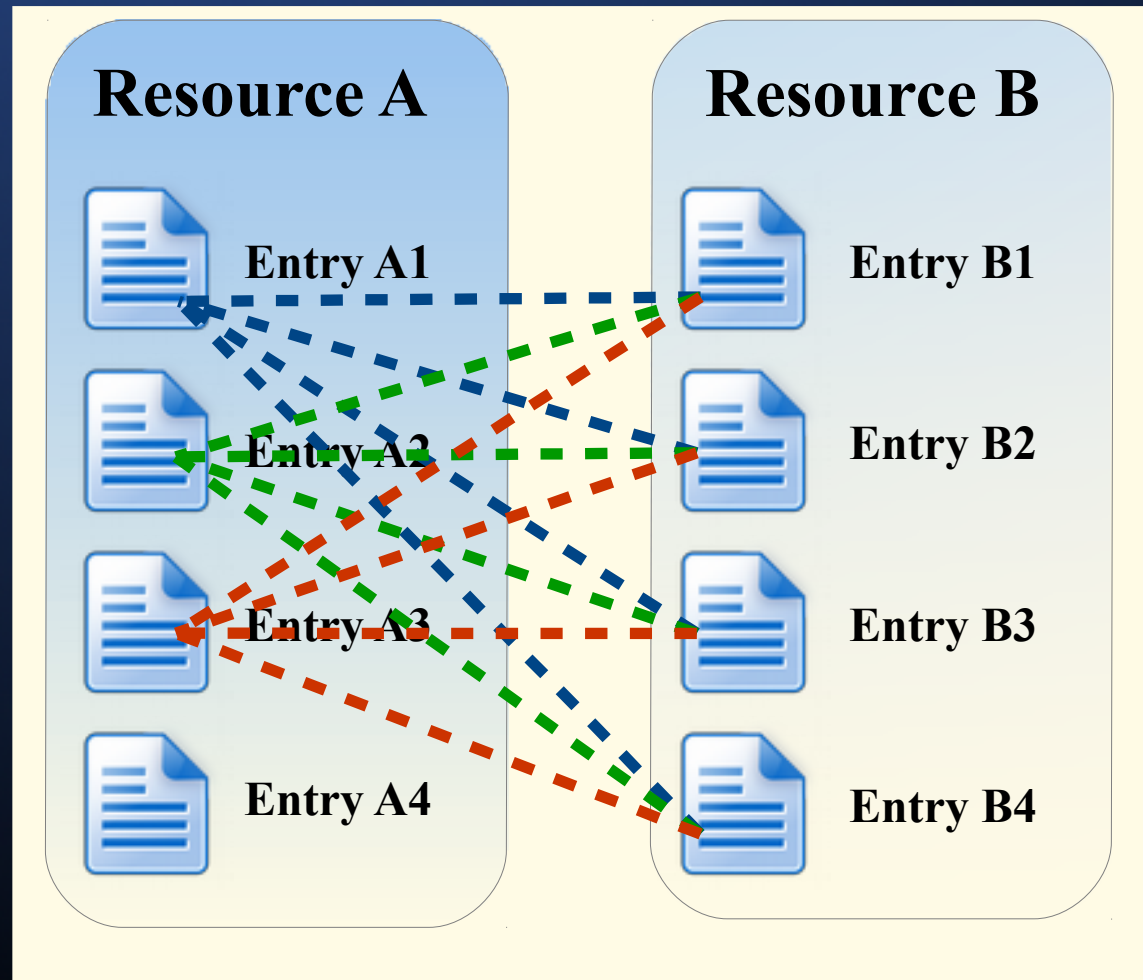
Metrics:
Word overlap
Gloss overlap
Etc.

Algorithms: Computing Similarity Scores



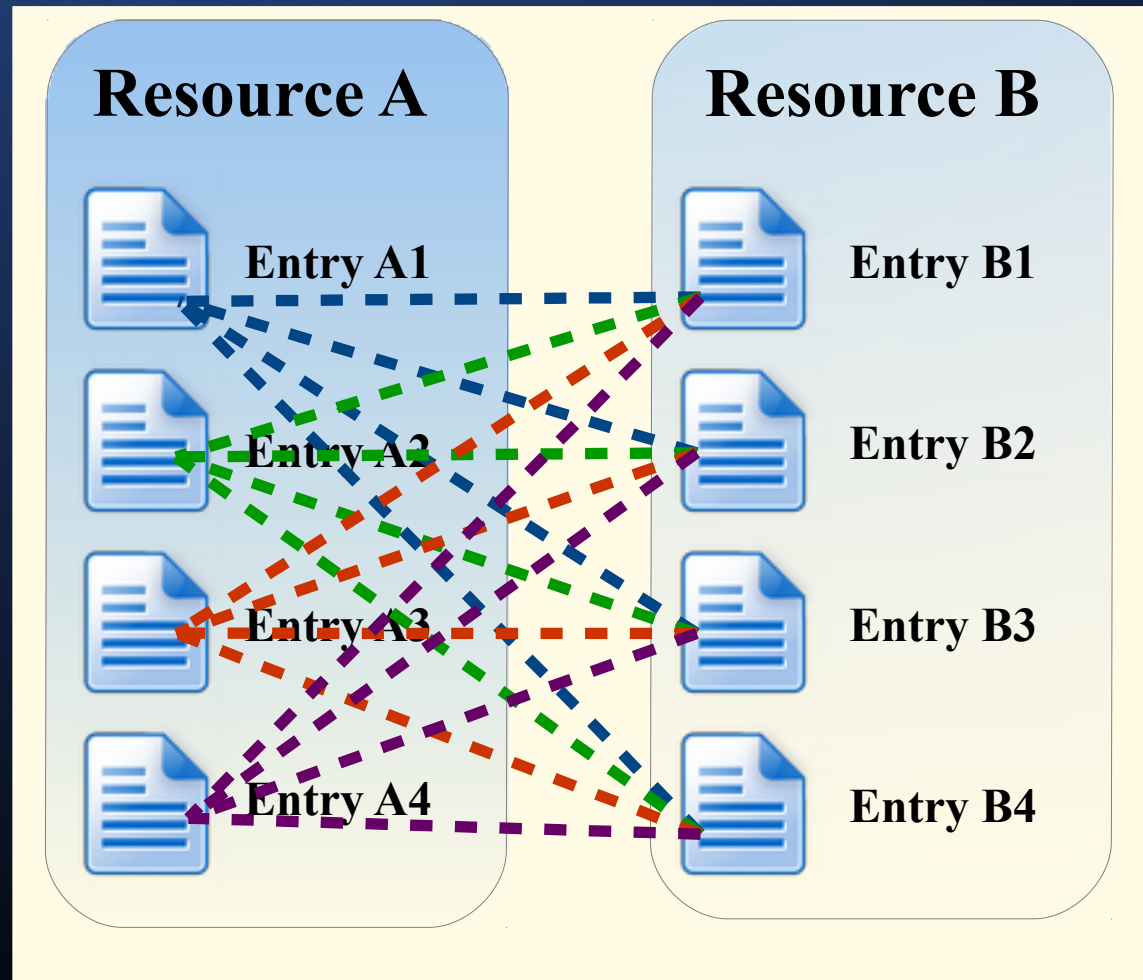
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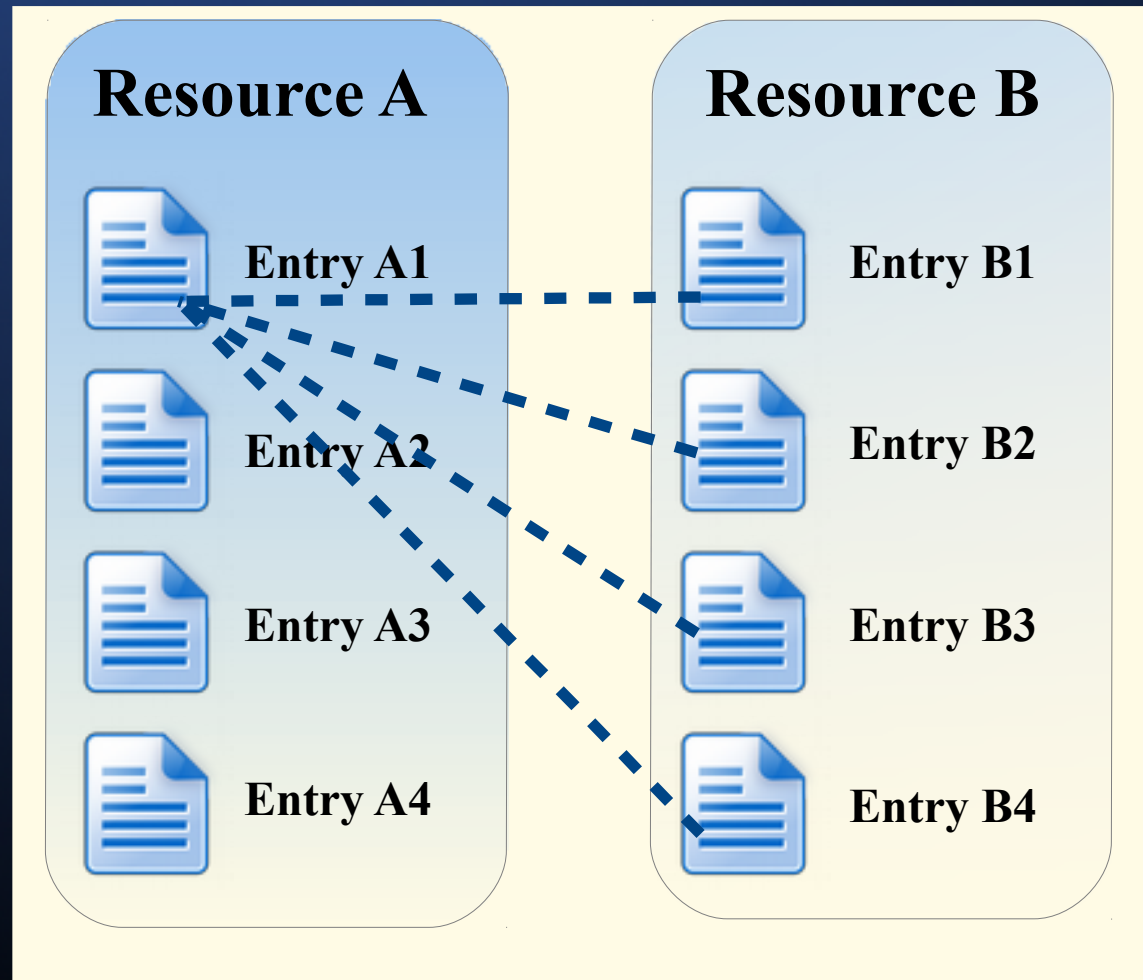
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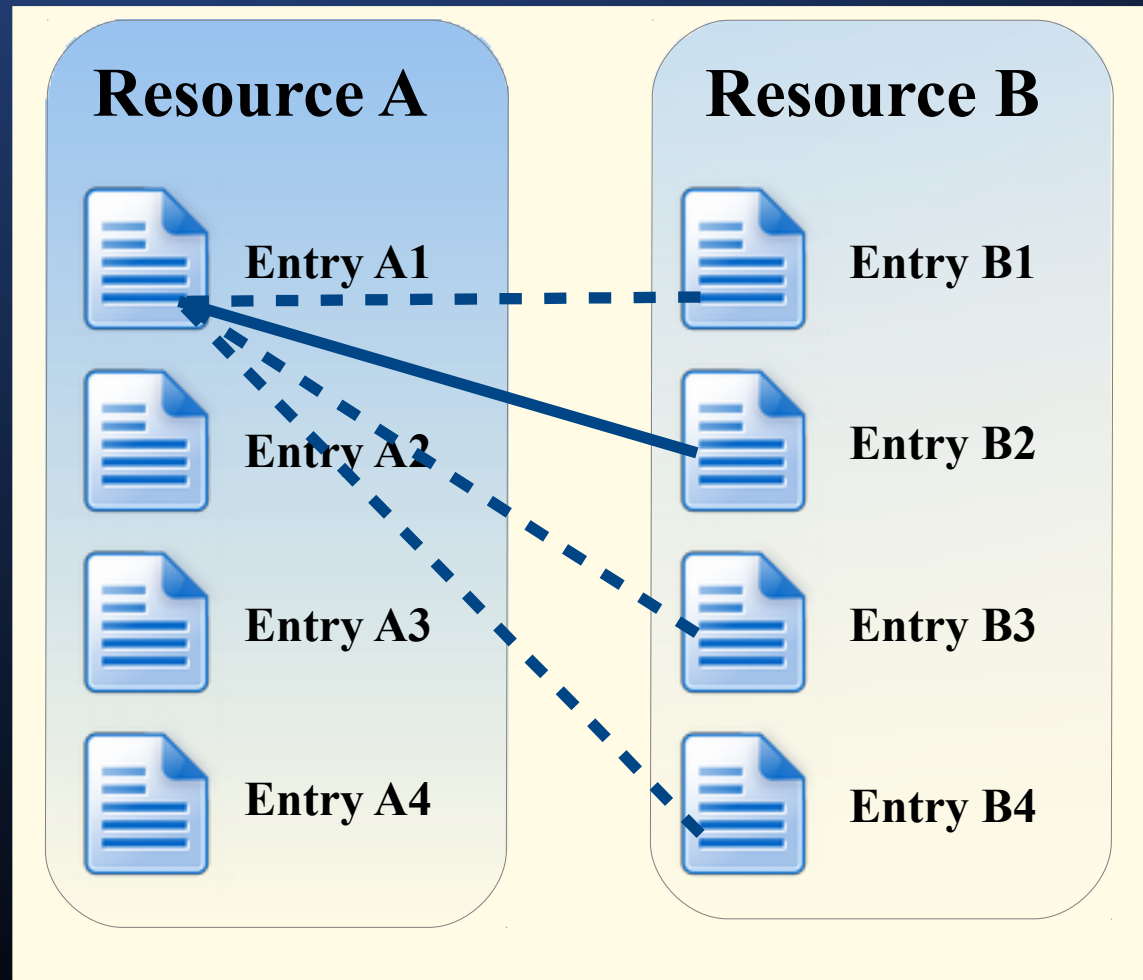


Metrics:
Word overlap
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Etc.

