NewsReader

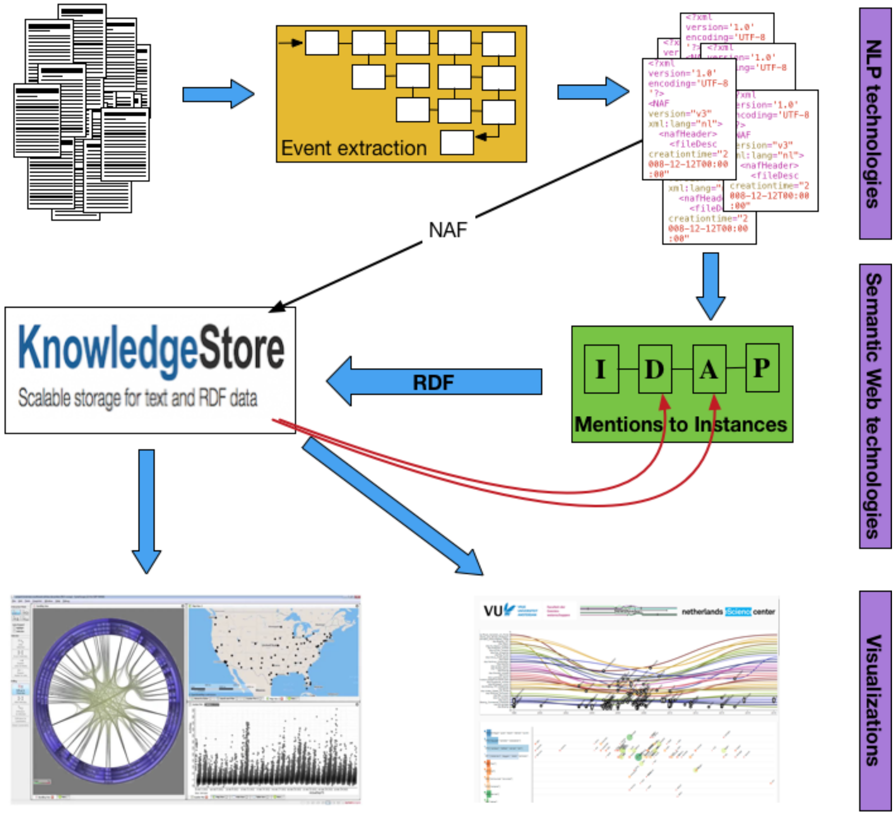
Building structured event indexes
of large volumes of financial and economic data
for making decisions
FP7-2012-ICT-315404

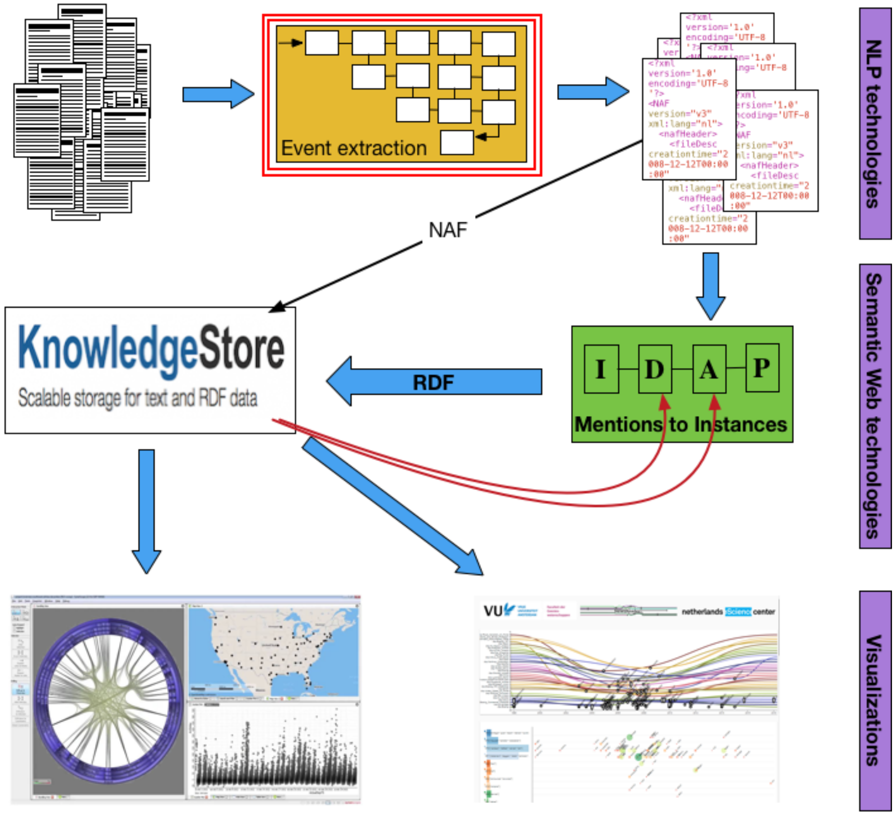
Event Detection

Itziar Aldabe / German Rigau / Egoitz Laparra

IXA group, UPV/EHU

http://ixa.si.ehu.es


Event extraction
NAF
KnowledgeStore
Scalable storage for text and RDF data
RDF
I
D
A
P
Mentions to Instances
NLP technologies
Semantic Web technologies
Visualizations


Event extraction
<?xml
version='1.0'
encoding='UTF-8
'?>
<NAF
version="v3"
xml:lang="nl">
<nafHeader>
<fileDesc
creationtime="2
008-12-12T00:00
:00"
NAF
KnowledgeStore
Scalable storage for text and RDF data
RDF
I
D
A
P
Mentions to Instances
NLP technologies
Semantic Web technologies
Visualizations
VU
netherlands eScience center

Project Objectives

- Event Detection in English, Dutch, Spanish and Italian
  - events in terms of *who* did *what when* and *where*
  - relations between events
  - factual / non-factual or speculative
  - provenance: who tells what and when
- Narrative schemas and storylines over longer periods of time
- Event reasoning: richness, coherence, relevance
- Large-scale processing, storage and retrieval of events (integrate new with old)

Project Objectives

- **Event Detection in English, Dutch, Spanish and Italian**
  - **events in terms of *who* did *what when* and *where***
  - **relations between events**
  - **factual / non-factual or speculative**
  - **provenance: who tells what and when**
- Narrative schemas and storylines over longer periods of time
- Event reasoning: richness, coherence, relevance
- Large-scale processing, storage and retrieval of events (integrate new with old)

NewsReader: Event detection

English news

June 6, 2005
Apple Computer CEO and co-founder Steve Jobs gave his annual opening speech to the World Wide Developers Conference (WWDC) at Moscone Center in San Francisco, California on Monday

Spanish news

6 de junio de 2005
Steve Jobs, cofundador y CEO de Apple Computer, ofreció el lunes su conferencia inaugurual anual de la World Wide Developers Conference (WWDC) celebrada en el Moscone Center de San Francisco (California)

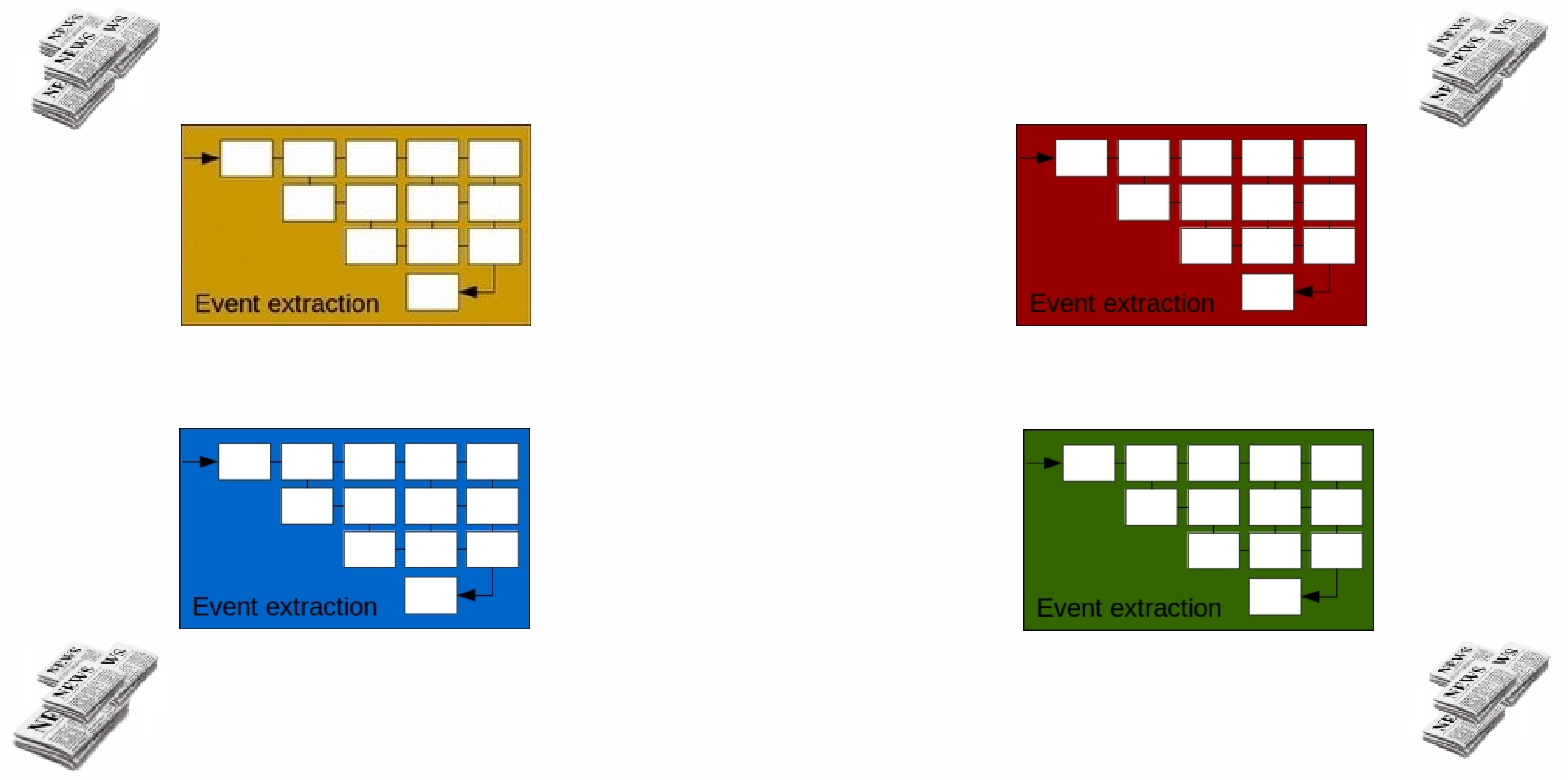
06-Jun-05
Apple Computer CEO en medeoprichter Steve Jobs gaf afgelopen maandag zijn jaarlijkse opening keynote tijdens de World Wide Developers Conference (WWDC), die wordt gehouden in het Moscone Center in San Francisco, Californië.

Dutch news

6 giugno 2005
Lunedì, il CEO di Apple Computer e cofondatore Steve Jobs ha tenuto il suo discorso di apertura annuale alla World Wide Developers Conference (WWDC), presso il Moscone Center di San Francisco, California.

