How to Represent the Content of Free-form Battlefield Reports

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Content

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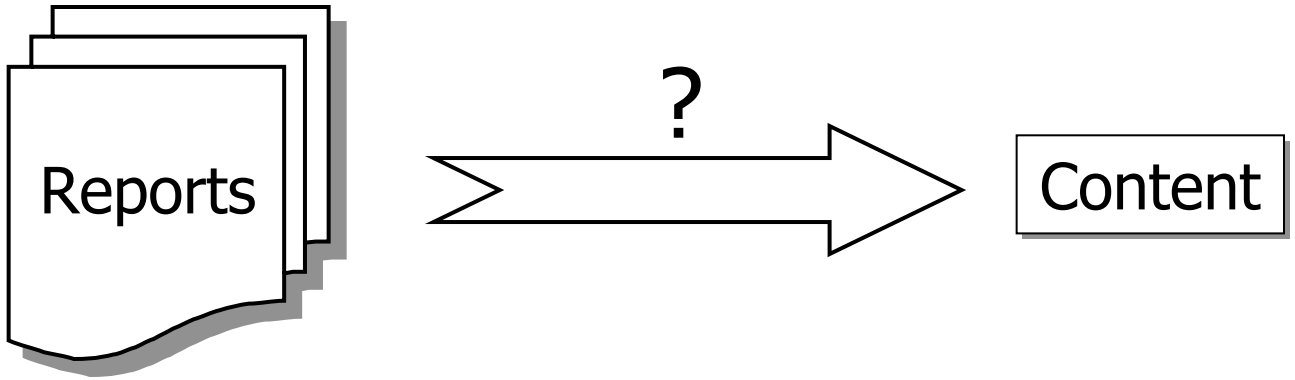
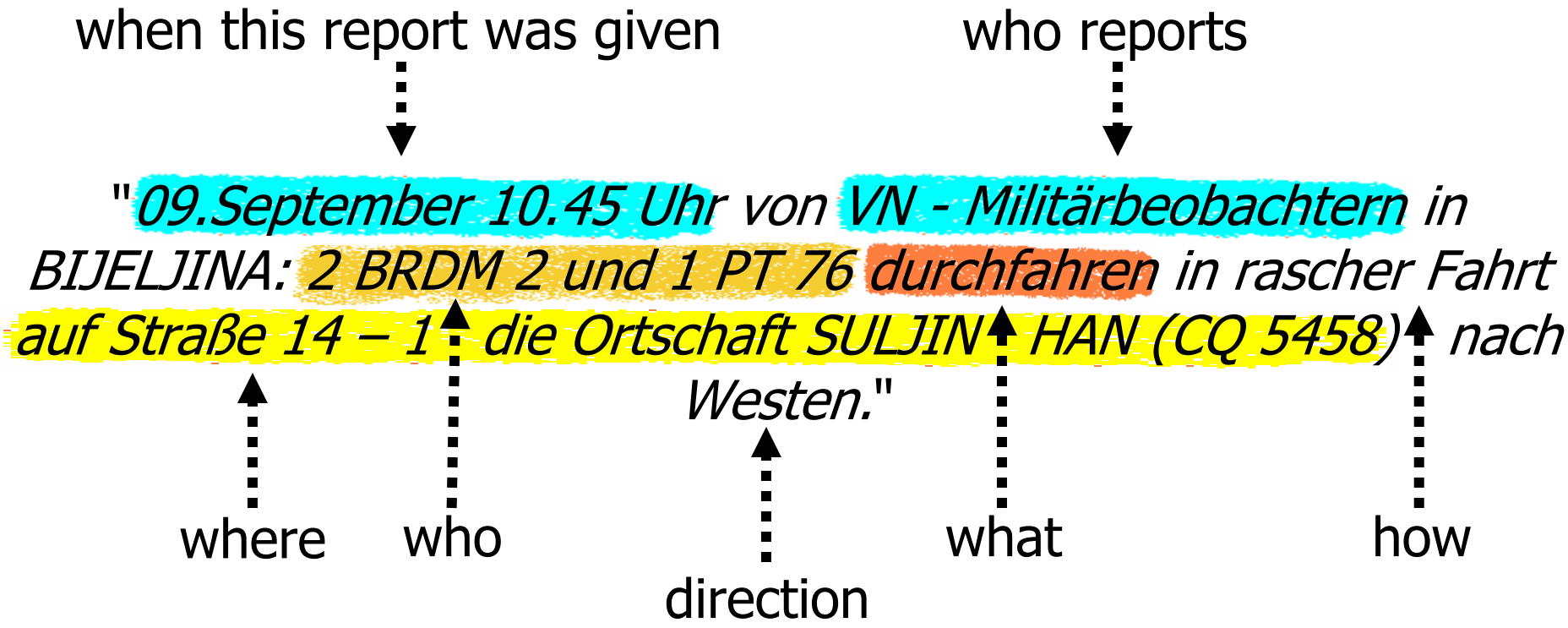