Algorithms: Choosing Best Alignments

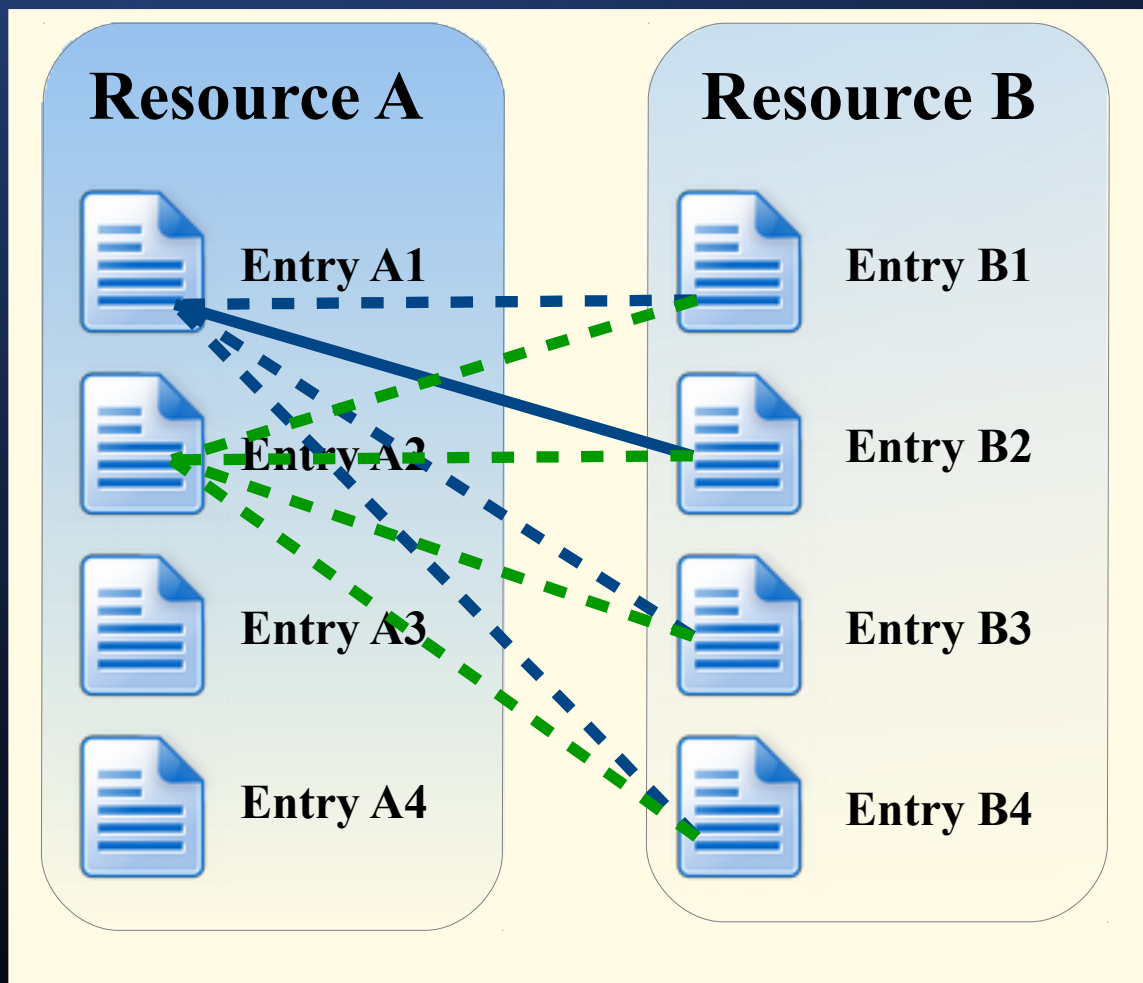


Algorithms: Choosing Best Alignments



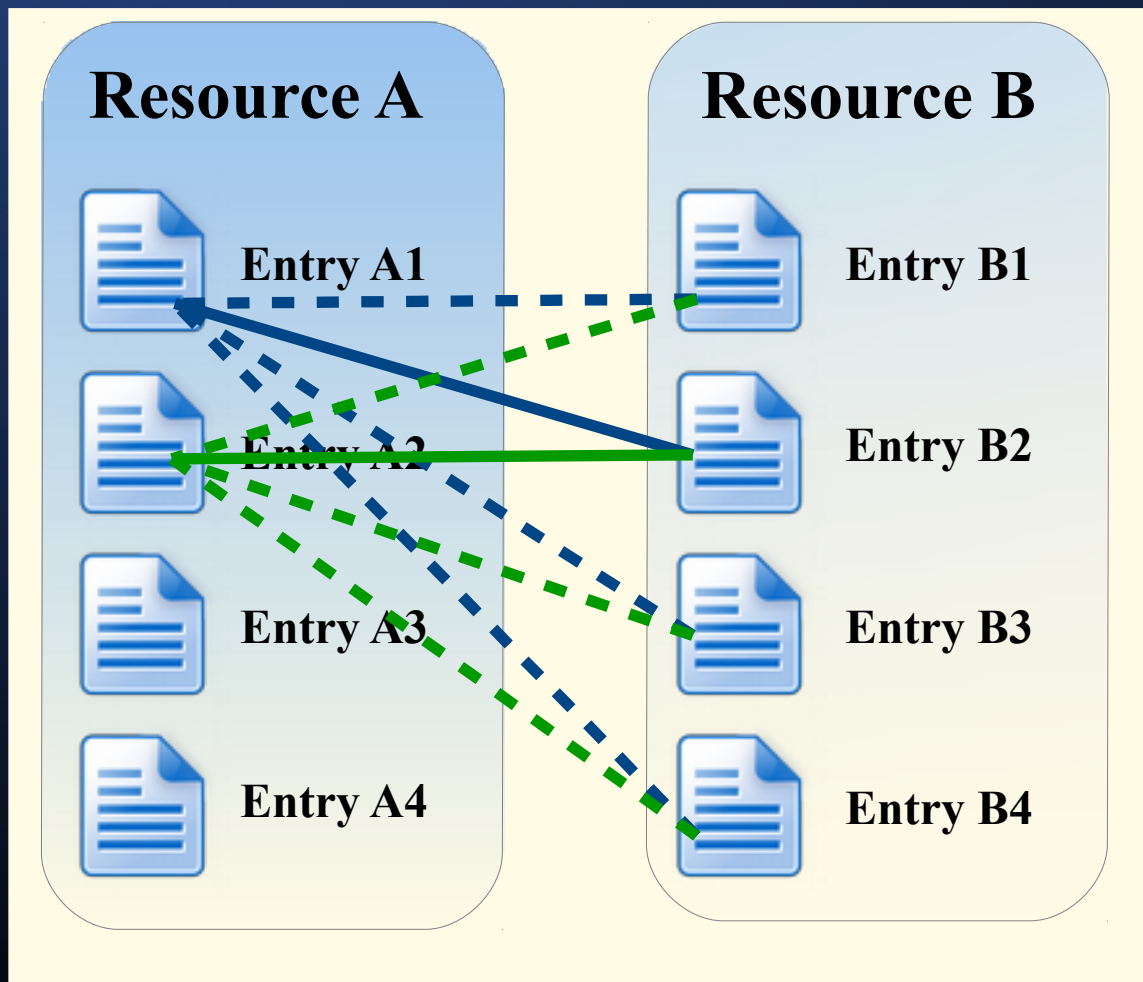
**Which one
has the
highest
Score?**

Algorithms: Choosing Best Alignments



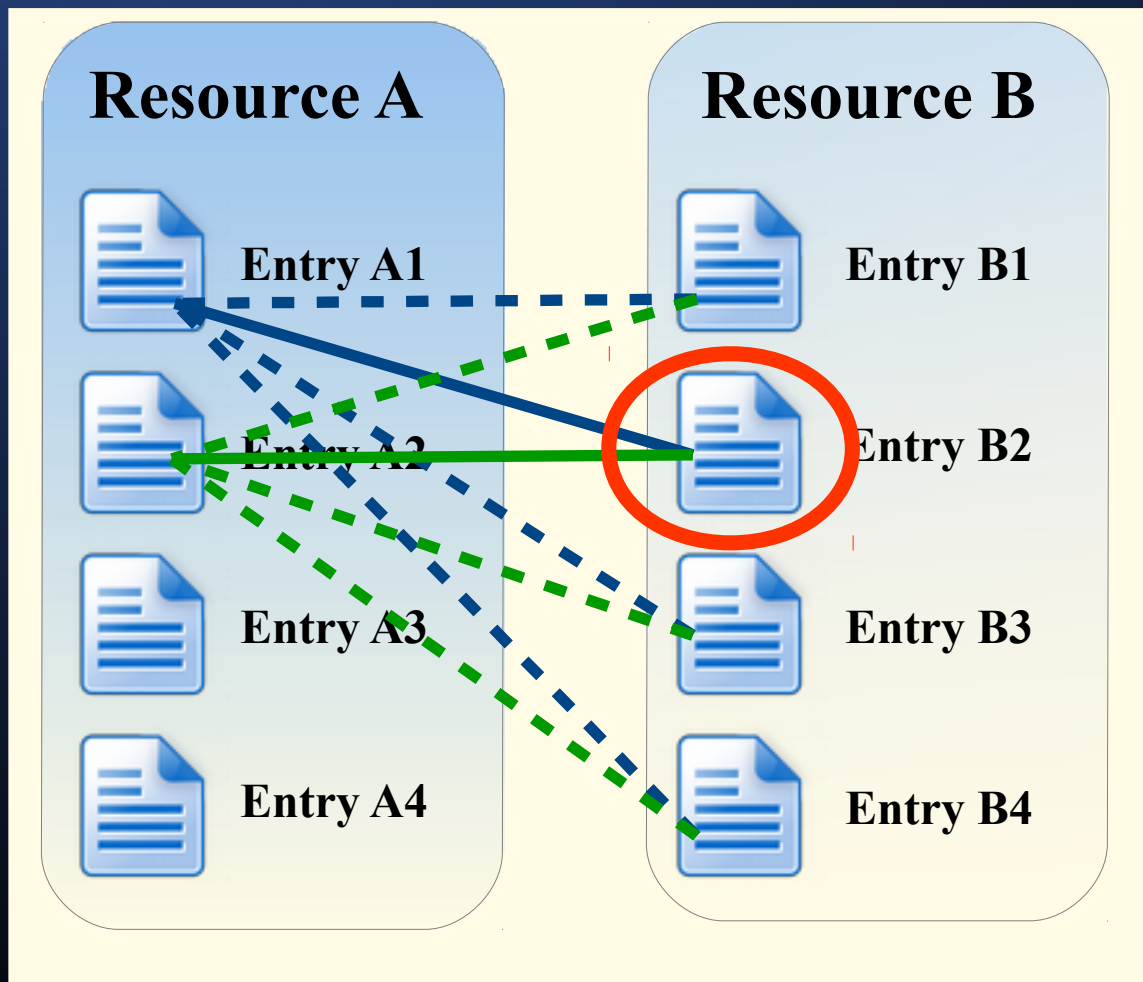
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Algorithms: Choosing Best Alignments