Italian news

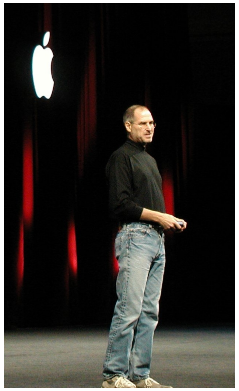
NewsReader: Event detection

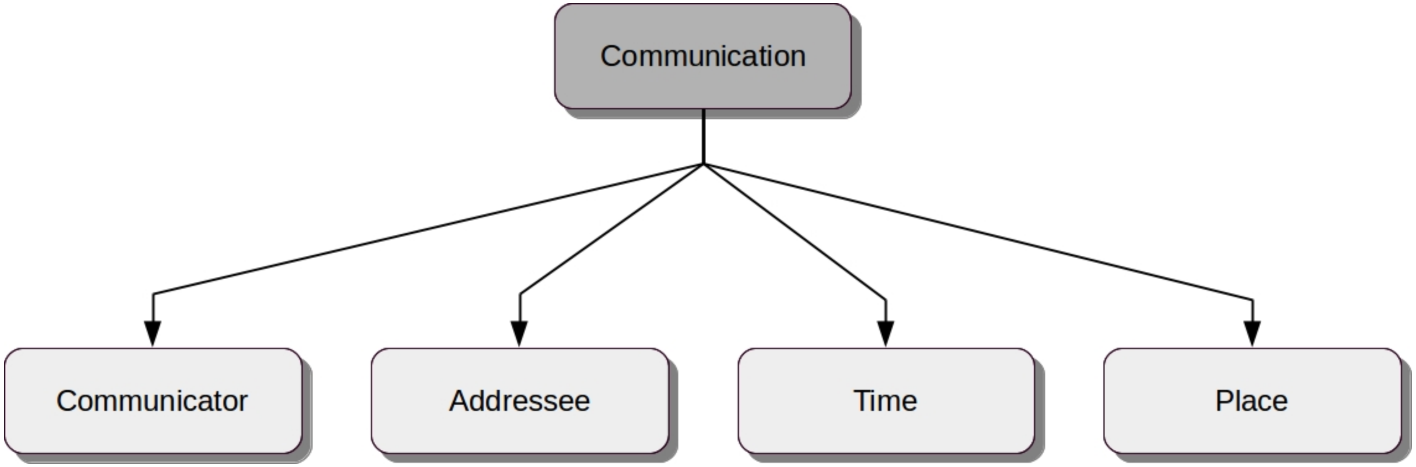


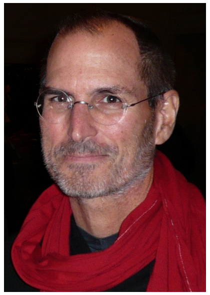
Event Detection: Main goals

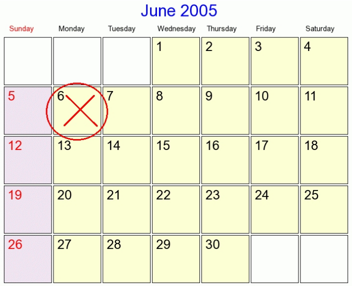
- **Events**, **participants**, their **roles** in text
- **Time** and **place** expressions
- **Attribution** of the events (aka *Authority* and *Factuality*)
- Standard **output** and **scaling**

June 6, 2005
Apple Computer CEO and co-founder Steve Jobs gave his annual **opening speech** to the World Wide Developers Conference (WWDC) at Moscone Center in San Francisco, California on Monday





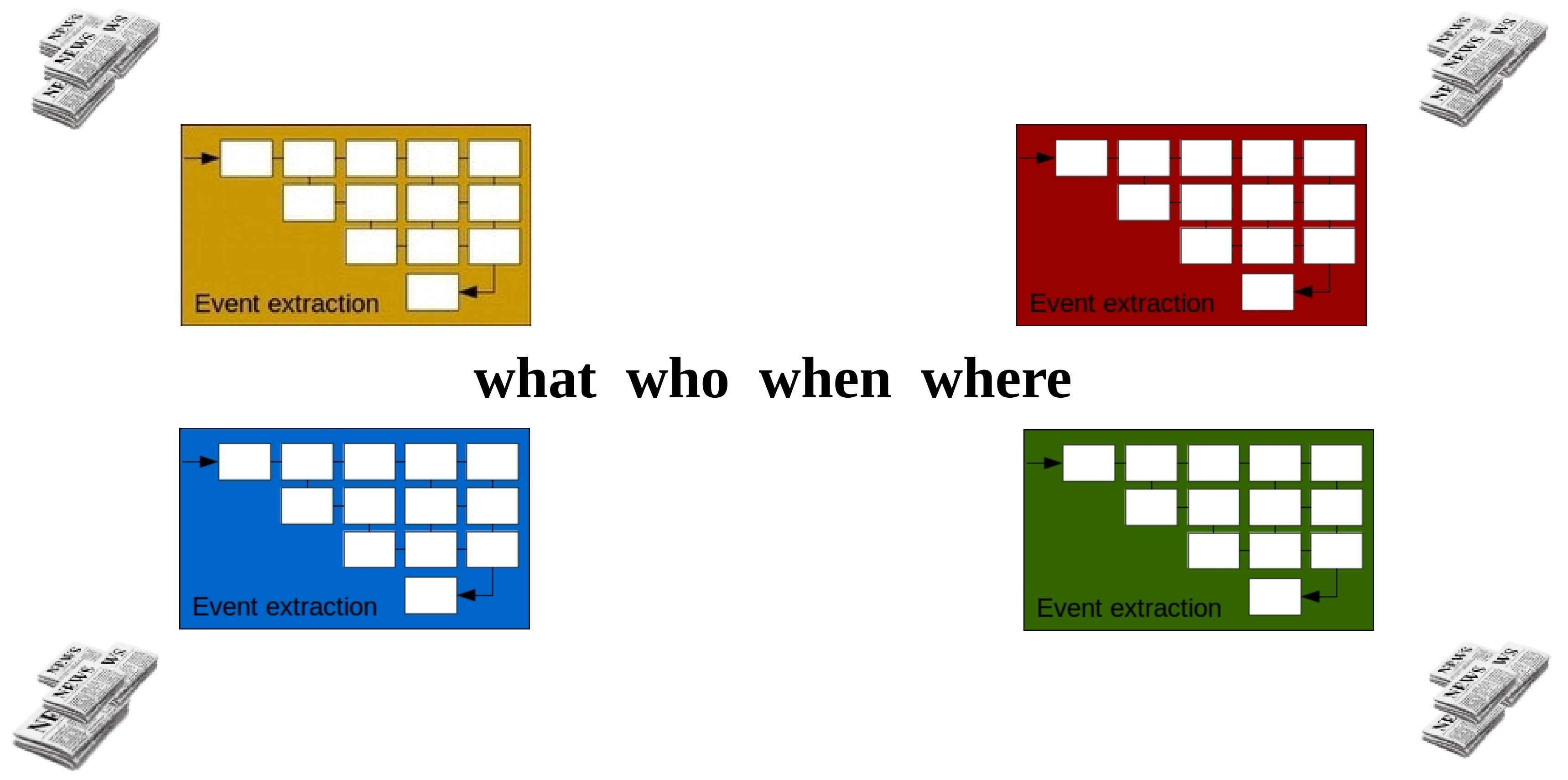




June 2005

Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

NewsReader: Event detection



English news

Spanish news

Event extraction

Event extraction

what who when where

Event extraction

Event extraction

Dutch news

Italian news

Event Detection: Example

David Cameron announced yesterday in London that the budget cuts will continue next year.

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

- who: ?
- what: ?
- when: ?
- where: ?

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

who: David Cameron

what: that the budget cuts will continue next year

when: yesterday

where: in London

Event Detection: Example

David Cameron announced yesterday in London that the budget cuts will **continue** next year.

event1: announced
- who: David Cameron
- what: that the budget cuts will continue next year
- when: yesterday
- where: in London

event3: continue
- what: ?
- when: ?

Event Detection: Example

David Cameron announced yesterday in London that the budget cuts will **continue** next year.

event1: announced

- who: David Cameron
- what: that the budget cuts will continue next year
- when: yesterday
- where: in London

event3: continue

- what: the budget cuts
- when: next year

Event Detection: Example

David Cameron announced yesterday in London that the budget **cuts** will continue next year.

event1: announced
- who: David Cameron
- what: that the budget cuts will continue next year
- when: yesterday
- where: in London

event2: cuts
- what: ?

event3: continue
- what: the budget cuts
- when: next year

Event Detection: Example

David Cameron announced yesterday in London that the budget **cuts** will continue next year.

event1: announced
- who: David Cameron
- what: that the budget cuts will continue next year
- when: yesterday
- where: in London

event2: cuts
- what: budget

event3: continue
- what: the budget cuts
- when: next year

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

who: David Cameron

what: that the budget cuts will continue next year

when: yesterday

where: in London

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

- who: David Cameron NERC (PER)
- what: that the budget cuts will continue next year
- when: yesterday
- where: in London NERC (LOC)

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

who: David Cameron

- http://dbpedia.org/resource/David_Cameron NED

- what: that the budget cuts will continue next year

when: yesterday

where: in London

- http://dbpedia.org/resource/London NED

Event Detection: Example

Bush announced yesterday in London that the budget cuts will continue next year.

- http://dbpedia.org/page/George_H._W._Bush
- http://dbpedia.org/page/George_W._Bush
- http://dbpedia.org/page/Jeb_Bush

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced

- who: David Cameron
- what: that the budget cuts will continue next year
- when: yesterday
  - 2016-03-09 TIMEX3
- where: in London

Event Detection: Example

David Cameron **announced** yesterday in London that the budget cuts will continue next year.

event1: announced => announce.01

who: Mariano Rajoy

- Arg0-PAG: announcer (vnrole: 37.7-1-Agent, 48.1.2-Agent)

what: that the budget cuts will continue next year

- Arg1-PPT: utterance (vnrole: 37.7-1-Topic, 48.1.2-Theme)

when: yesterday

- AM-TMP

where: in Madrid

- AM-LOC

SRL + Predicate Matrix

Event Detection: NLP tools

David Cameron announced yesterday in London that the budget cuts will continue next year.

NERC NED COREF EVENTS PARTICIPANTS TIME ...
FACTUALITY ATTRIBUTION OPINION ...

Outline

- EN, SP, IT and NL pipelines
- Cross-lingual interoperability
- Benchmarking

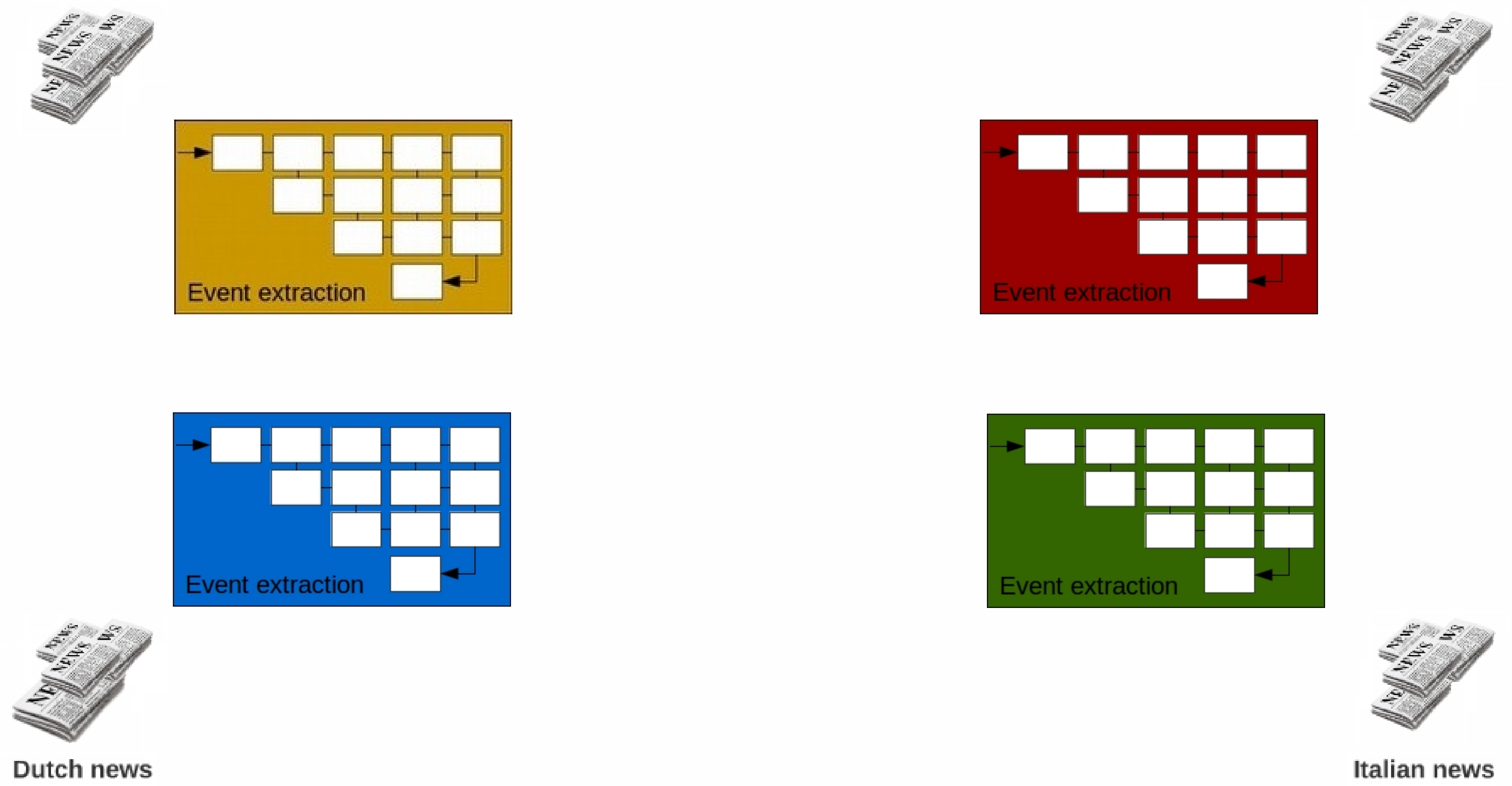
Standards for inter-operability

- NAF
  - Basic format for inter-document NLP analysis
  - Stand-off XML, multi-layered annotation format
  - Allows parallel processing
  - Covers many linguistic levels
  - All NLP modules read and write NAF