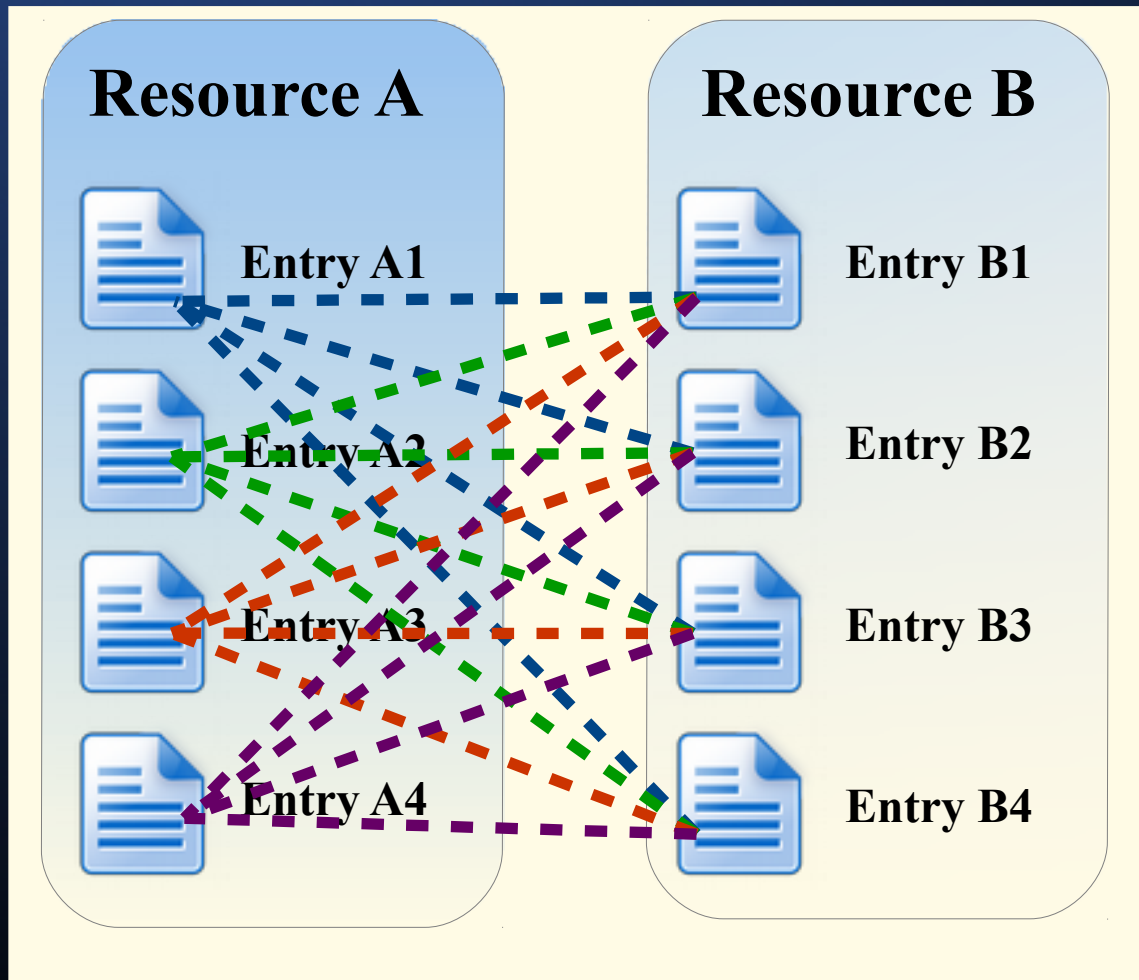
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Algorithms: Choosing Best Alignments



Which one
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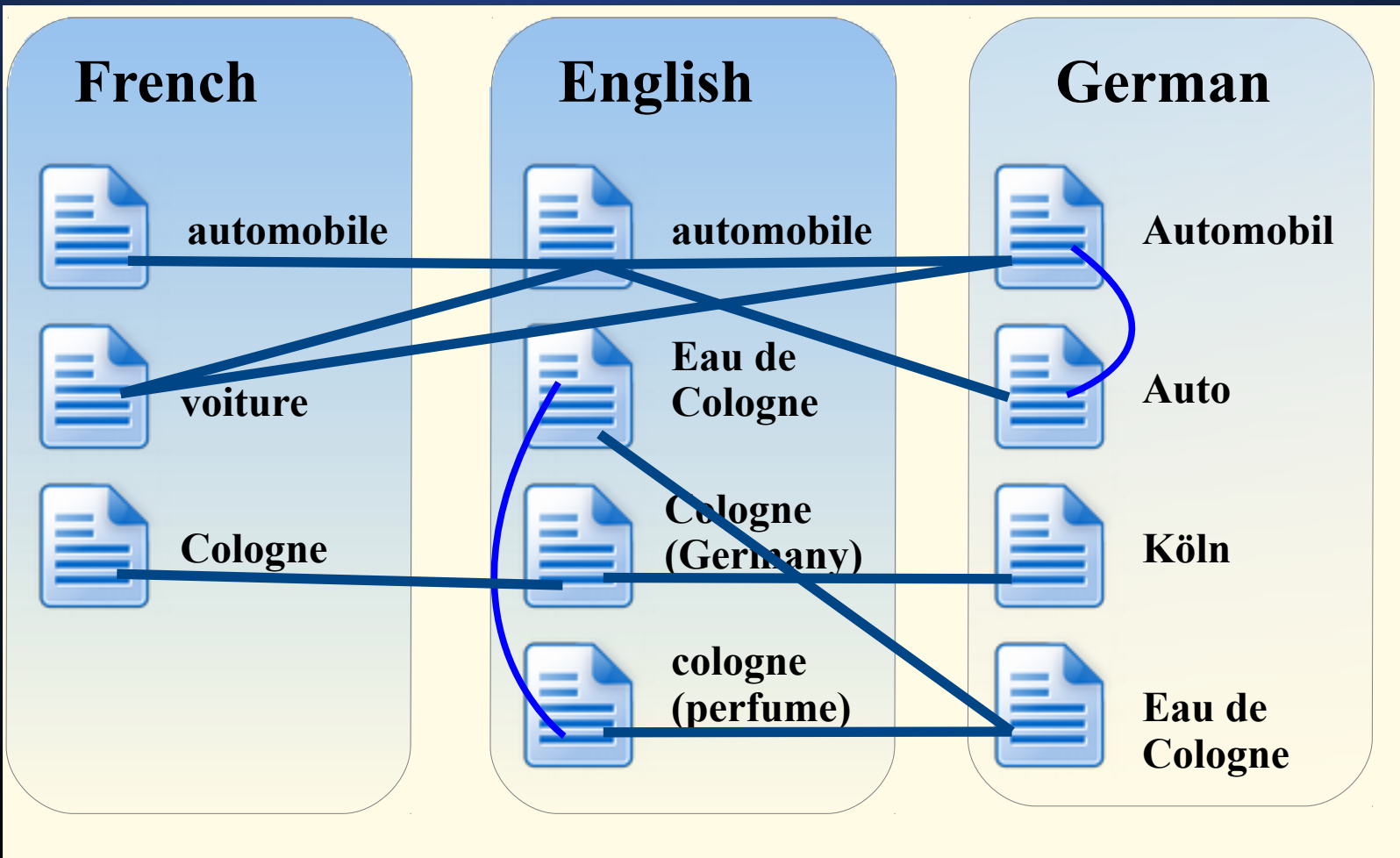
Algorithms: Choosing Best Alignments



**For 1-to-1
Alignment:
Maximal
Matching
as global
optimum**

e.g. Hungarian Algorithm (Kuhn-Munkres algorithm)

Algorithms: Choosing Best Alignments



**For arbitrary alignments:
global optimum
via algorithms
from de Melo
(2010, 2012)**

Separated Concepts (Multilingual Wikipedia)

English concept	German concept (translated)	Explanation
Coffee percolator	French Press	different brewing devices
Baqa-Jatt	Baqa al-Gharbiyye	Baqa-Jatt resulted from merger of Baqa al-Gharbiyye and Jatt
Leucothoe (plant)	Leucothea (Orchamos)	plant vs. figure of Greek mythology
Compulsory education	Right to education	duty vs. right
Franz Kafka's Diaries	Franz Kafka	diaries vs. person

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Separated Concepts (Multilingual Wikipedia)

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Baqa-Jatt	Baqa al-Gharbi	Derived from merger of Baqa and Jatt
l	(Ord	ek
C	uca	
e		
I		
Diana		

Model as two
separate entries



Coffee
percolator

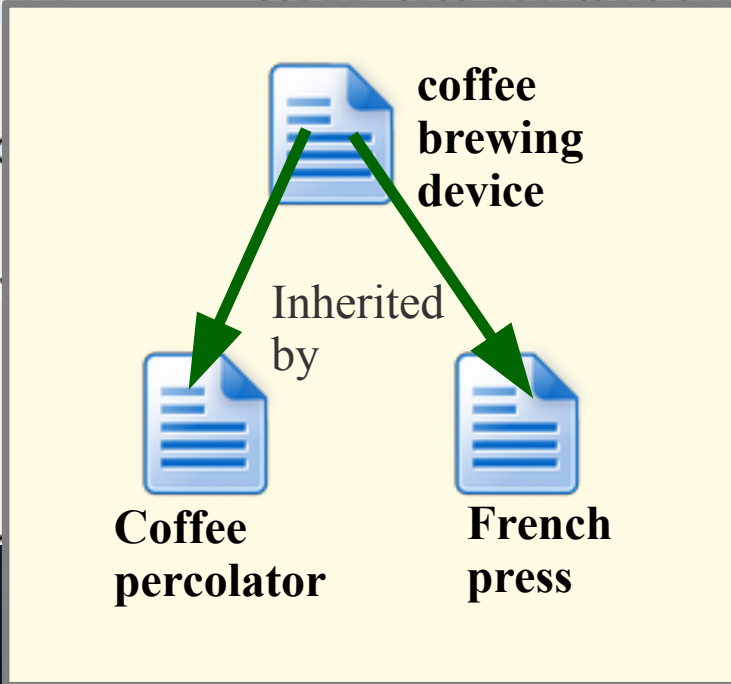


French
press

Separated Concepts (Multilingual Wikipedia)

English concept	German concept (translated)	Explanation
Coffee percolator	French Press	different brewing devices
Baqa-Jatt	Baqa al-Gharbi	Derived from merger of French Press and Jatt

Model as two separate entries
but make their relationship explicit



Granularity

WordNet Search - 3.1

[- WordNet home page](#) - [Glossary](#) - [Help](#)

Word to search for:

Display Options:

Key: "S." = Show Synset (semantic) relations, "W." = Show Word (lexical) relations

Display options for sense: (gloss) "an example sentence"

Noun

- [S. \(n\)](#) [carry](#) (the act of carrying something)

Verb

- [S. \(v\)](#) [transport](#), [carry](#) (move while supporting, either in a vehicle or in one's hands or on one's body) "You must carry your camping gear"; "carry the suitcases to the car"; "This train is carrying nuclear waste"; "These pipes carry waste water into the river"
- [S. \(v\)](#) [carry](#), [pack](#), [take](#) (have with oneself, have on one's person) "She always takes an umbrella"; "I always carry money"; "She packs a gun when she goes into the mountains"
- [S. \(v\)](#) [impart](#), [conduct](#), [transmit](#), [convey](#), [carry](#), [channel](#) (transmit or serve as the medium for transmission) "Sound carries well over water"; "The airwaves carry the sound"; "Many metals conduct heat"
- [S. \(v\)](#) [carry](#), [convey](#), [express](#) (serve as a means for expressing something) "The painting of Mary carries motherly love"; "His voice carried a lot of anger"
- [S. \(v\)](#) [carry](#) (bear or be able to bear the weight, pressure, or responsibility of) "His efforts carried the entire project"; "How many credits is this student carrying?"; "We carry a very large mortgage"
- [S. \(v\)](#) [hold](#), [carry](#), [bear](#) (support or hold in a certain manner) "She holds her head high"; "He carried himself upright"
- [S. \(v\)](#) [hold](#), [bear](#), [carry](#), [contain](#) (contain or hold, have within) "The jar carries wine"; "The canteen holds fresh water"; "This can contains water"
- [S. \(v\)](#) [carry](#) (extend to a certain degree) "carry too far"; "She carries her ideas to the extreme"
- [S. \(v\)](#) [carry](#), [extend](#) (continue or extend) "The civil war carried into the neighboring province"; "The disease extended into the remote mountain provinces"
- [S. \(v\)](#) [carry](#) (be necessarily associated with or result in or involve) "This crime carries a penalty of five years in prison"
- [S. \(v\)](#) [carry](#) (win in an election) "The senator carried his home state"
- [S. \(v\)](#) [carry](#) (include, as on a list) "How many people are carried on the payroll?"
- [S. \(v\)](#) [behave](#), [acquit](#), [bear](#), [deport](#), [conduct](#), [comport](#), [carry](#) (behave in a certain manner) "She carried herself well"; "he bore himself with dignity"; "They conducted themselves well during these difficult times"