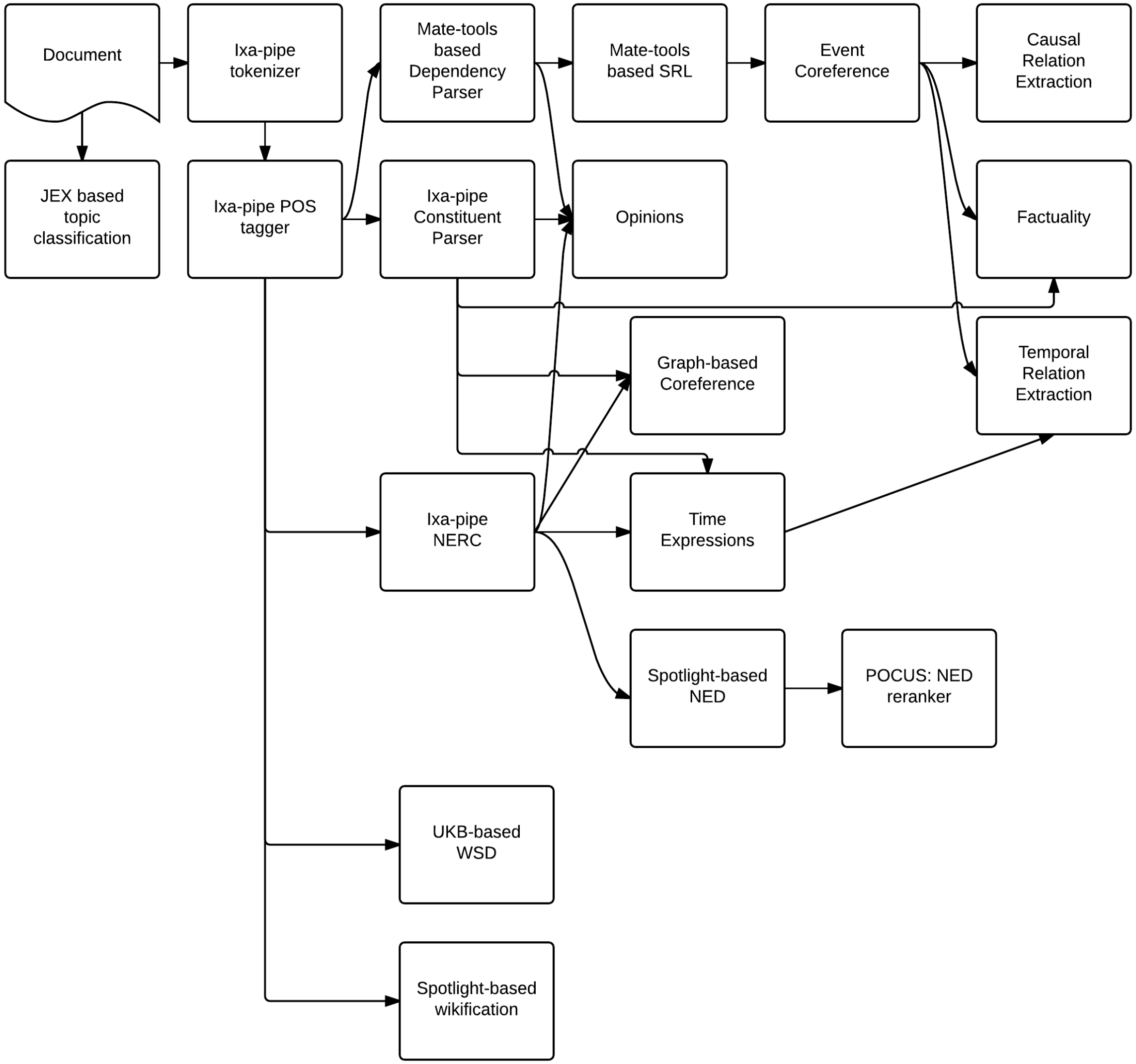
English news

NewsReader: Event detection

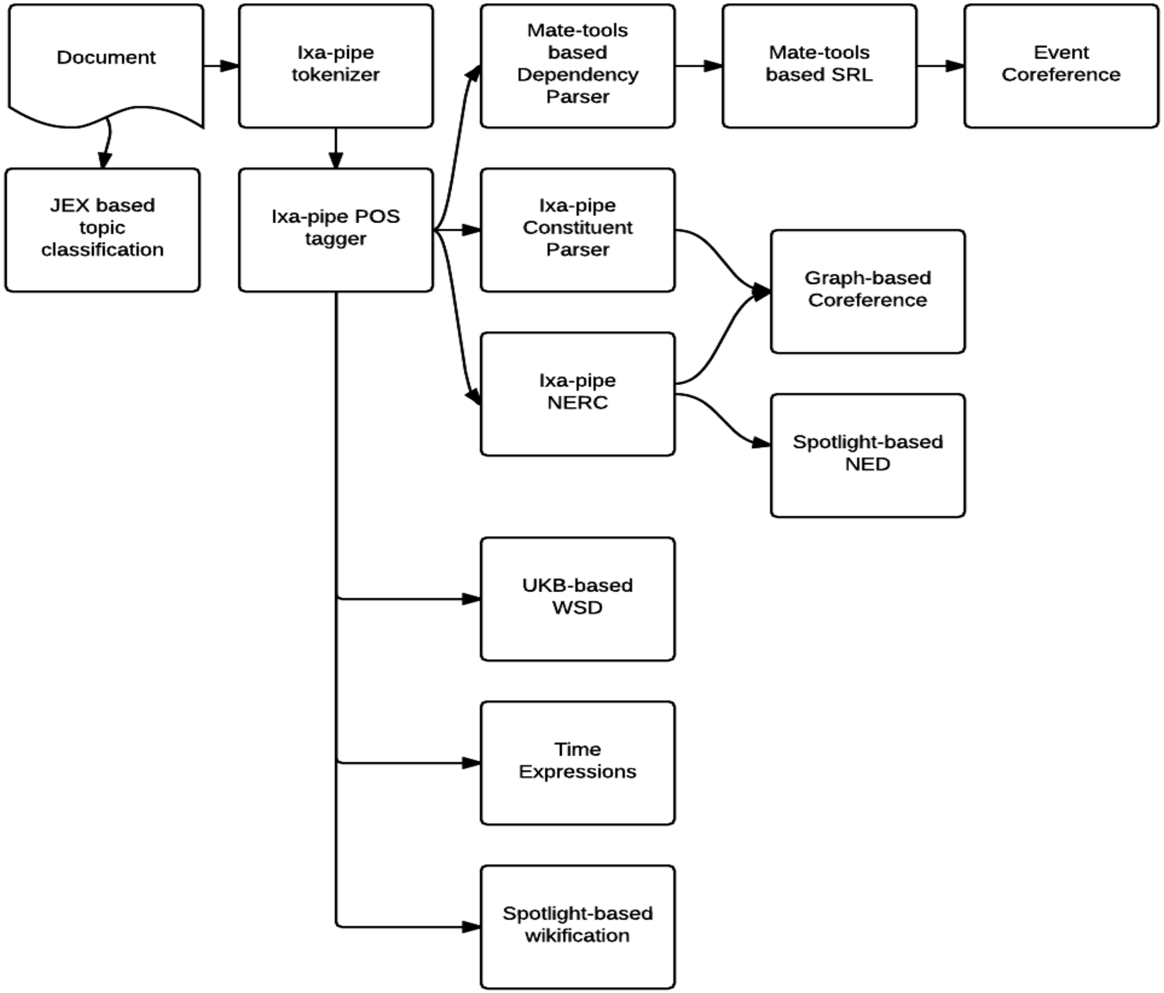
Spanish news



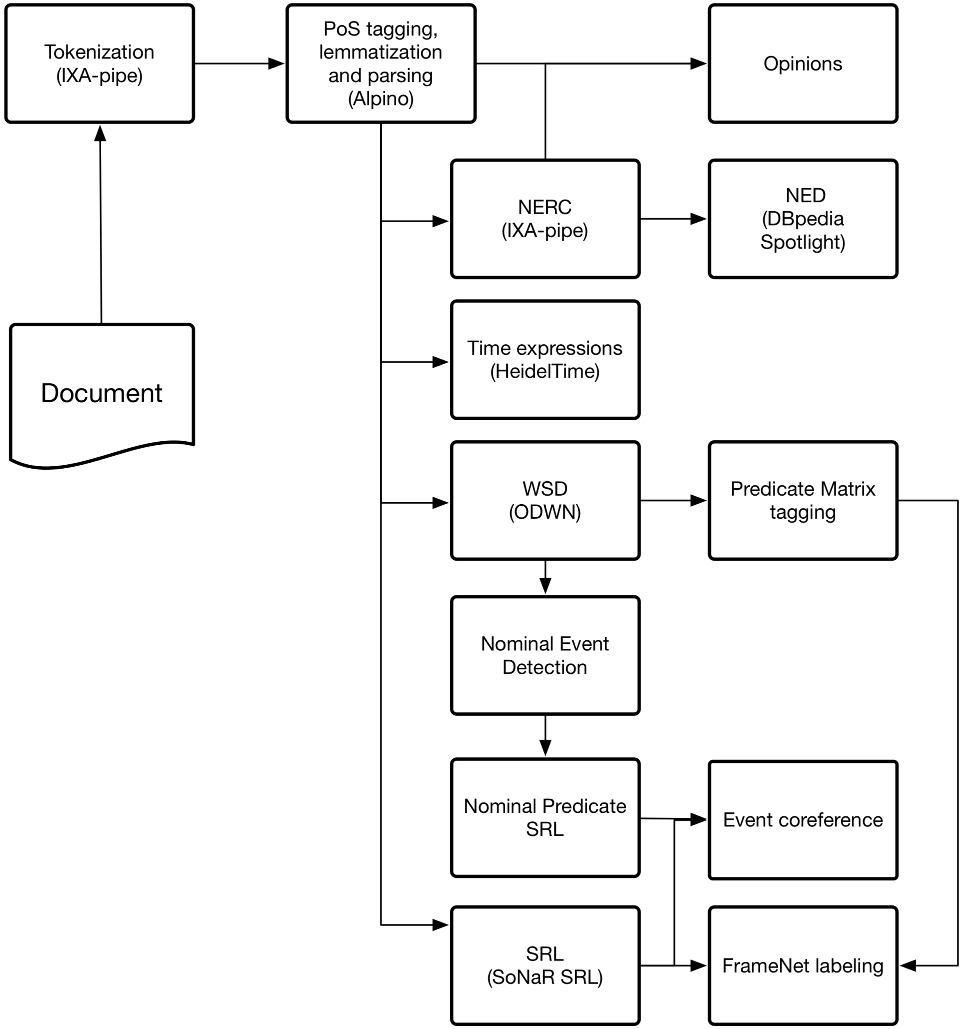
English generic pipeline v3.0



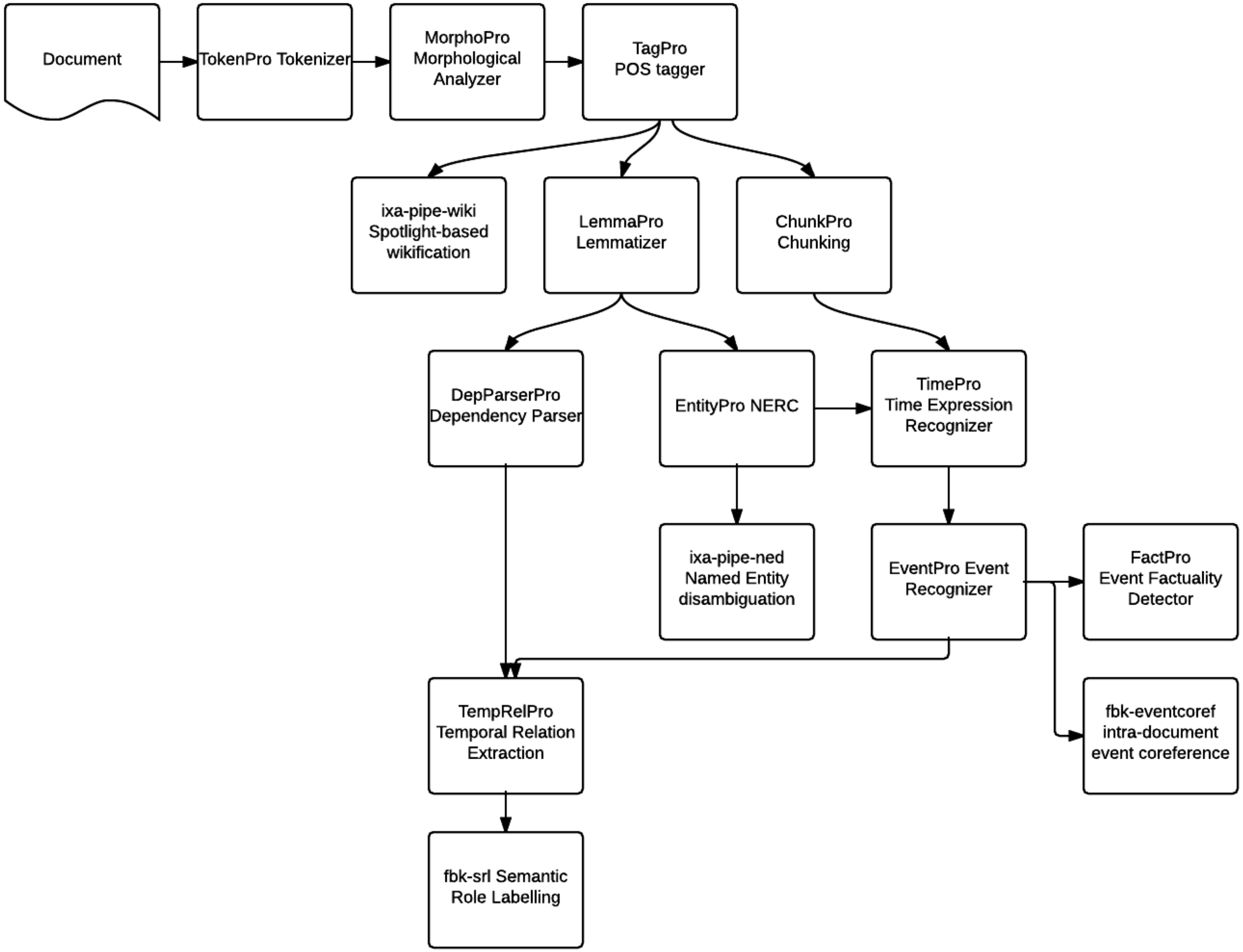
Spanish generic pipeline v3.0



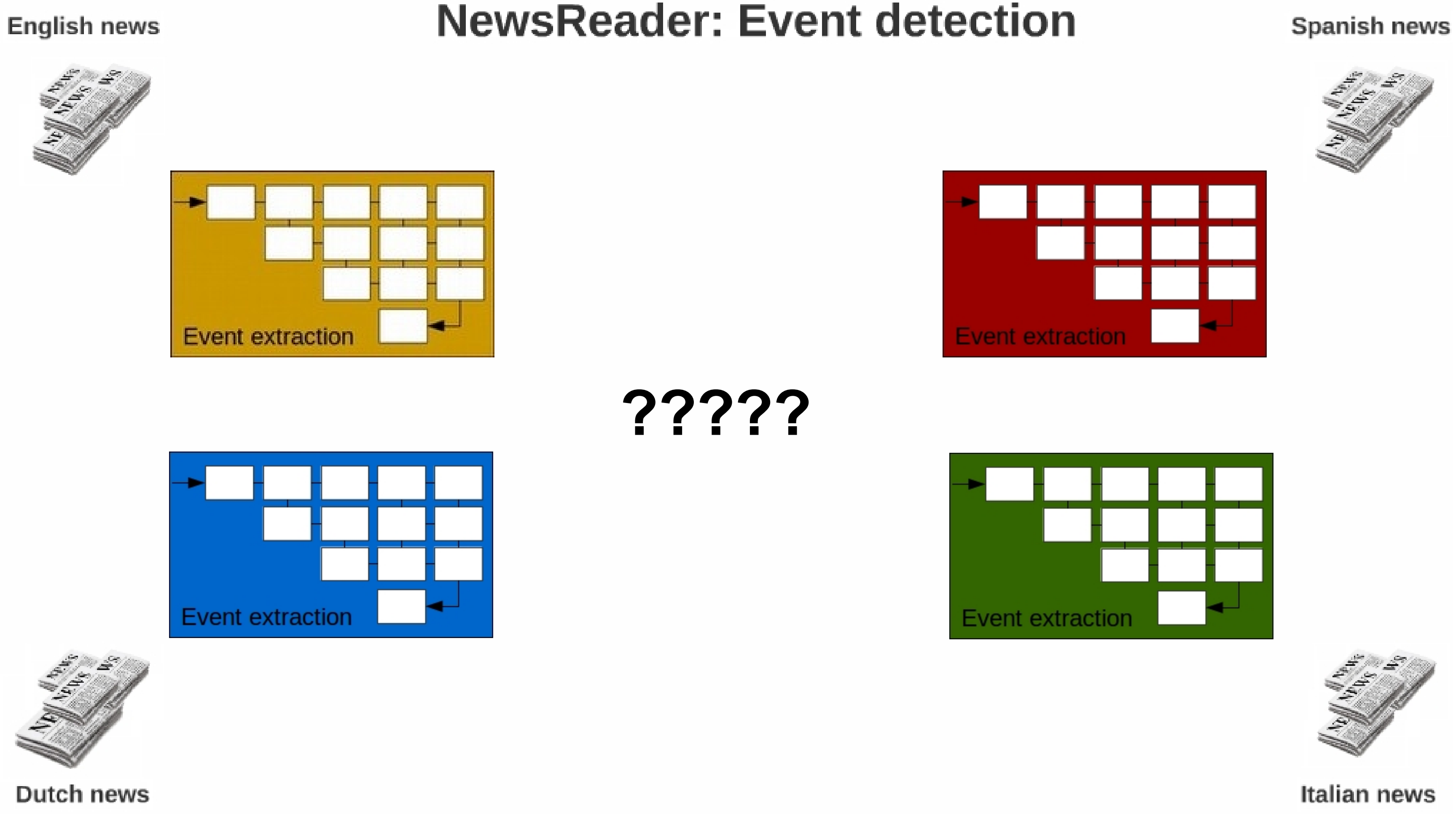
Dutch generic pipeline v3.0



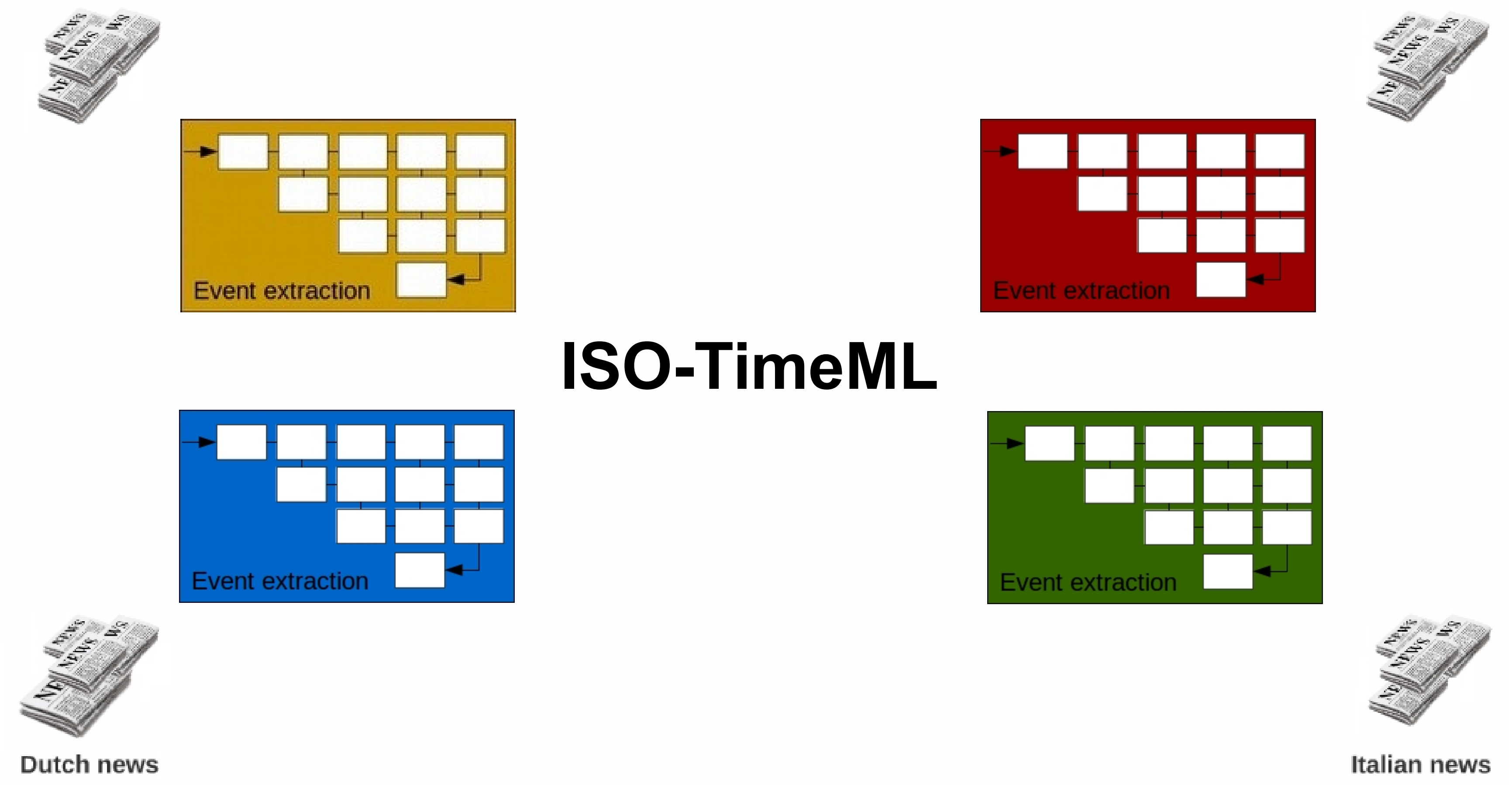
Italian generic pipeline v3.0


Document
TokenPro Tokenizer
MorphoPro Morphological Analyzer
TagPro POS tagger
ixa-pipe-wiki Spotlight-based wikification
LemmaPro Lemmatizer
ChunkPro Chunking
DepParserPro Dependency Parser
EntityPro NERC
TimePro Time Expression Recognizer
ixa-pipe-ned Named Entity disambiguation
EventPro Event Recognizer
FactPro Event Factuality Detector
TempRelPro Temporal Relation Extraction
fbk-eventcoref intra-document event coreference
fbk-srl Semantic Role Labelling