- [S. \(v\)](#) [stock](#), [carry](#), [stockpile](#) (have on hand) "Do you carry kerosene heaters?"
- [W. \(v\)](#) [carry](#), [run](#) (include as the content, broadcast or publicize) "We ran the ad three times"; "This paper carries a restaurant review"; "All major networks carried the press conference"
- [S. \(v\)](#) [dribble](#), [carry](#) (propel) "Carry the ball"; "dribble the ball"
- [W. \(v\)](#) [carry](#) (pass on a communication) "The news was carried to every village in the province"
- [S. \(v\)](#) [carry](#) (have as an inherent or characteristic feature or have as a consequence) "This new washer carries a two year guarantee"; "The loan carries a high interest rate"; "This undertaking carries many dangers"; "She carries her mother's genes"; "These bonds carry warrants"; "The restaurant carries an unusual name"
- [S. \(v\)](#) [carry](#) (be conveyed over a certain distance) "Her voice carries very well in this big opera house"
- [S. \(v\)](#) [carry](#) (keep up with financial support) "The Federal Government carried the province for many years"
- [S. \(v\)](#) [carry](#) (have or possess something abstract) "I carry her image in my mind's eye"; "I will carry the secret to my grave"; "I carry these thoughts in the back of my head"; "I carry a lot of life insurance"
- [W. \(v\)](#) [carry](#) (be equipped with (a mast or sail)) "This boat can only carry a small sail"
- [W. \(v\)](#) [carry](#), [persuade](#), [sway](#) (win approval or support for) "Carry all before one"; "His speech did not sway the voters"
- [W. \(v\)](#) [carry](#) (compensate for a weaker partner or member by one's own performance) "I resent having to carry her all the time"
- [W. \(v\)](#) [carry](#) (take further or advance) "carry a cause"
- [W. \(v\)](#) [carry](#) (have on the surface or on the skin) "carry scars"
- [W. \(v\)](#) [carry](#) (capture after a fight) "The troops carried the town after a brief fight"
- [W. \(v\)](#) [post](#), [carry](#) (transfer (entries) from one account book to another)
- [W. \(v\)](#) [carry](#) (transfer (a number, cipher, or remainder) to the next column or unit's place before or after, in addition or multiplication) "put down 5 and carry 2"
- [W. \(v\)](#) [carry](#) (pursue a line of scent or be a bearer) "the dog was taught to fetch and carry"
- [W. \(v\)](#) [carry](#) (bear (a crop)) "this land does not carry olives"
- [W. \(v\)](#) [carry](#) (propel or give impetus to) "The sudden gust of air propelled the ball to the other side of the fence"
- [W. \(v\)](#) [carry](#), [hold](#) (drink alcohol without showing ill effects) "He can hold his liquor"; "he had drunk more than he could carry"
- [W. \(v\)](#) [carry](#) (be able to feed) "This land will carry ten cows to the acre"
- [W. \(v\)](#) [carry](#) (have a certain range) "This rifle carries for 3,000 feet"
- [W. \(v\)](#) [carry](#) (cover a certain distance or advance beyond) "The drive carried to the green"
- [W. \(v\)](#) [carry](#) (secure the passage or adoption (of bills and motions)) "The motion carried easily"
- [W. \(v\)](#) [carry](#) (be successful in) "She lost the game but carried the match"
- [W. \(v\)](#) [carry](#) (sing or play against other voices or parts) "He cannot carry a tune"
- [S. \(v\)](#) [have a bun in the oven](#), [bear](#), [carry](#), [gestate](#), [expect](#) (be pregnant with) "She is bearing his child"; "They are expecting another child in January"; "I am carrying his child"

Granularity: OntoNotes, PropBank, VerbNet

Palmer, Dang & Fellbaum, NLE 2007

PropBank
Frameset1*

cost-54.2, ON2

fit-54.3, ON3

WN1 WN2

WN5 WN20 WN22 WN24

WN24 WN31 WN33 WN34

WN1 WN3 WN8

WN11 WN 23

WN9 WN16 WN17 WN19

WN27 WN37 WN38

WN28 WN32 WN35 WN36

ON4 – win election

carry-11.4, CARRY,-FN, ON1

* ON5-ON11
carry oneself,
carried away/out/off
carry to term

Source: Martha Palmer (2012)

Granularity: OntoNotes, PropBank, VerbNet

Palmer, Dang & Fellbaum, NLE 2007

PropBank
Frameset1*

cost-54.2, ON2

carry

WN1 WN2

WN5 WN

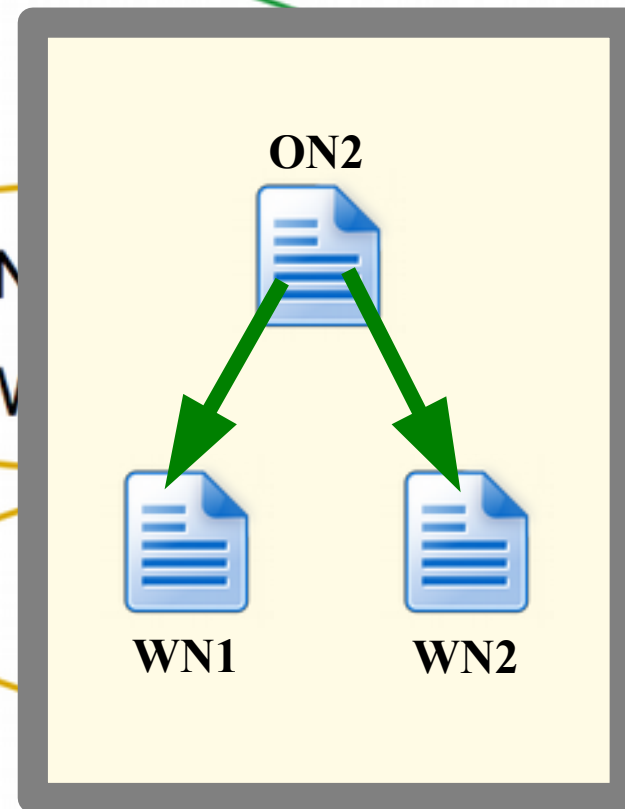
WN24 W

WN1 WN3 WN8

WN9 WN16 WN17 WN19

WN28 WN32 WN35 WN36

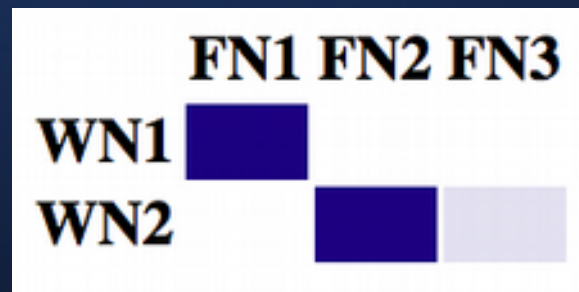
carry-11.4, CARRY,-FN, ON1



* ON5-ON11
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Analysis of Alignments

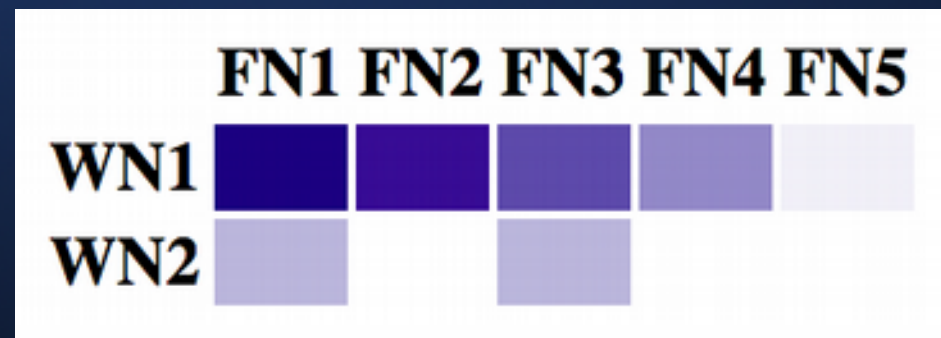
- Study based on analysis of multiply annotated sentences
- Conclusion: 1-to-1 alignments are not always possible



curious (adjective)

Non-Straightforward Alignments

- Study based on analysis of multiply annotated sentences
- Conclusion: 1-to-1 alignments are not always possible



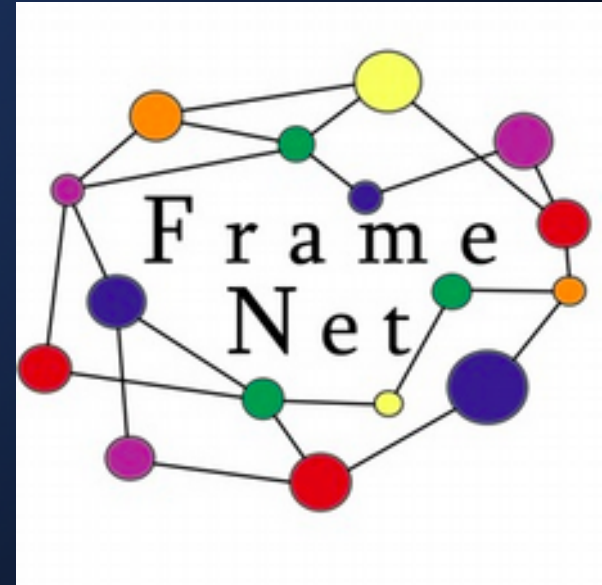
trace (noun)

Gerard de Melo, Collin F. Baker, Nancy Ide, Rebecca Passonneau, Christiane Fellbaum (2012)
Empirical Comparisons of MASC Word Sense Annotations. Proceedings of LREC 2012.
Data and Further Information: <http://icsi.berkeley.edu/~demelo/masc/>

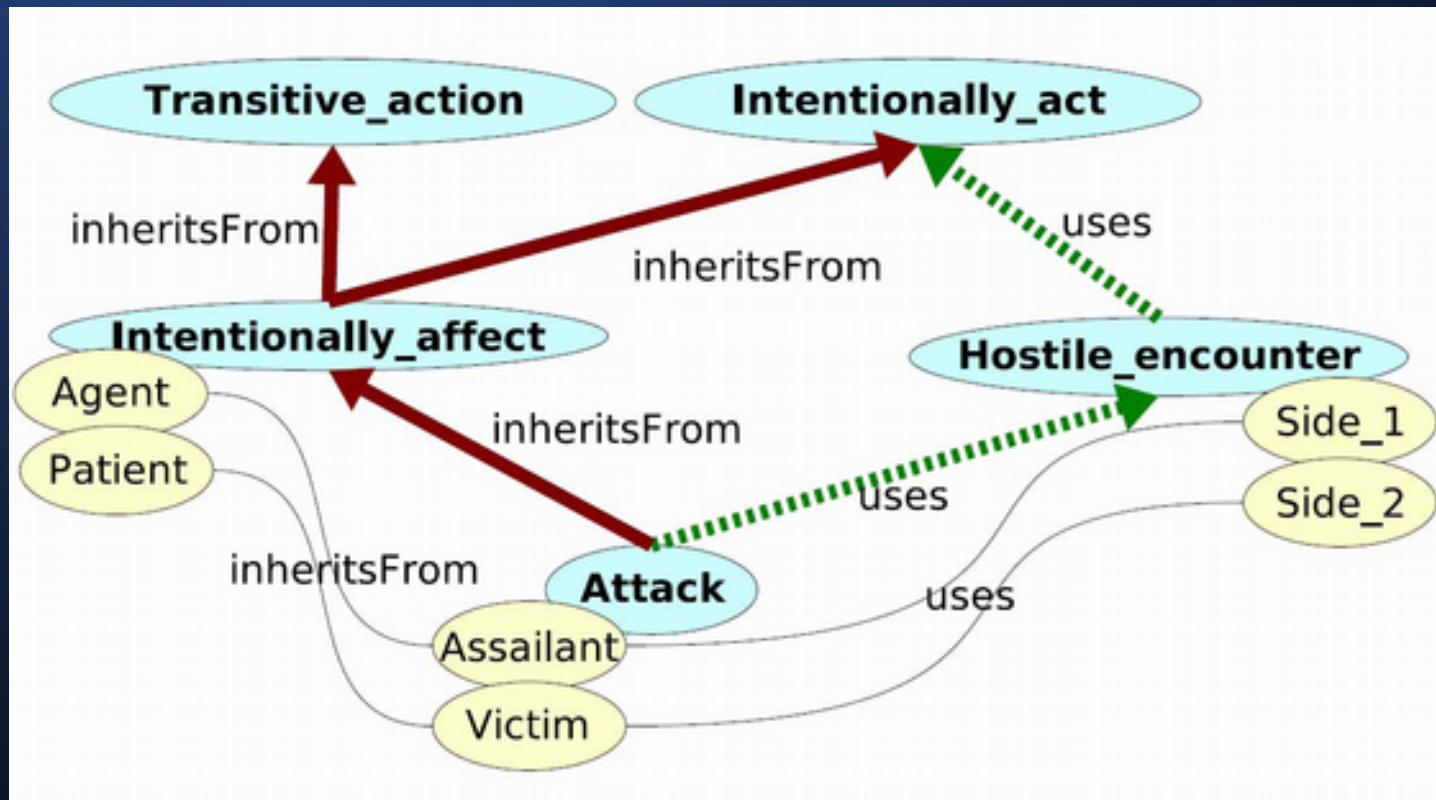
Non-Straightforward Alignments

Solution:

- Don't necessarily connect via 1-to-1 alignments.
- Connect using full range of semantic relations



Non-Straightforward Alignments



Jan Scheffczyk, Collin F. Baker, Srin Narayanan. Ontology-based reasoning about lexical resources. Proc. OntoLex 2006

Frame Relations: inheritsFrom, uses (involvement without requiring roles to be instantiated), etc.

Multilingual Alignments

- **Some non-English framenet projects re-use Berkeley FrameNet frames**
- **Non-English LUs can be added to existing English FrameNet frames**

Oliver Čulo, Gerard de Melo (2012). Source-Path-Goal: Investigating the Cross-Linguistic Potential of Frame-Semantic Text Analysis. *it - Information Technology* 54(3).

Multilingual Alignments

Commitment

[Lexical Unit Index](#)

Definition:

A **Speaker** makes a commitment to an **Addressee** to carry out some future action. This may be an action desirable (as with prometer 'promise') or not desirable (as with amenazar 'threaten') to the **Addressee**. Some of the words in this frame allow an **Addressee** to be expressed.

Me **PROMETISTE** que me harías un regalo. **ECNI**

Los dirigentes sindicales les **AMENAZARON** con endurecer las medidas de presión. **DNI**

FES:

Core:

Addressee [Add]

Semantic Type: Sentient

The **Speaker**'s commitment can be made to an **Addressee**. With those words which allow this frame element to be expressed, **Addressee** usually occurs as an Indirect Object of verbal target or as a PP Complement of nominal targets.

Les **PROMETIO** que les devolvería el dinero que le habían prestado.

Message [Mes]

Semantic Type: Message

An index expression of the commitment made by the Speaker expresses the frame element **Message**. Message is expressed as a finite or non-finite clausal Complement or an NP Object.

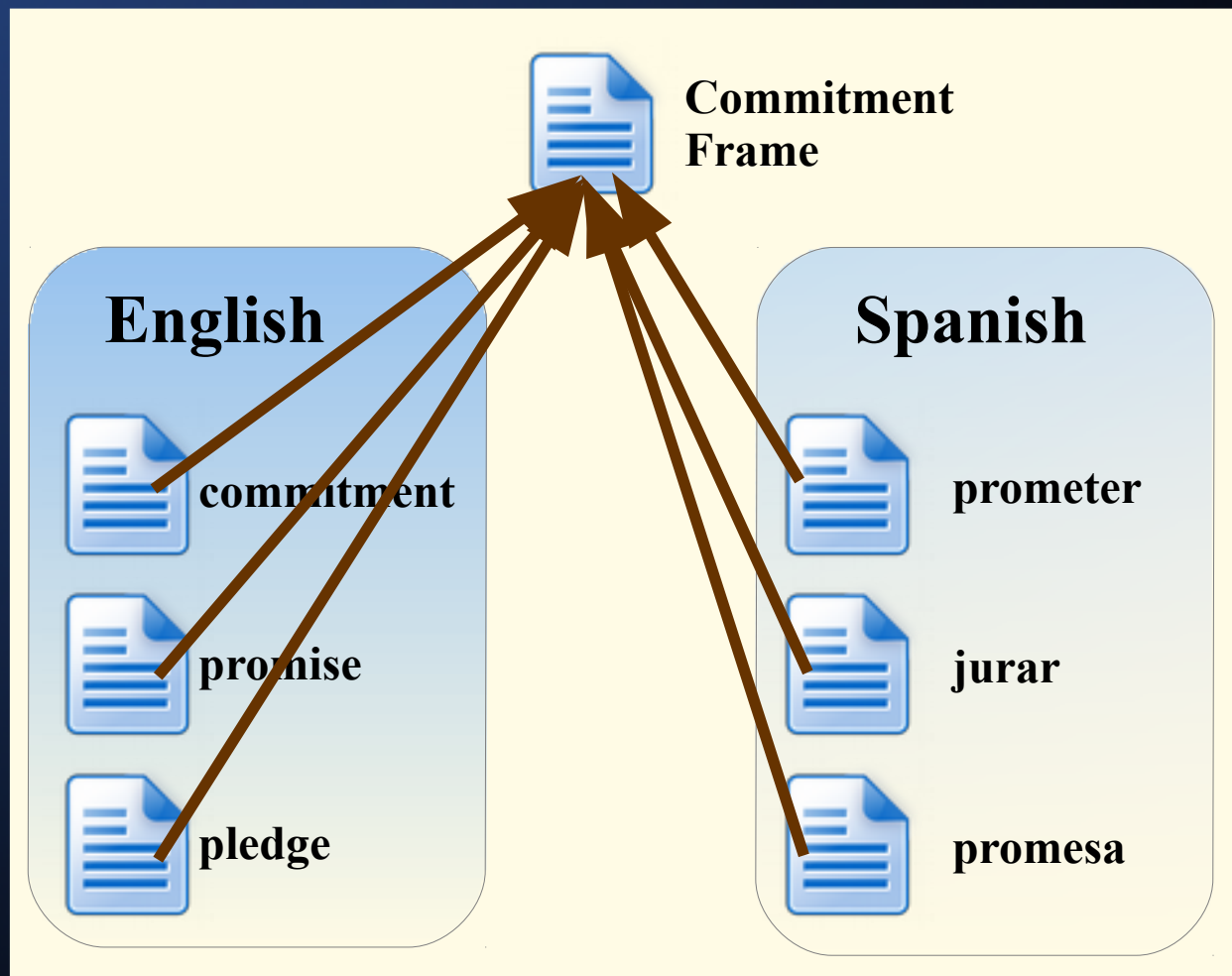
Me **PROMETIERON** que nos llamarían al llegar.

El ejército israelí **AMENAZO** con disparar contra cualquier vehículo sospechoso.

El nuevo presidente *mantuvo* su **PROMESA** de un referéndum sobre las instituciones europeas.

Multilingual Alignments

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Oliver Čulo, Gerard de Melo (2012). Source-Path-Goal: Investigating the Cross-Linguistic Potential of Frame-Semantic Text Analysis. *it - Information Technology* 54(3).

Multilingual Alignments

Motion Frame

Intention
FE

Purpose
FE

Juan fue a San Francisco a visitar a un amigo para pedirle dinero.
Juan went to San Francisco to visit a friend and ask him for money.

- **In some cases:
minor modifications of frames**

Multilingual Alignments

Motion Frame

Intention
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Purpose
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Juan fue a San Francisco a visitar a un amigo para pedirle dinero.
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- In some cases:
minor modifications of frames

(these frames should perhaps
be renamed and connected
to the original version)



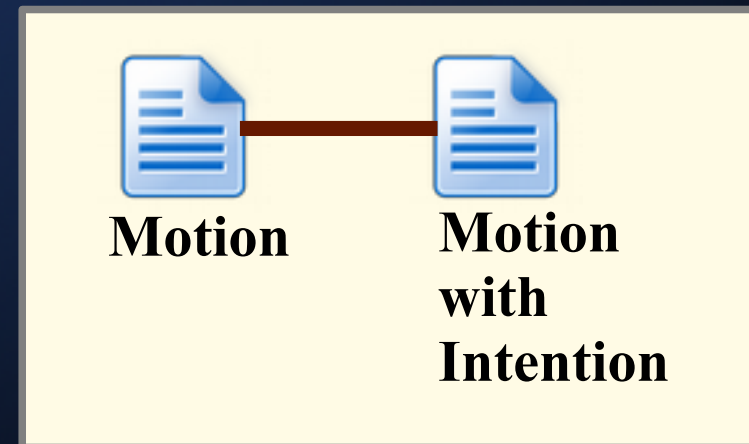
Motion



**Motion
with
Intention**

Multilingual Alignments

- Generally can create new frames to cover language-specific phenomena
- Connect these to existing hierarchy via a range of different relations.