NewsReader: Event detection



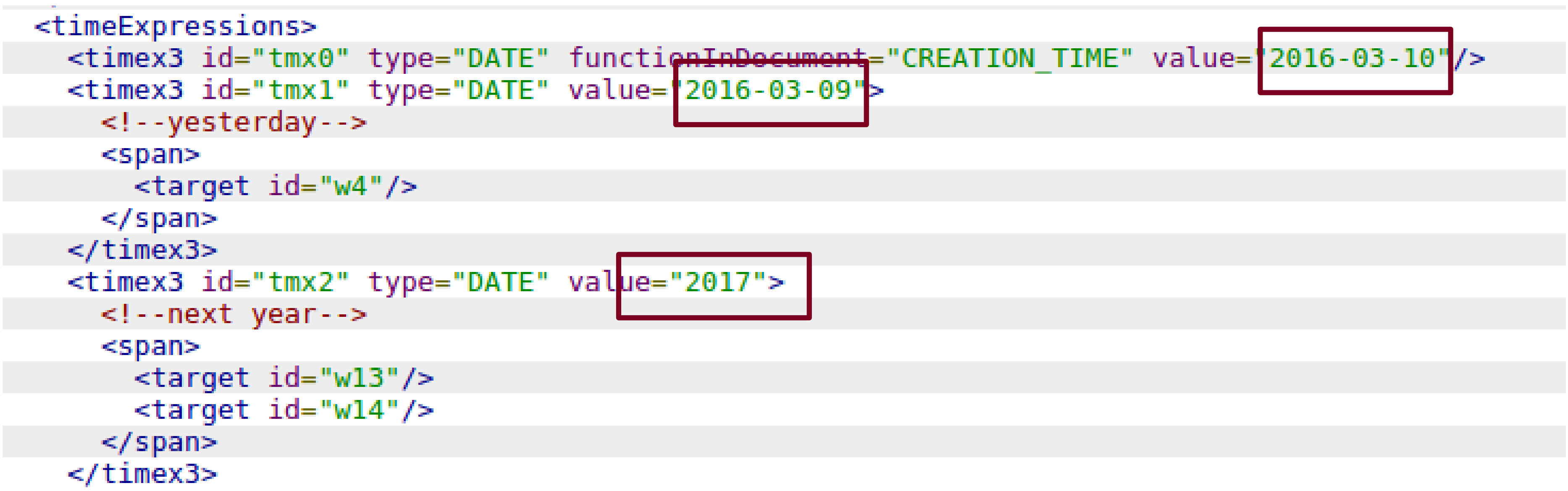
NewsReader: Event detection



ISO-TimeML

Cross-lingual interoperability: Time

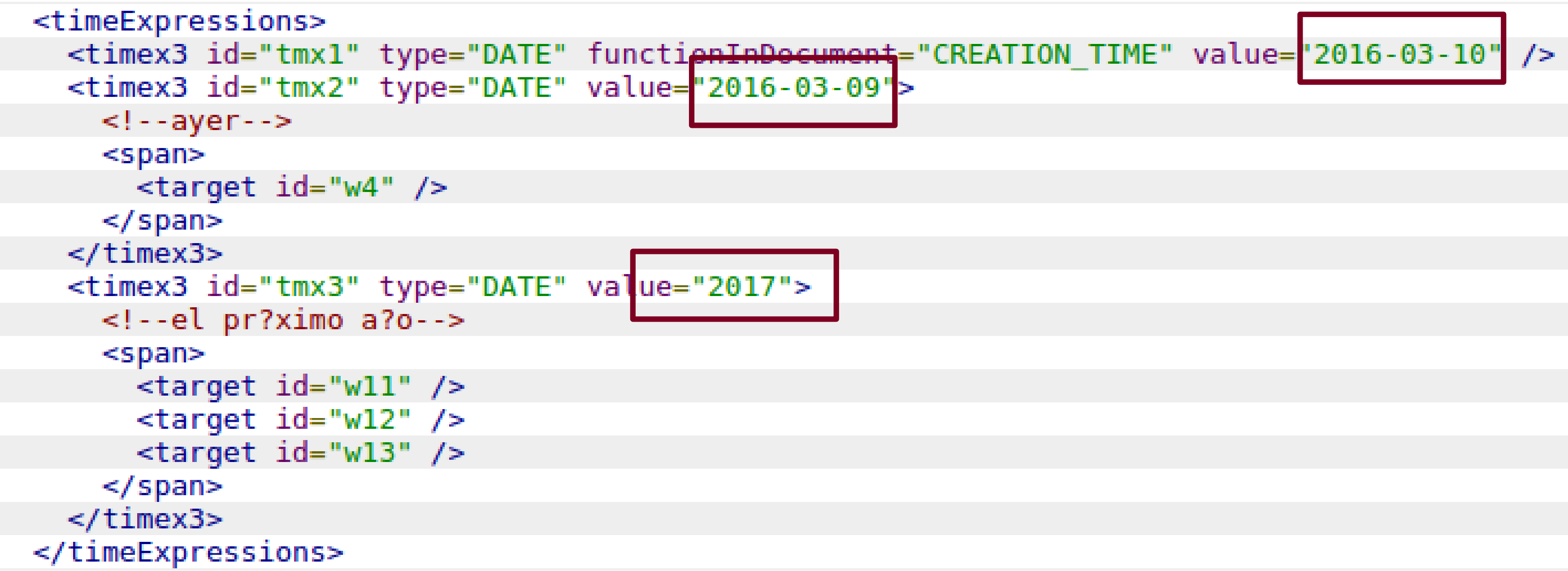
David Cameron announced **yesterday** in London that the budget cuts will continue **next year**.



```
<timeExpressions>
  <timex3 id="tmx0" type="DATE" functionInDocument="CREATION_TIME" value="2016-03-10"/>
  <timex3 id="tmx1" type="DATE" value="2016-03-09">
    <!--yesterday-->
    <span>
      <target id="w4"/>
    </span>
  </timex3>
  <timex3 id="tmx2" type="DATE" value="2017">
    <!--next year-->
    <span>
      <target id="w13"/>
      <target id="w14"/>
    </span>
  </timex3>
```

Cross-lingual interoperability: Time

David Cameron anunció **ayer** en Londres que los recortes continuarán **el próximo año**.

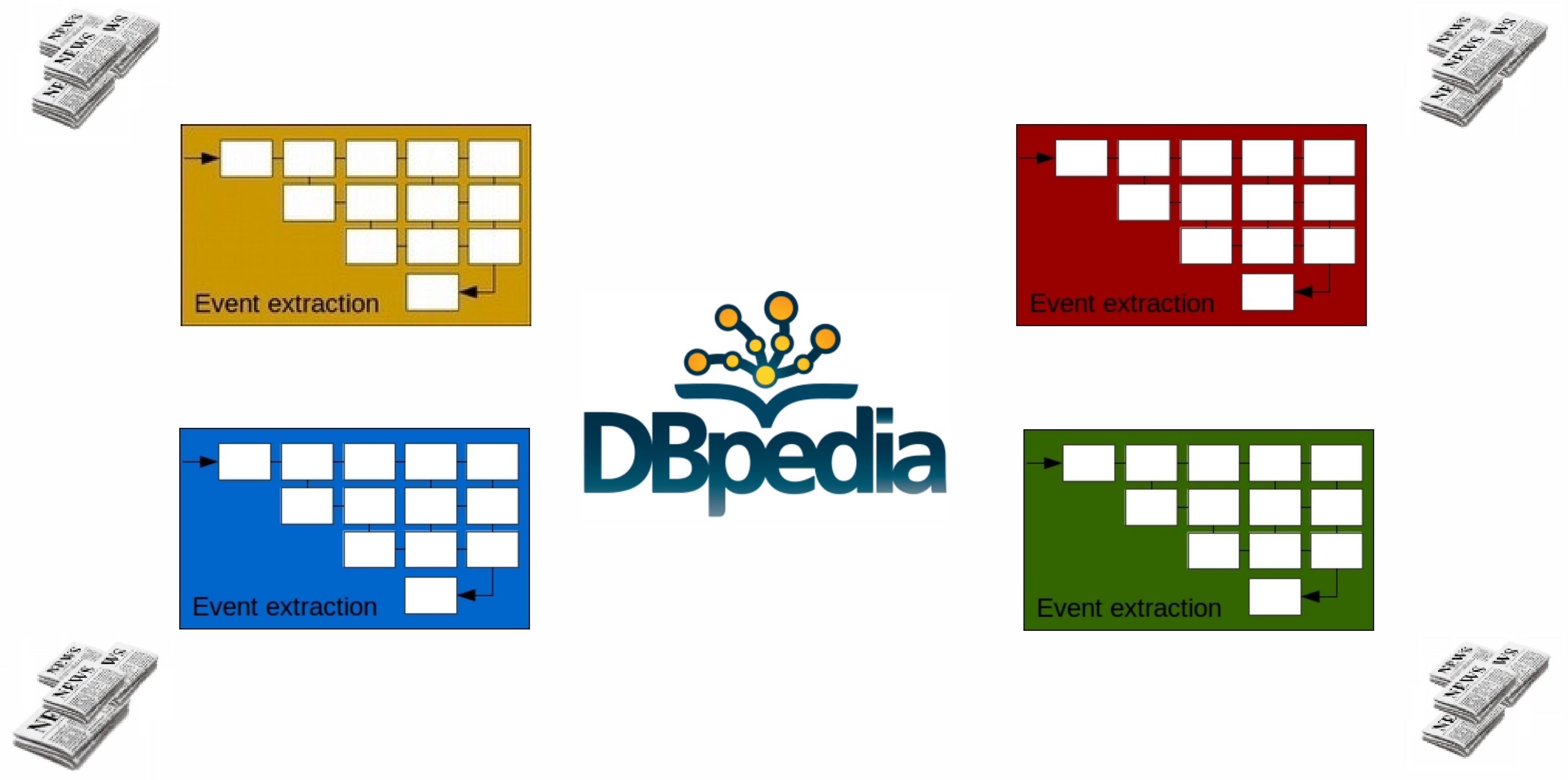


```
<timeExpressions>
  <timex3 id="tmx1" type="DATE" functionInDocument="CREATION_TIME" value="2016-03-10" />
  <timex3 id="tmx2" type="DATE" value="2016-03-09">
    <!--ayer-->
    <span>
      <target id="w4" />
    </span>
  </timex3>
  <timex3 id="tmx3" type="DATE" value="2017">
    <!--el pr?ximo a?o-->
    <span>
      <target id="w11" />
      <target id="w12" />
      <target id="w13" />
    </span>
  </timex3>
</timeExpressions>
```

NewsReader: Event detection

English news

Spanish news



Event extraction

Event extraction

Event extraction

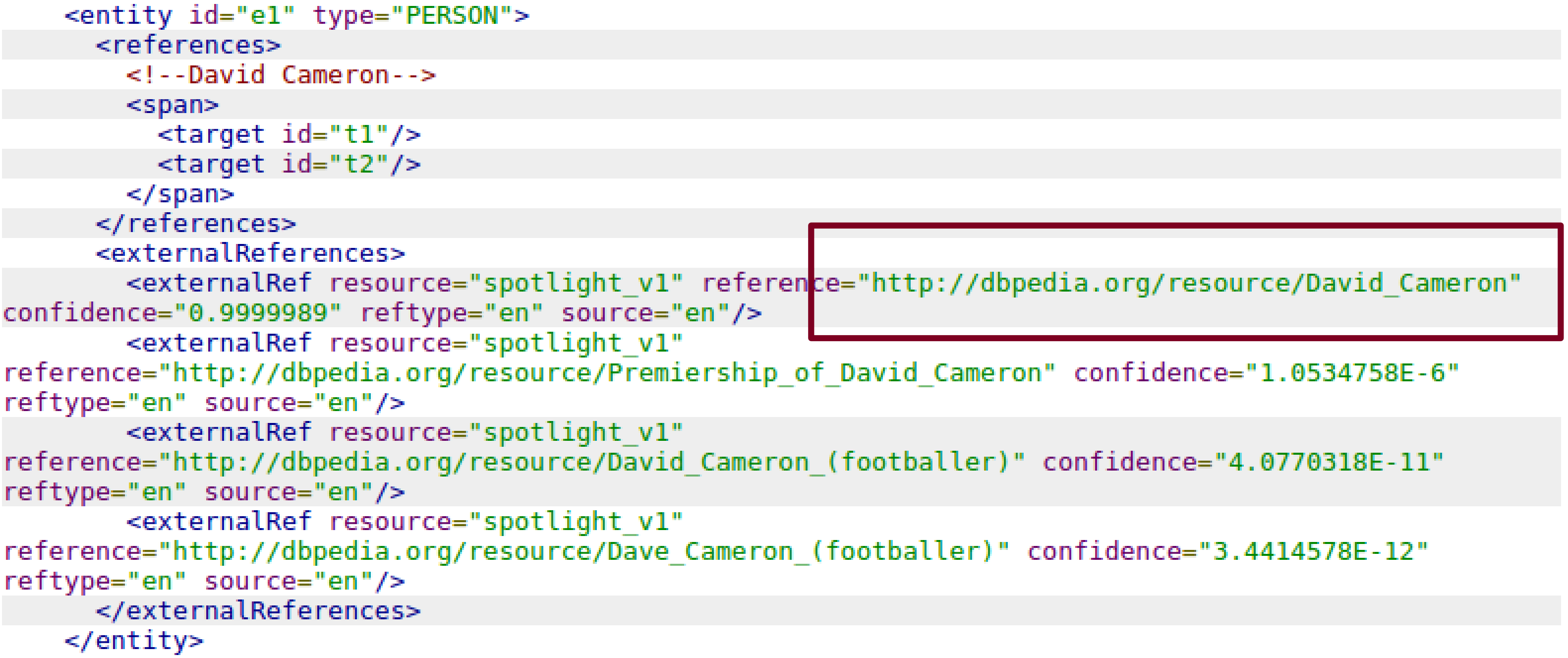
Event extraction

Dutch news

Italian news

Cross-lingual interoperability: Named entities

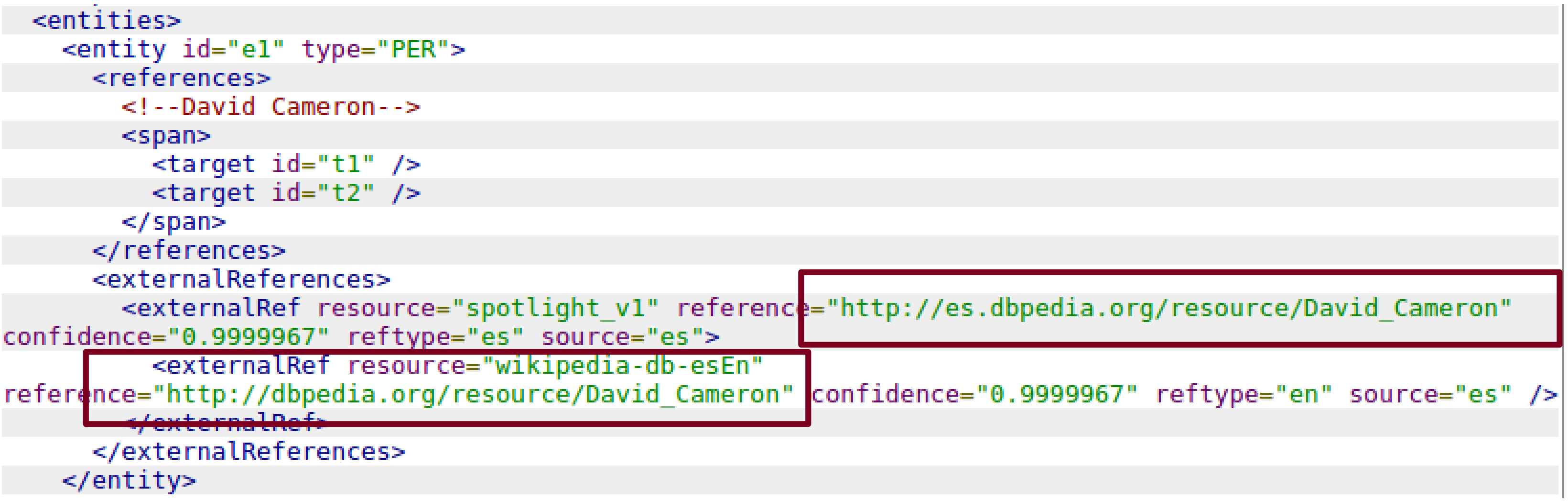
David Cameron announced yesterday in London that the budget cuts will continue next year.



```
    <entity id="e1" type="PERSON">
      <references>
        <!--David Cameron-->
        <span>
          <target id="t1"/>
          <target id="t2"/>
        </span>
      </references>
      <externalReferences>
        <externalRef resource="spotlight_v1" reference="http://dbpedia.org/resource/David_Cameron"
confidence="0.9999989" reftype="en" source="en"/>
        <externalRef resource="spotlight_v1"
reference="http://dbpedia.org/resource/Premiership_of_David_Cameron" confidence="1.0534758E-6"
reftype="en" source="en"/>
        <externalRef resource="spotlight_v1"
reference="http://dbpedia.org/resource/David_Cameron_(footballer)" confidence="4.0770318E-11"
reftype="en" source="en"/>
        <externalRef resource="spotlight_v1"
reference="http://dbpedia.org/resource/Dave_Cameron_(footballer)" confidence="3.4414578E-12"
reftype="en" source="en"/>
      </externalReferences>
    </entity>
```

Cross-lingual interoperability: Named entities

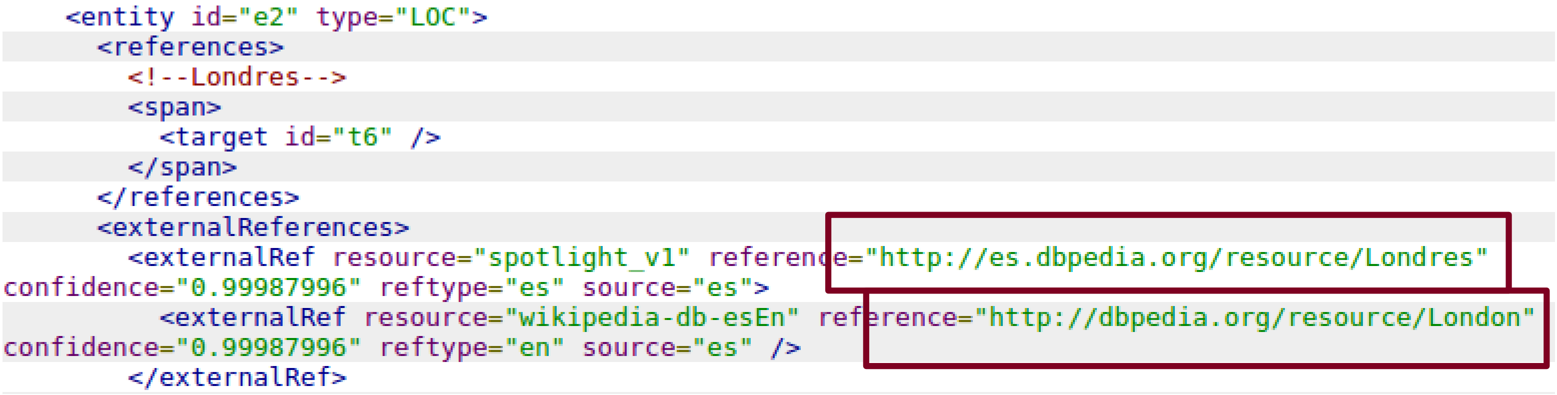
David Cameron anunció ayer en Londres que los recortes continuarán el próximo año.



```
  <entities>
    <entity id="e1" type="PER">
      <references>
        <!--David Cameron-->
        <span>
          <target id="t1" />
          <target id="t2" />
        </span>
      </references>
      <externalReferences>
        <externalRef resource="spotlight_v1" reference="http://es.dbpedia.org/resource/David_Cameron"
confidence="0.9999967" reftype="es" source="es">
          <externalRef resource="wikipedia-db-esEn"
reference="http://dbpedia.org/resource/David_Cameron" confidence="0.9999967" reftype="en" source="es" />
        </externalRef>
      </externalReferences>
    </entity>
```

Cross-lingual interoperability: Named entities

David Cameron anunció ayer en **Londres** que los recortes continuarán el próximo año.

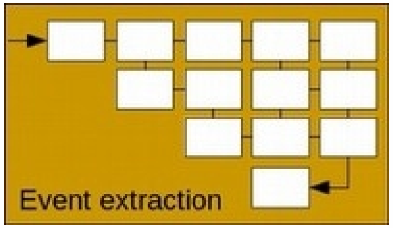


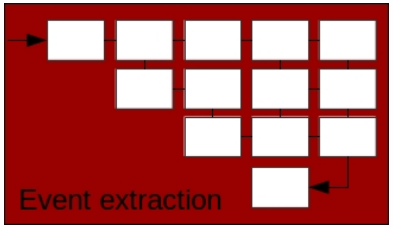
```
    <entity id="e2" type="LOC">
      <references>
        <!--Londres-->
        <span>
          <target id="t6" />
        </span>
      </references>
      <externalReferences>
        <externalRef resource="spotlight_v1" reference="http://es.dbpedia.org/resource/Londres"
confidence="0.99987996" reftype="es" source="es">
          <externalRef resource="wikipedia-db-esEn" reference="http://dbpedia.org/resource/London"
confidence="0.99987996" reftype="en" source="es" />
        </externalRef>
```

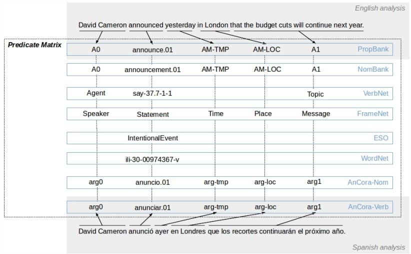
NewsReader: Event detection

English news

Spanish news







English analysis

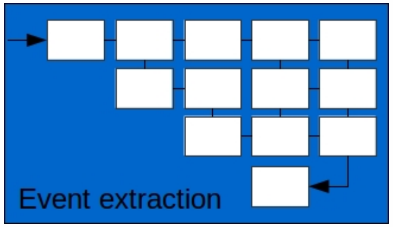
David Cameron announced yesterday in London that the budget cuts will continue next year.

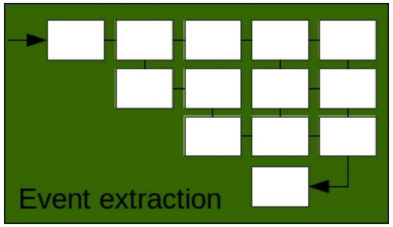
Predicate Matrix

A0	announce.01	AM-TMP	AM-LOC	A1	PropBank
A0	announcement.01	AM-TMP	AM-LOC	A1	NomBank
Agent	say-37.7-1-1			Topic	VerbNet
Speaker	Statement	Time	Place	Message	FrameNet
	IntentionalEvent				ESO
	ili-30-00974367-v				WordNet
arg0	anuncio.01	arg-tmp	arg-loc	arg1	AnCora-Nom
arg0	anunciar.01	arg-tmp	arg-loc	arg1	AnCora-Verb

David Cameron anunció ayer en Londres que los recortes continuarán el próximo año.

Spanish analysis





Dutch news

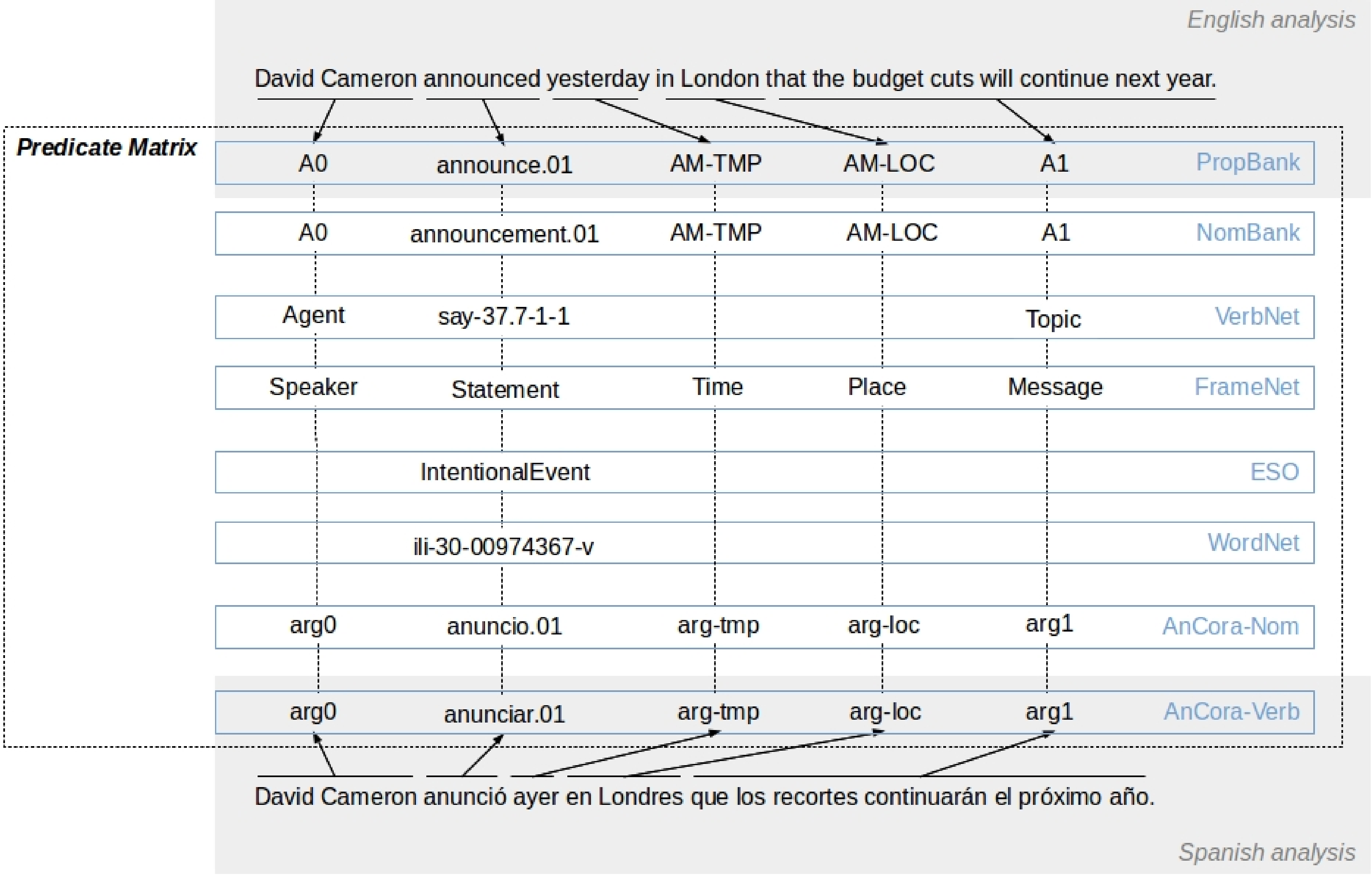
Italian news

Cross-lingual interoperability: Events

- Predicate Matrix is a new lexical resource resulting from the integration of multiple sources of predicate information including FrameNet, VerbNet, PropBank and WordNet.

- http://adimen.si.ehu.es/web/PredicateMatrix

Predicate Matrix



English analysis

David Cameron announced yesterday in London that the budget cuts will continue next year.

Predicate Matrix

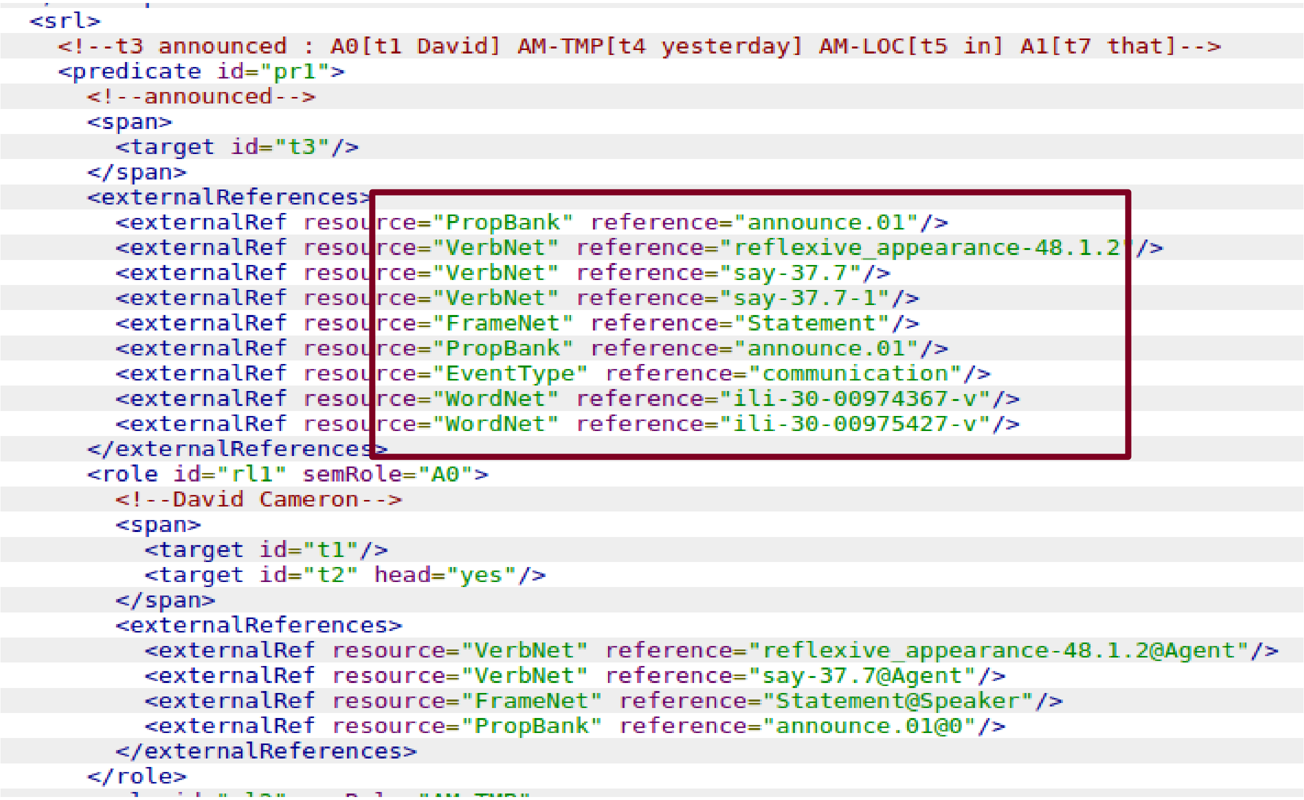
A0	announce.01	AM-TMP	AM-LOC	A1	PropBank
A0	announcement.01	AM-TMP	AM-LOC	A1	NomBank
Agent	say-37.7-1-1			Topic	VerbNet
Speaker	Statement	Time	Place	Message	FrameNet
	IntentionalEvent				ESO
	ili-30-00974367-v				WordNet
arg0	anuncio.01	arg-tmp	arg-loc	arg1	AnCora-Nom
arg0	anunciar.01	arg-tmp	arg-loc	arg1	AnCora-Verb

David Cameron anunció ayer en Londres que los recortes continuarán el próximo año.