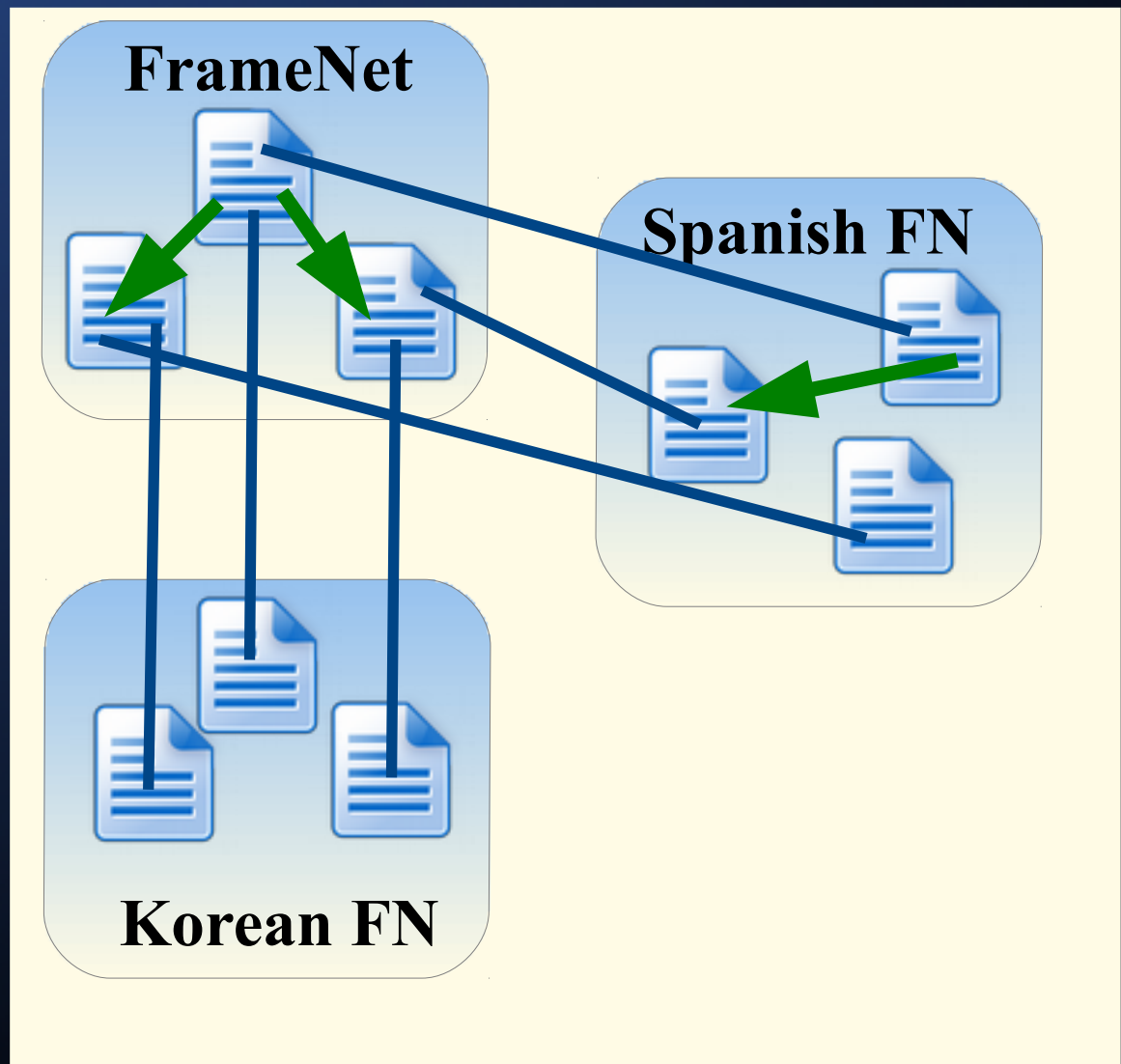


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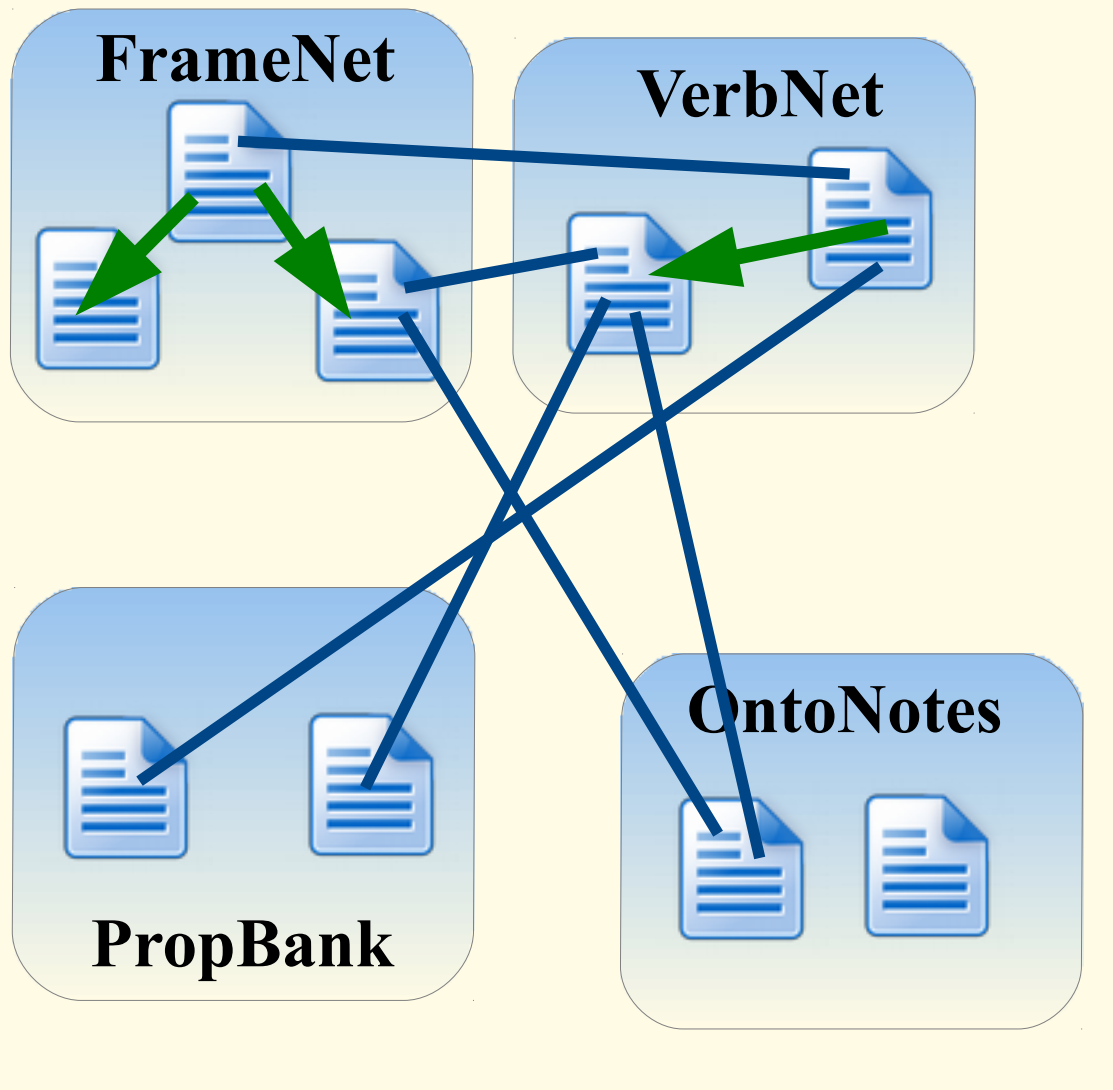
- **Simple Alignments**
- **Less Straightforward Connections**
- **Ecosystem of Resources**

Multilingual FNs

Some multilingual
framenets
are linked to
English FrameNet



SemLink

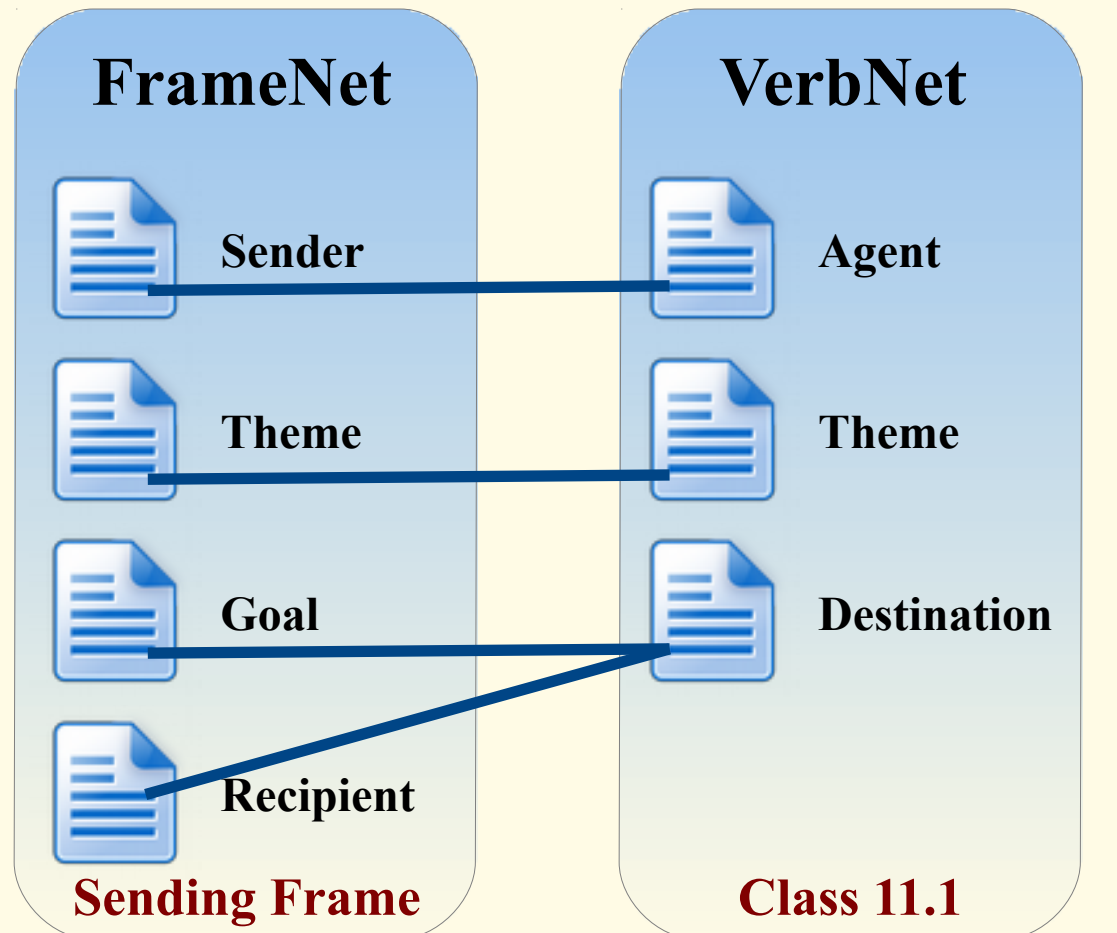


Project led by Martha Palmer

<https://verbs.colorado.edu/semlink/>

- VerbNet ↔ FrameNet
- PropBank ↔ VerbNet
- VerbNet ↔ OntoNotes

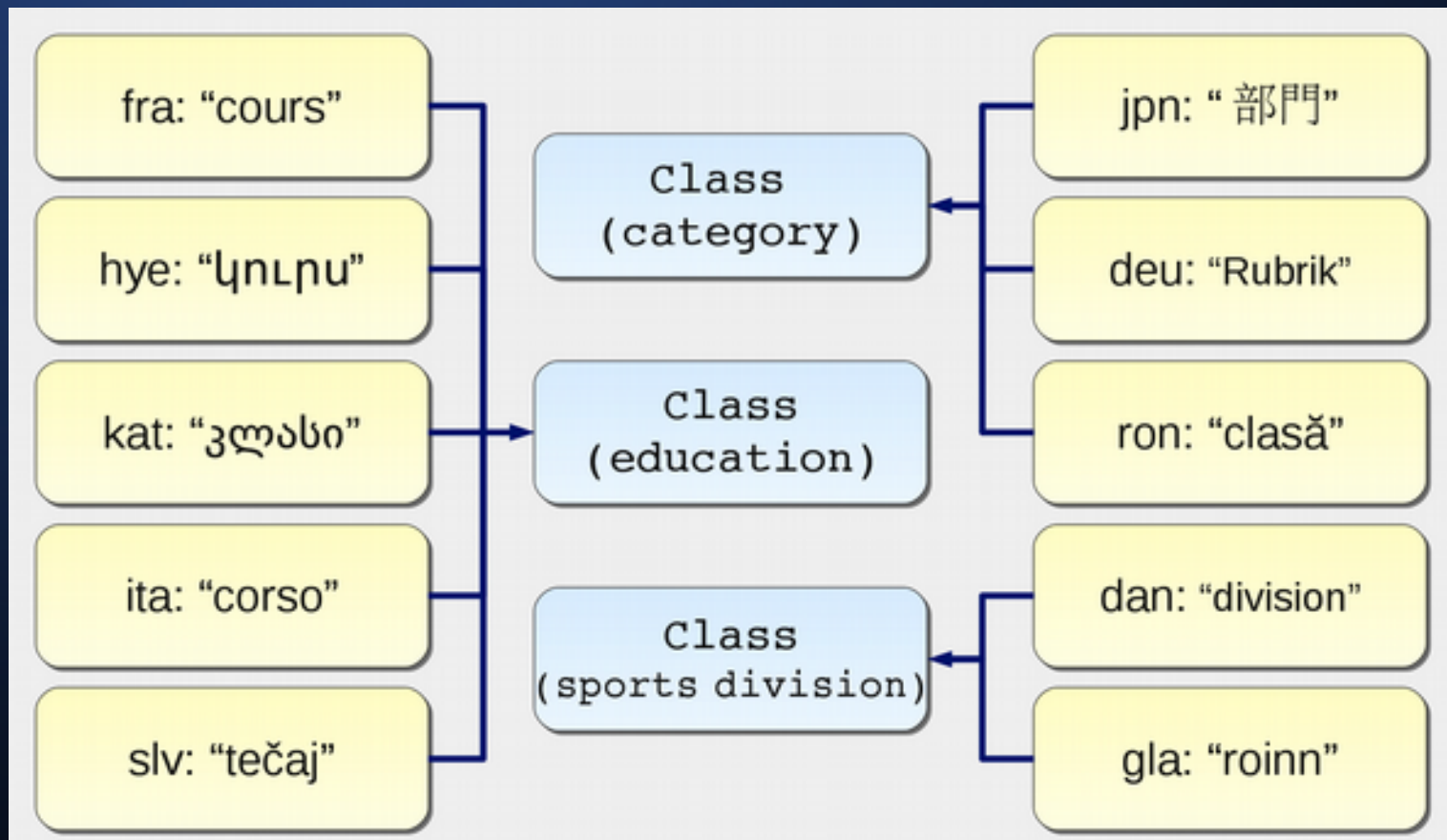
SemLink: Role Alignments



Project led by Martha Palmer
<https://verbs.colorado.edu/semlink/>

- VerbNet ↔ FrameNet
- PropBank ↔ VerbNet
- VerbNet ↔ WordNet

Multilingual LUs via Universal WordNet (UWN)



CIKM 2009

ICGL 2008
Best Paper Award

Multilingual LUs via Universal WordNet (UWN)

UWN Query Contact

s/v438495

[New Query](#)

Information

has gloss	(verb) reduce the speed of; "He slowed down the car" slow down, decelerate
lexicalization	eng: decelerate
	eng: slow down
subclass of	(verb) cause to change; make different; cause a transformation; "The advent of the automobile may have changed my thinking about the issue" alter, change, modify
has subclass	(verb) make less fast or intense; "moderate your speed" moderate
	(verb) cause to move more slowly or operate at a slower rate; "This drug will retard your heart rate" retard
	(verb) slow down by moving the tail sideways; "The airplane fishtailed on the runway" fishtail

Meaning

Bulgarian

lexicalization	bul: забавям
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Catalan

lexicalization	cat: desaccelerar
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Czech

lexicalization	ces: zpomalit
----------------	---------------

Mandarin Chinese

lexicalization	cmn: jiǎn dī sù dù
	cmn: 减低速度
	cmn: 减低速度

German

lexicalization	deu: abbremsen
	deu: verlangsamen

Over 1,000,000 LUs in over 100 languages can be attached to nearest frames

<http://www.lexvo.org/uwn/>

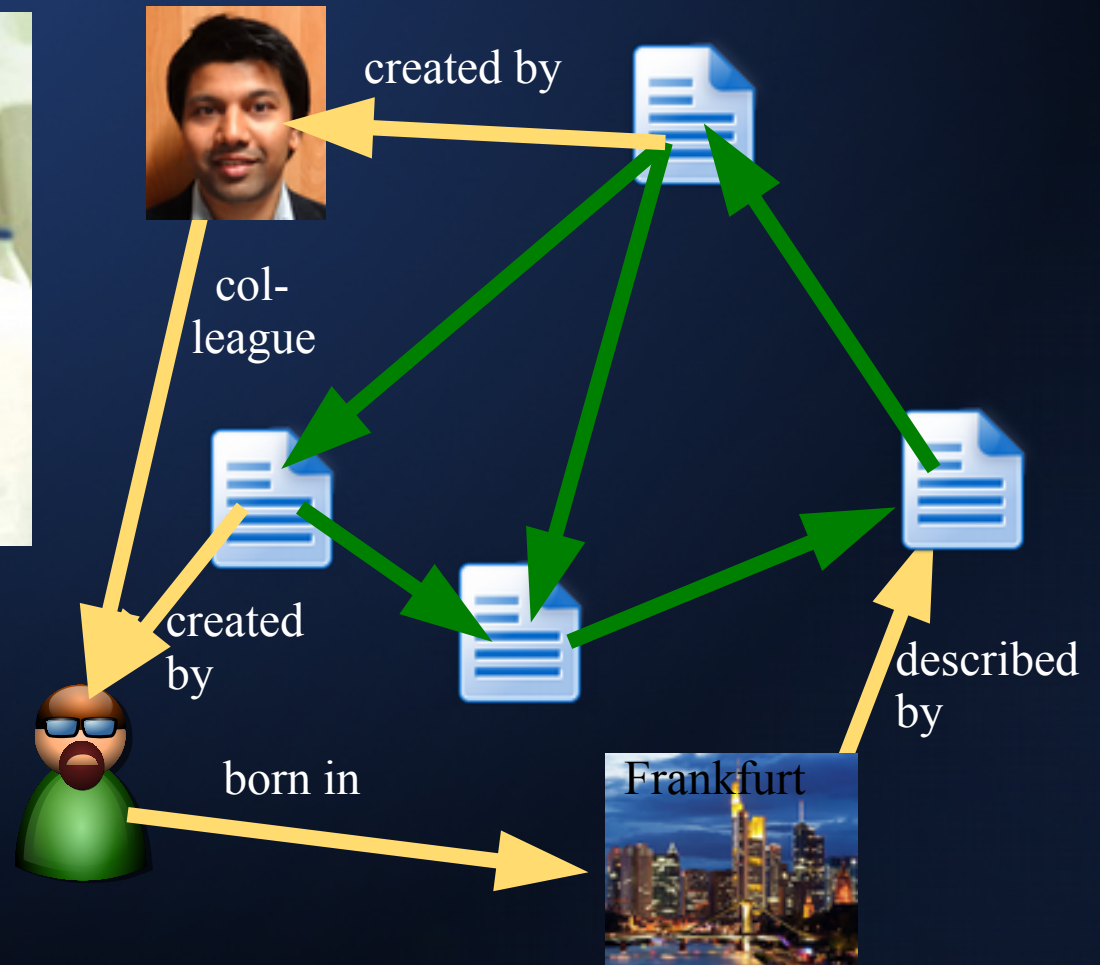
The Semantic Web

Tim Berners-Lee

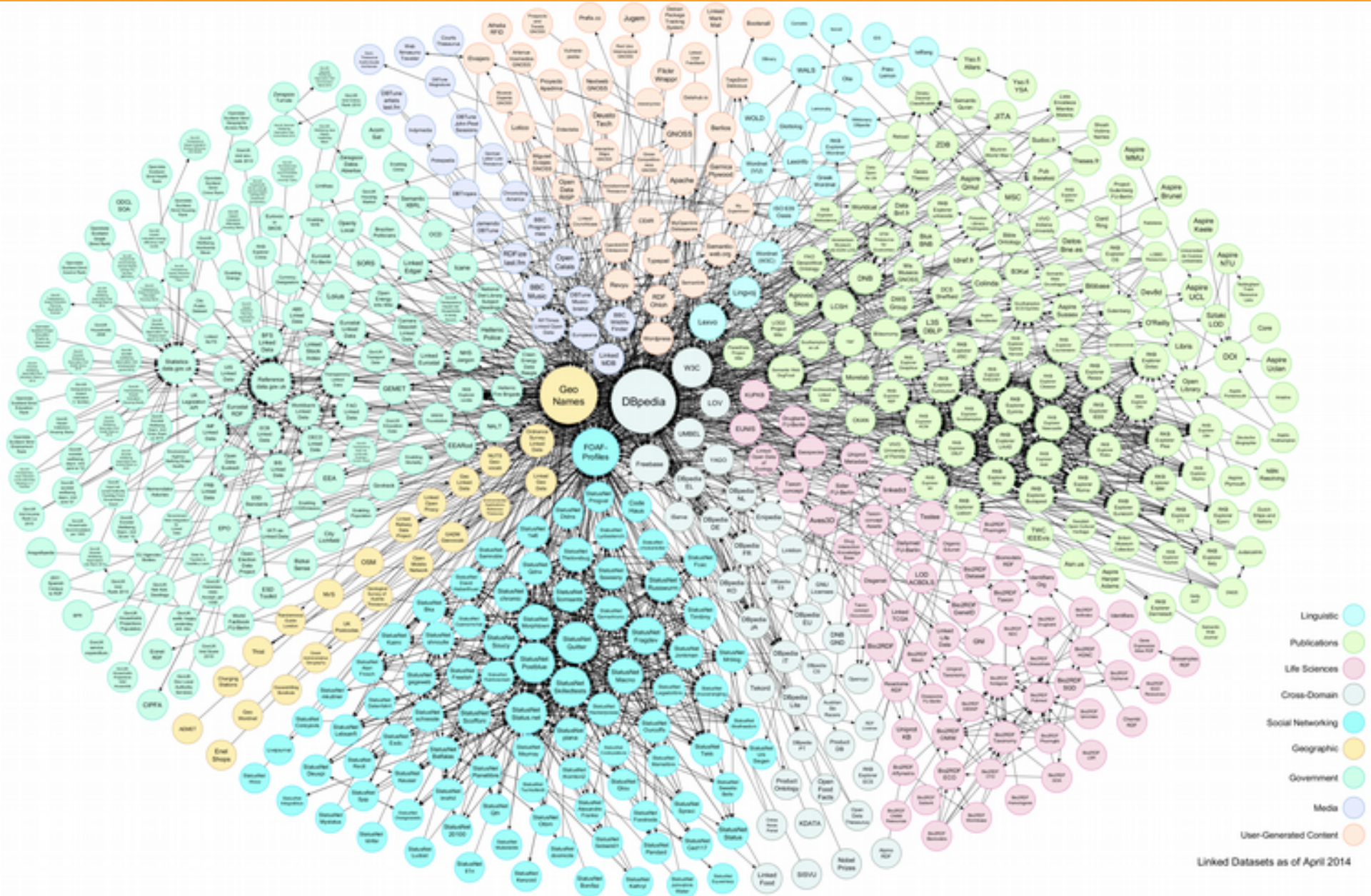


<http://geekcom.wordpress.com/2009/03/19/>

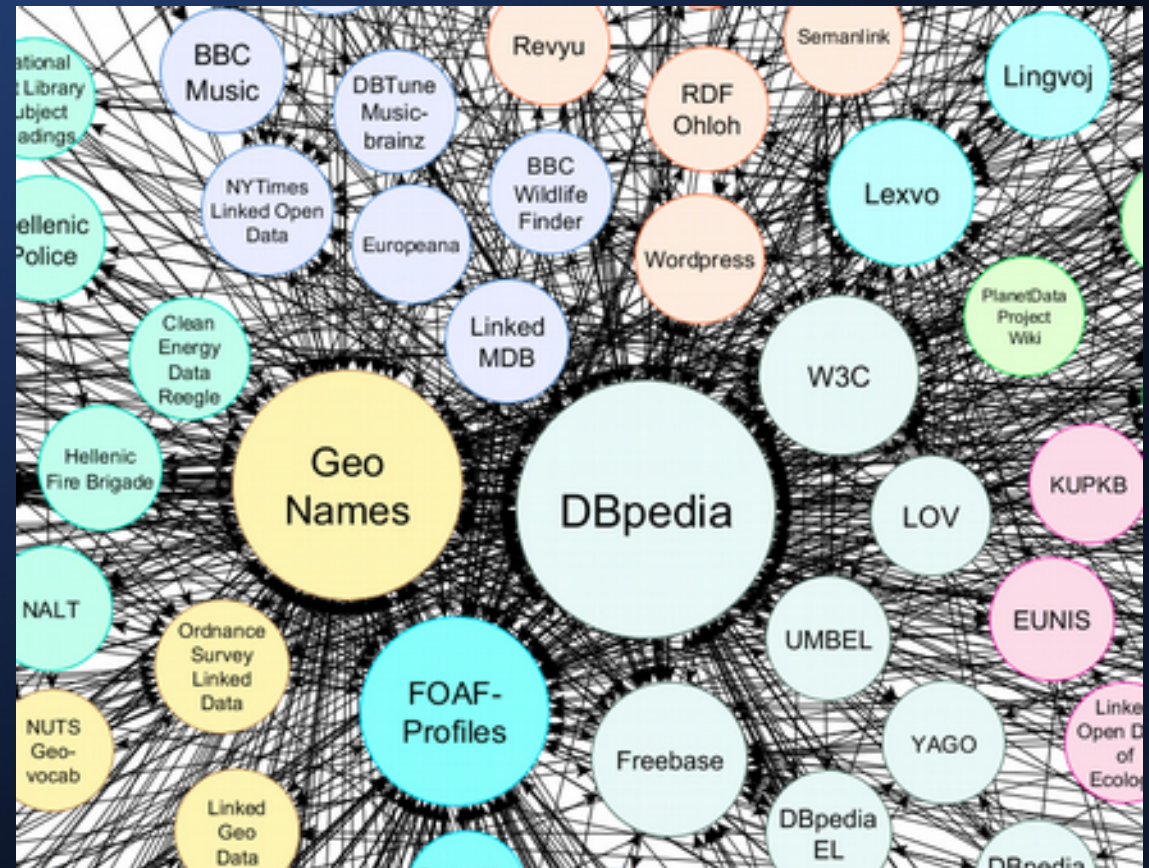
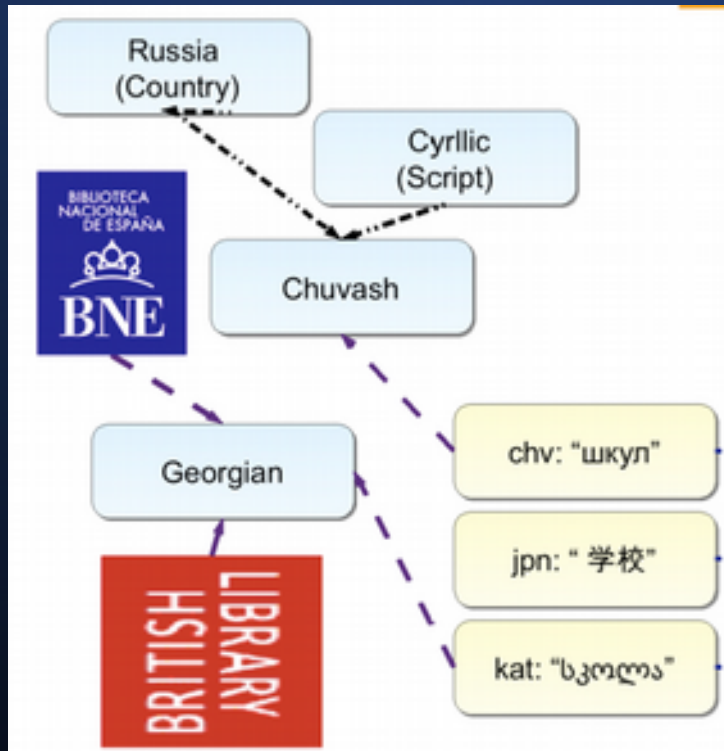
A Web of
machine-readable
entity-relationship
data



The Web of Data: Linked Data



The Web of Data: Lexvo.org



Interdisciplinary
Work, e.g. in
Digital Humanities

Semantic Web
Journal 2014

Knowledge on the Semantic Web

- Pairwise properties around an event (unreified)

- ✗ From N up to $N(N-1)$ triples:

- person1 gotMarriedWith person2
 - person1 gotMarriedInPlace place
 - person2 gotMarriedInPlace place
 - person1 gotMarriedOnDate time
 - person2 gotMarriedOnDate time
 - person1 ceremonyType marriageCeremonyType
 - person2 ceremonyType marriageCeremonyType
 - place holdWeddingOnDate time

- ✗ Without events, connections are unknown:

- Sarkozy gotMarriedWith Carla_Bruni
 - Sarkozy gotMarriedWith Cécilia_Attias
 - Sarkozy gotMarriedOnDate 2007
 - Sarkozy gotMarriedOnDate 1996

FrameBase: Aligning Knowledge via FrameNet

taking_sides
Taking_time
Talking_into
Tasting
Telling
Temperature
Temporal_collocation
Temporal_pattern
Temporal_subregion
Temporary_group
Temporary_leave
Temporary_stay
Temporary_transfer_scenario
Terms_of_agreement
Terrorism
Text
Text_creation
Theft
Thermodynamic_phase
Thriving
Thwarting
Time_period_of_action
Time_vector
Timespan
Tolerating
Tool_purpose
Topic
Touring
Toxic_substance
Trajector-Landmark
Transfer
Transfer_scenario
Transitive_action
Translating
Transportation_status
Trap
Travel
Traversing
Treating_and_mistreating
Trendiness
Trial
Triggering
Trust
Try_defendant

Text_creation

Lexical Unit Index

Definition

An **Author** creates a **Text**, either written, such as a letter, or spoken, such as a speech, that contains meaningful linguistic tokens, and may have a particular **Addressee** in mind. The **Text** may include information about its topic, although the latter is not an FE in this frame.