Spanish analysis

Cross-lingual interoperability: Events

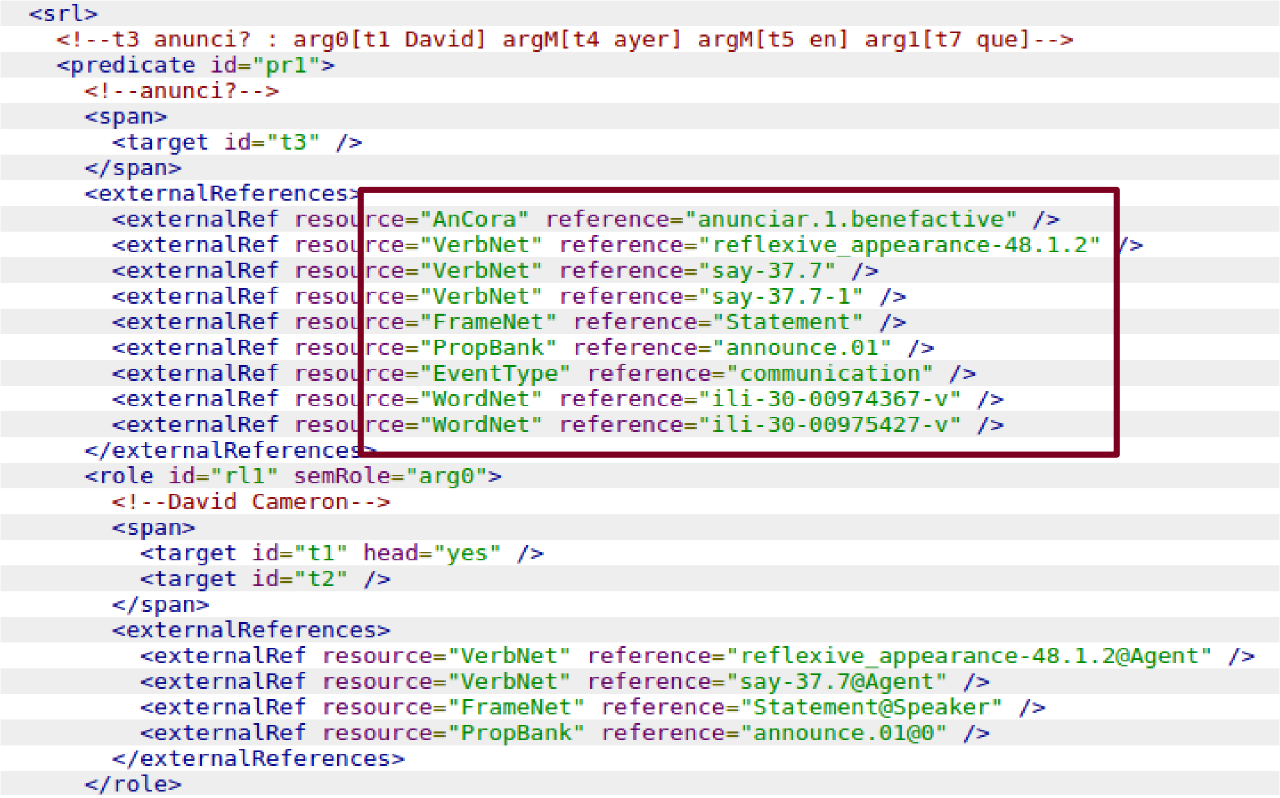
David Cameron **announced** yesterday in London that the budget cuts will continue next year.



```
<srl>
  <!--t3 announced : A0[t1 David] AM-TMP[t4 yesterday] AM-LOC[t5 in] A1[t7 that]-->
  <predicate id="pr1">
    <!--announced-->
    <span>
      <target id="t3"/>
    </span>
    <externalReferences>
      <externalRef resource="PropBank" reference="announce.01"/>
      <externalRef resource="VerbNet" reference="reflexive_appearance-48.1.2"/>
      <externalRef resource="VerbNet" reference="say-37.7"/>
      <externalRef resource="VerbNet" reference="say-37.7-1"/>
      <externalRef resource="FrameNet" reference="Statement"/>
      <externalRef resource="PropBank" reference="announce.01"/>
      <externalRef resource="EventType" reference="communication"/>
      <externalRef resource="WordNet" reference="ili-30-00974367-v"/>
      <externalRef resource="WordNet" reference="ili-30-00975427-v"/>
    </externalReferences>
    <role id="rl1" semRole="A0">
      <!--David Cameron-->
      <span>
        <target id="t1"/>
        <target id="t2" head="yes"/>
      </span>
      <externalReferences>
        <externalRef resource="VerbNet" reference="reflexive_appearance-48.1.2@Agent"/>
        <externalRef resource="VerbNet" reference="say-37.7@Agent"/>
        <externalRef resource="FrameNet" reference="Statement@Speaker"/>
        <externalRef resource="PropBank" reference="announce.01@0"/>
      </externalReferences>
    </role>
```

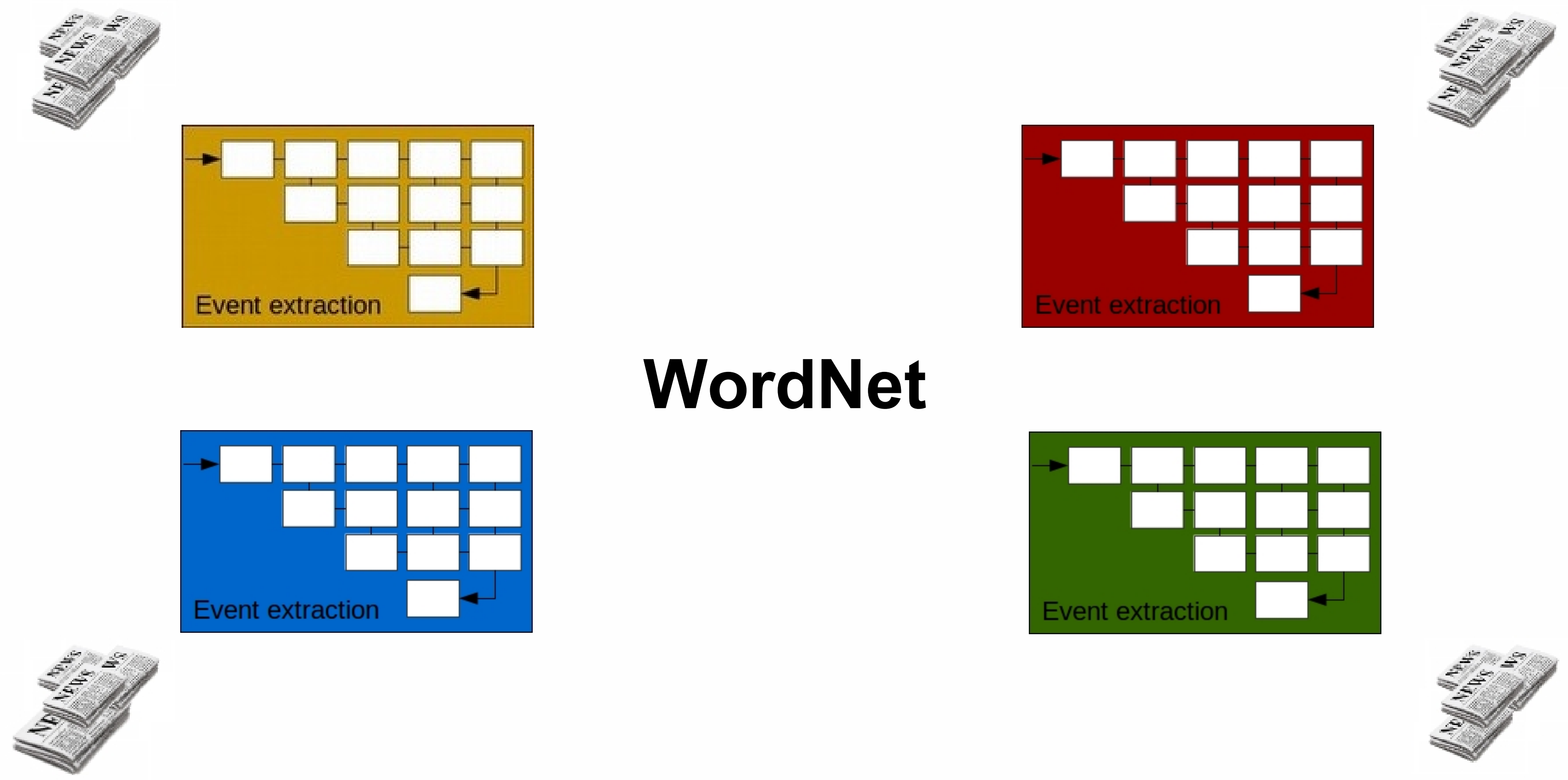
Cross-lingual interoperability: Events

David Cameron **anunció** ayer en Londres que los recortes continuarán el próximo año.



```
<srl>
  <!--t3 anunci? : arg0[t1 David] argM[t4 ayer] argM[t5 en] arg1[t7 que]-->
  <predicate id="pr1">
    <!--anunci?-->
    <span>
      <target id="t3" />
    </span>
    <externalReferences>
      <externalRef resource="AnCora" reference="anunciar.1.benefactive" />
      <externalRef resource="VerbNet" reference="reflexive_appearance-48.1.2" />
      <externalRef resource="VerbNet" reference="say-37.7" />
      <externalRef resource="VerbNet" reference="say-37.7-1" />
      <externalRef resource="FrameNet" reference="Statement" />
      <externalRef resource="PropBank" reference="announce.01" />
      <externalRef resource="EventType" reference="communication" />
      <externalRef resource="WordNet" reference="ili-30-00974367-v" />
      <externalRef resource="WordNet" reference="ili-30-00975427-v" />
    </externalReferences>
    <role id="rl1" semRole="arg0">
      <!--David Cameron-->
      <span>
        <target id="t1" head="yes" />
        <target id="t2" />
      </span>
      <externalReferences>
        <externalRef resource="VerbNet" reference="reflexive_appearance-48.1.2@Agent" />
        <externalRef resource="VerbNet" reference="say-37.7@Agent" />
        <externalRef resource="FrameNet" reference="Statement@Speaker" />
        <externalRef resource="PropBank" reference="announce.01@0" />
      </externalReferences>
    </role>
```