I **penned** a letter concerning racism **to** Congress.

The brothers **said** not two words **to** each other.

Jot **any notes you need** **below the line** **in red pen only**.

Frame Elements

Core Elements

Author The **Author** produces a particular **Text**.

Semantic Type: Sentient

Text [text]

The entity which results from the act of writing or speaking.

Michael **wrote** a frame description.

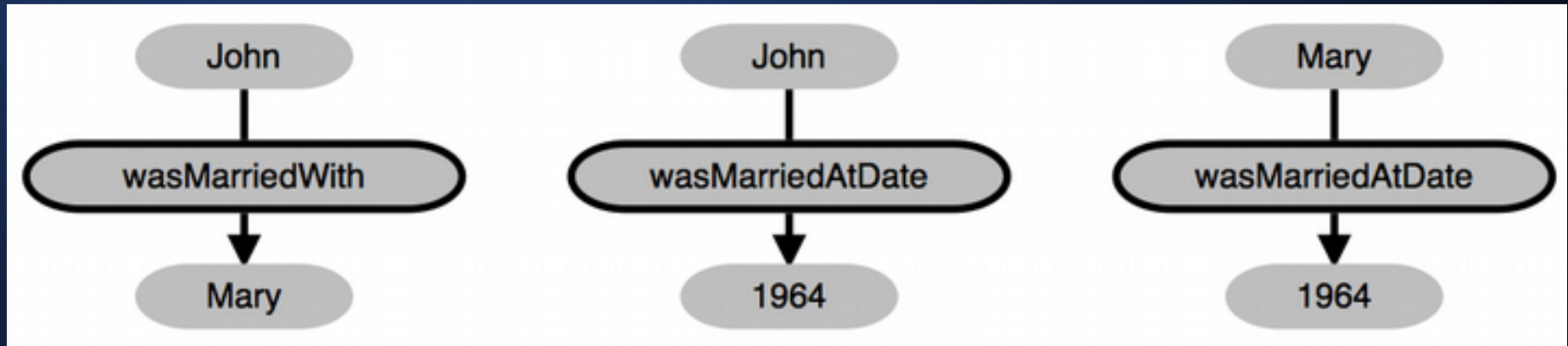
Cybil wanted to **speak** those three words.

X isAuthorOf Y
Y writtenBy X
X wrote Y
Y writtenInYear Z

FrameBase.org
Bringing knowledge into a standard form

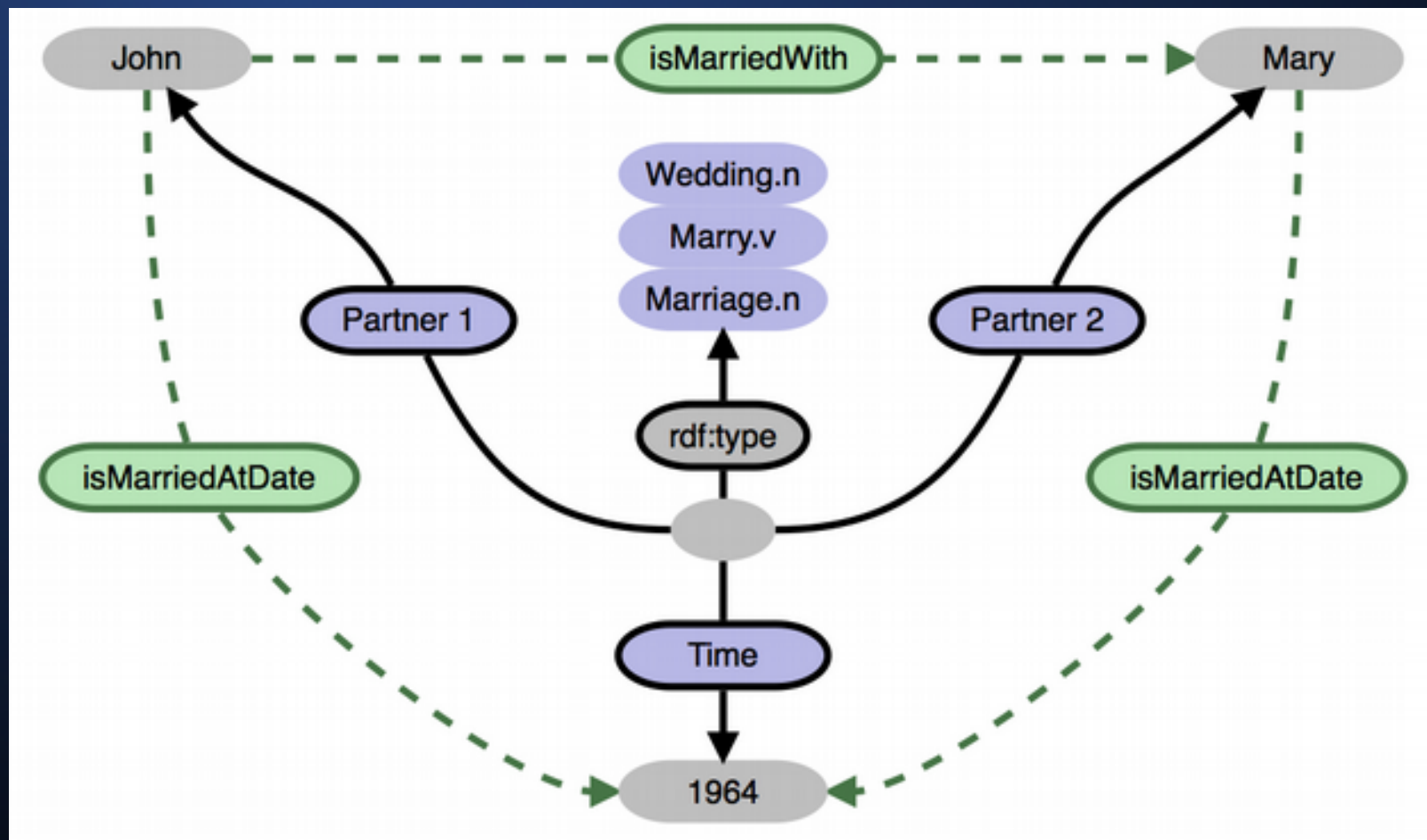
a prepositional phrase introduced by

FrameBase: Aligning Knowledge via FrameNet



FrameBase.org
Bringing knowledge into a standard form

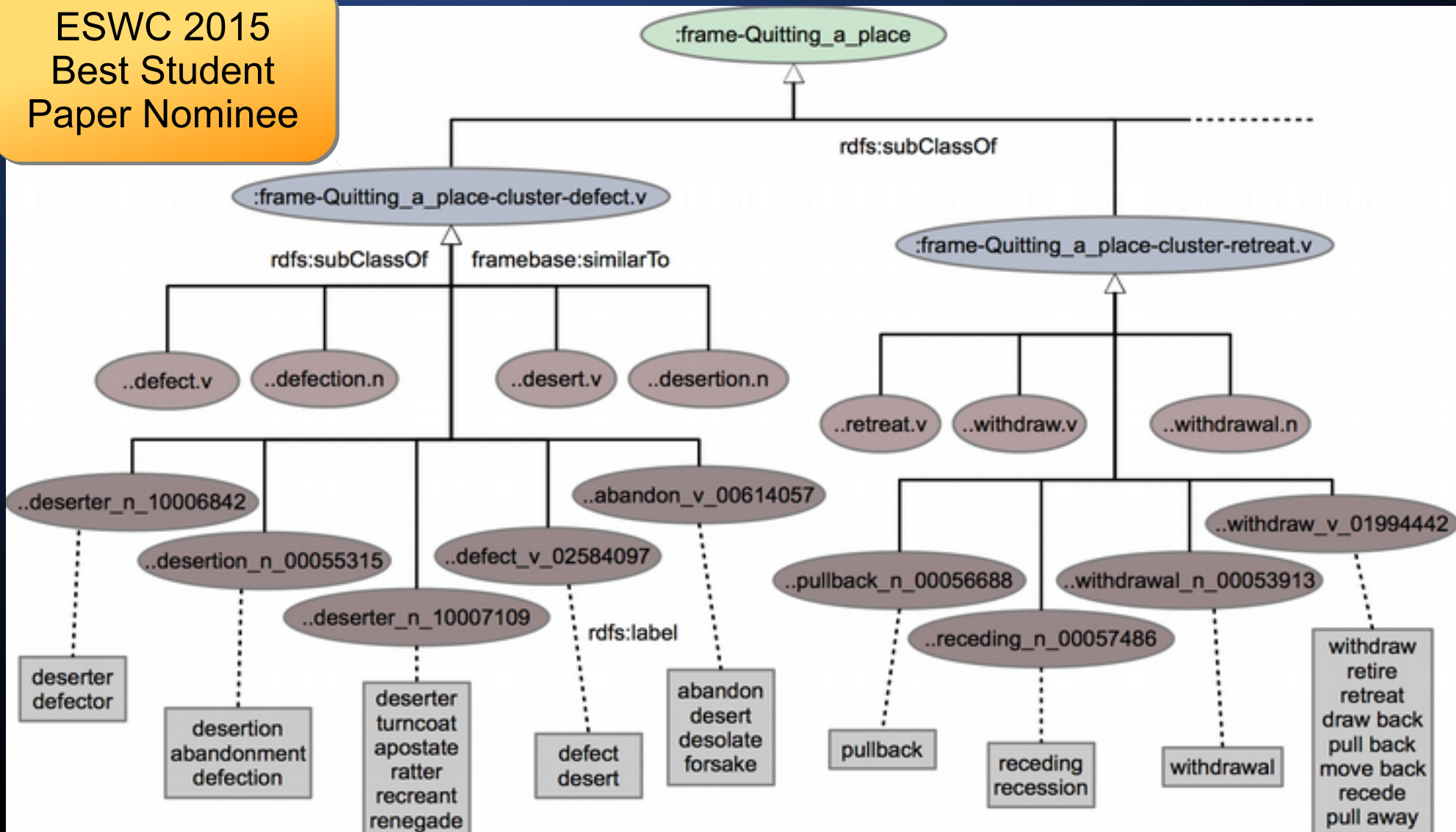
Aligning Knowledge using FrameNet



FrameBase.org
Bringing knowledge into a standard form

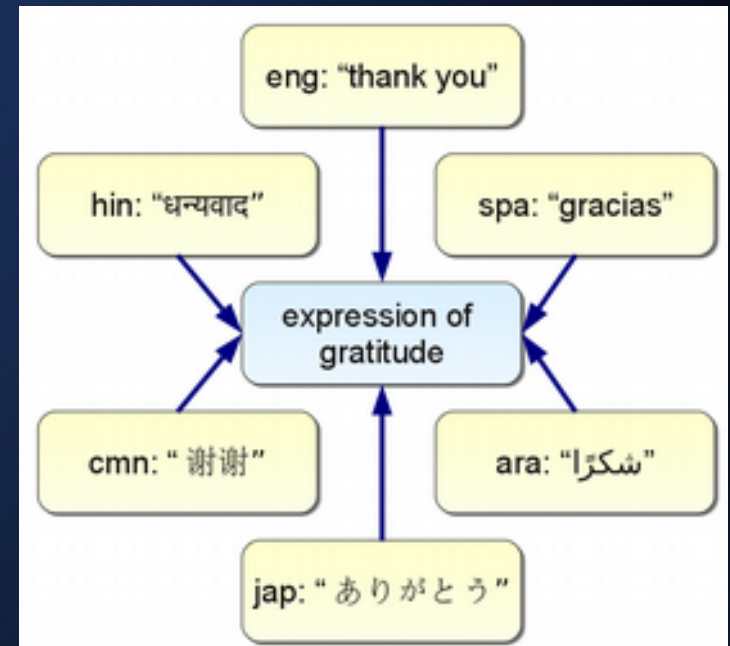
FrameBase: Aligning Knowledge via FrameNet

ESWC 2015
Best Student
Paper Nominee



Summary

- **Alignments are typically not straightforward**
- **Still, multilingual versions of FrameNet can be connected**
 - ▶ Some frames can be shared
 - ▶ For others, use connections beyond just 1-to-1 alignments
- **Ecosystem**
 - ▶ SemLink, WordNet, multilingual wordnets
 - ▶ Linked Data, FrameBase.org



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