NewsReader: Event detection



English news

Spanish news

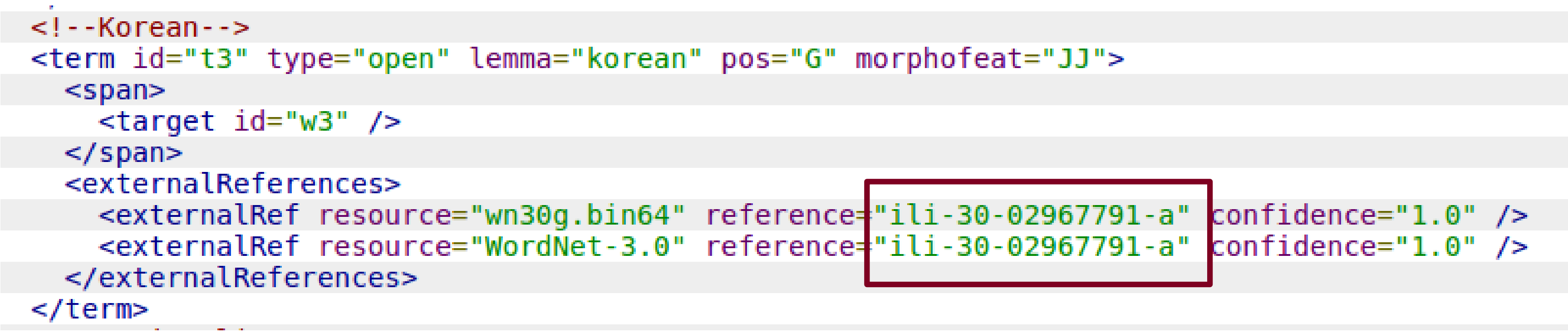
WordNet

Dutch news

Italian news

Cross-lingual interoperability: Concepts

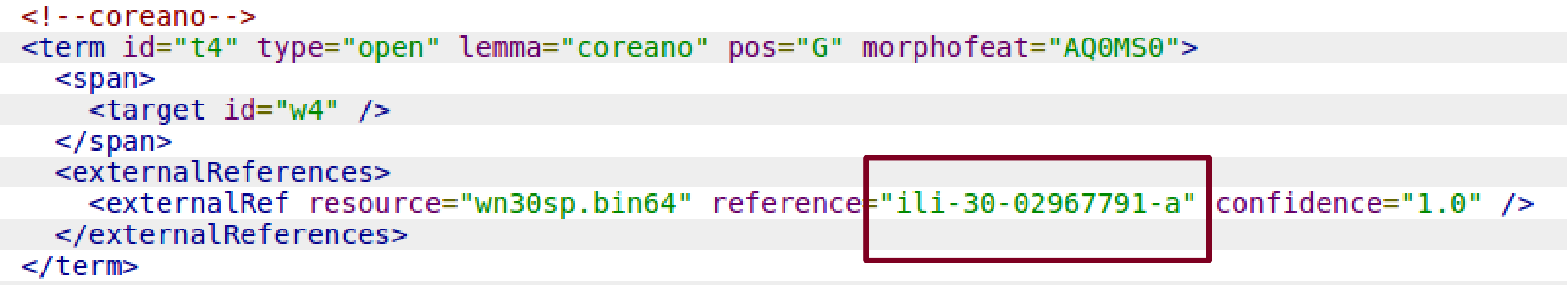
A militant **Korean** nationalist has slashed the face of the US ambassador to South Korea at a breakfast meeting in Seoul.



```
<!--Korean-->
<term id="t3" type="open" lemma="korean" pos="G" morphofeat="JJ">
  <span>
    <target id="w3" />
  </span>
  <externalReferences>
    <externalRef resource="wn30g.bin64" reference="ili-30-02967791-a" confidence="1.0" />
    <externalRef resource="WordNet-3.0" reference="ili-30-02967791-a" confidence="1.0" />
  </externalReferences>
</term>
```

Cross-lingual interoperability: Concepts

Un militante nacionalista **coreano** ha rajado la cara del embajador estadounidense en Corea del Sur en un desayuno de trabajo en Seúl.



```
<!--coreano-->
<term id="t4" type="open" lemma="coreano" pos="G" morphofeat="AQ0MS0">
  <span>
    <target id="w4" />
  </span>
  <externalReferences>
    <externalRef resource="wn30sp.bin64" reference="ili-30-02967791-a" confidence="1.0" />
  </externalReferences>
</term>
```

Cross-lingual interoperability

- **Named entities**
  - **Cross-lingual links** from DBpedia
- **Events**
  - **Predicate Matrix**
  - **Interoperable** event models
    - VN, FN, PB, WN (SUMO, etc.), ESO
  - Extending to **nominal** predicates (EN)
  - **Cross-lingual** PM (EN, ES, NL, IT)
- **Time**
  - **Cross-lingual** time normalization
- **Concepts**
  - **Cross-lingual** wordnets
  - MCR, MultiWordNet, OMW

Open source modules and VMs

- Open source code (>30 modules)
    - http://github.com/newsreader

- Virtual Machines for clusters (automatic deployment)

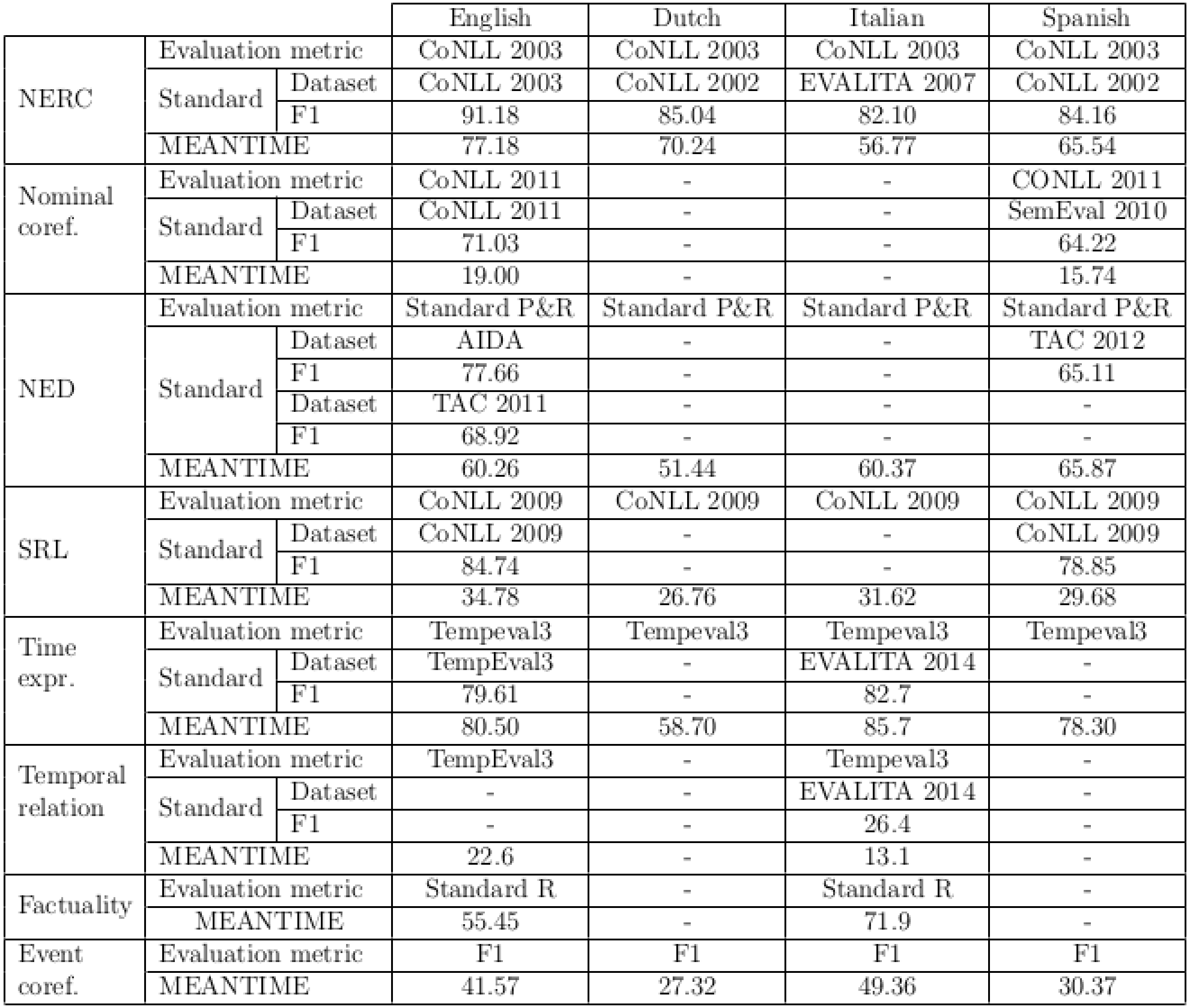
    http://github.com/ixa-ehu/vmc-from-scratch

NLP Benchmarking

- Intra-document Benchmarking
  - On **standard datasets** (EN, ES, IT, NL)
    - CoNLLs, AIDA, TAC, TempEval, Evalita, etc.
  - **MEANTIME**
    - WikiNews (EN, ES, IT, NL) :
      - 19K English, 8K Italian, 7K Spanish and 1K Dutch
    - 120 documents (EN **manually translated** to ES, IT, NL)
    - 600 sentences per language **manually annotated** at multiple levels
    - Using CAT (intra-document) and CROMER (cross-document)
    - Timelines (SemEval-2015)

NLP benchmarking

- Intra-document Benchmarking
  - **No standard datasets** for all languages and tasks
  - All **advanced** components
    - NERC (EN, ES, IT, NL)
    - NED (EN, ES, IT, NL)
    - Nominal Coref (EN, ES)
    - SRL (EN, ES, IT, NL)
    - Factuality (EN, IT, *ES*)
    - Temporal Normalization (EN, ES, IT, NL)
    - Temporal Relation (EN, IT, *ES*)
    - Event Coref (EN, ES, IT, NL)



			English	Dutch	Italian	Spanish
NERC	Evaluation metric		CoNLL 2003	CoNLL 2003	CoNLL 2003	CoNLL 2003
	Standard	Dataset	CoNLL 2003	CoNLL 2002	EVALITA 2007	CoNLL 2002
		F1	91.18	85.04	82.10	84.16
	MEANTIME		77.18	70.24	56.77	65.54
Nominal coref.	Evaluation metric		CoNLL 2011	-	-	CONLL 2011
	Standard	Dataset	CoNLL 2011	-	-	SemEval 2010
		F1	71.03	-	-	64.22
	MEANTIME		19.00	-	-	15.74
NED	Evaluation metric		Standard P&R	Standard P&R	Standard P&R	Standard P&R
	Standard	Dataset	AIDA	-	-	TAC 2012
		F1	77.66	-	-	65.11
		Dataset	TAC 2011	-	-	-
		F1	68.92	-	-	-
	MEANTIME		60.26	51.44	60.37	65.87
SRL	Evaluation metric		CoNLL 2009	CoNLL 2009	CoNLL 2009	CoNLL 2009
	Standard	Dataset	CoNLL 2009	-	-	CoNLL 2009
		F1	84.74	-	-	78.85
	MEANTIME		34.78	26.76	31.62	29.68
Time expr.	Evaluation metric		Tempeval3	Tempeval3	Tempeval3	Tempeval3
	Standard	Dataset	TempEval3	-	EVALITA 2014	-
		F1	79.61	-	82.7	-
	MEANTIME		80.50	58.70	85.7	78.30
Temporal relation	Evaluation metric		TempEval3	-	Tempeval3	-
	Standard	Dataset	-	-	EVALITA 2014	-
		F1	-	-	26.4	-
	MEANTIME		22.6	-	13.1	-
Factuality	Evaluation metric		Standard R	-	Standard R	-
	MEANTIME		55.45	-	71.9	-
Event coref.	Evaluation metric		F1	F1	F1	F1
	MEANTIME		41.57	27.32	49.36	30.37

Table 54: Evaluation results on Standard benchmark datasets and NewsReader MEANTIME in the 4 languages of the project

NLP benchmarking (EN)

- Most **complete** evaluation for EN
    - All standard datasets (except Time Relations)
    - All MEANTIME annotations
- **SOA** results in standard datasets
    - NERC (**new** SOA)
- Best results on all tasks, **except** in MEANTIME:
    - NED (ES)
    - Time Detection (IT)
    - Factuality (IT)
    - V-Coref (IT)
- Significant **drop** between standard and MEANTIME

NLP benchmarking (NL)

- Most **complete** evaluation for NL
  - Except N-coref, TempRel, Factuality
  - Standard datasets (only NERC)
- NERC (**new** SOA)
- Slightly lower results on some tasks in MEANTIME (except NERC which obtains the best results)
- **Less resources and datasets** than other languages
- Almost **no standard datasets** for advanced tasks
  - No comparison between standard and MEANTIME

NLP benchmarking (IT)

- Most **complete** evaluation for IT
  - Except N-coref
- NERC (**new** SOA)
- **Best** results in:
  - Time Detection
  - Factuality
  - V-coref
- **No standard datasets** for advanced tasks
  - N-coref
  - NED
  - SRL

NLP benchmarking (ES)

- Most **complete** evaluation for ES
  - Except Temporal Relation, Factuality
- NERC (**new** SOA)
- **Best** results in:
  - NED MEANTIME
- **No standard datasets** for advanced tasks
  - Temporal Relations (incomplete)
  - Factuality

NLP benchmarking

- Most modules perform as **SOA**
- NERC **best results**
    - all languages (EN, ES, IT, NL, DE, EU)
    - **in** and **out** of domain
- **Similar results** across languages
    - when having appropriate linguistic resources and annotation datasets
- **Very difficult** tasks:
    - Time relations, Coref
- Significant **drop** in performance between Standard and MEANTIME on most tasks
    - N-coref: singletons, guidelines, cascading errors
    - SRL: guidelines (TimeML vs. SRL annotation!)

NewsReader

Building structured event indexes
of large volumes of financial and economic data
for making decisions
FP7-2012-ICT-315404

WP4 Event Detection

The team

Rodrigo Agerri, Itziar Aldabe, Zuhaitz Beloki, Egoitz Laparra, German Rigau, Aitor Soroa, Mariek van Erp, Antske Fokkens, Filip Ilievski, Ruben Izquierdo, Roser Morante, Chantal van Son, Piek Vossen, Anne-Lyse Minard