- There are a lot of natural language texts (military reports, emails, web pages, scientific reports, documents, ...) which can't be evaluated due to missing specialists.
- Which technical possibilities exist of automating the content extraction?

➔ Practical approach: Information Extraction (IE)

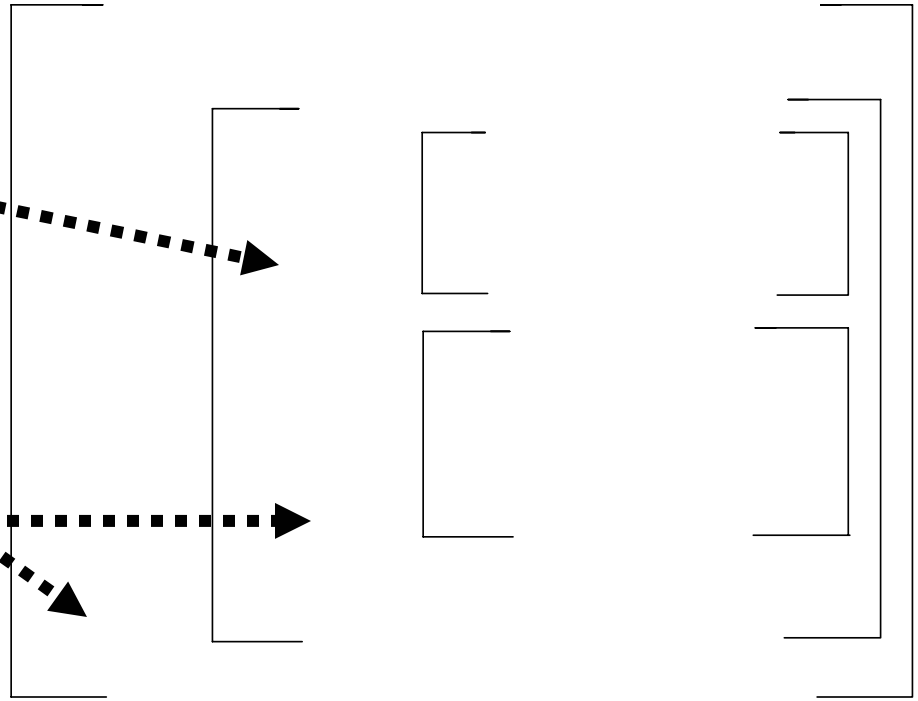
- Information extraction (IE) is the task of identifying, collecting and normalizing information from natural language text.
- Relevant information about the Who, What, When, etc. is looked for.
- The information of interest is described through domain-specific lexicon rules and patterns called *templates*.
- During the IE task these templates are filled with the collected information.
- The templates are domain and task specific, i.e. for each new task and domain they must be newly created.

Partial analysis of a military free-form report from our Bosnia scenario :



Report ⇒ Formal representation of content

"... in BIJELJINA:
2 BRDM 2 und 1 PT 76
durchfahren
n rascher Fahrt
auf Straße 14 – 1
lie Ortschaft SULJIN
HAN (CQ 5458) nach
Vesten."



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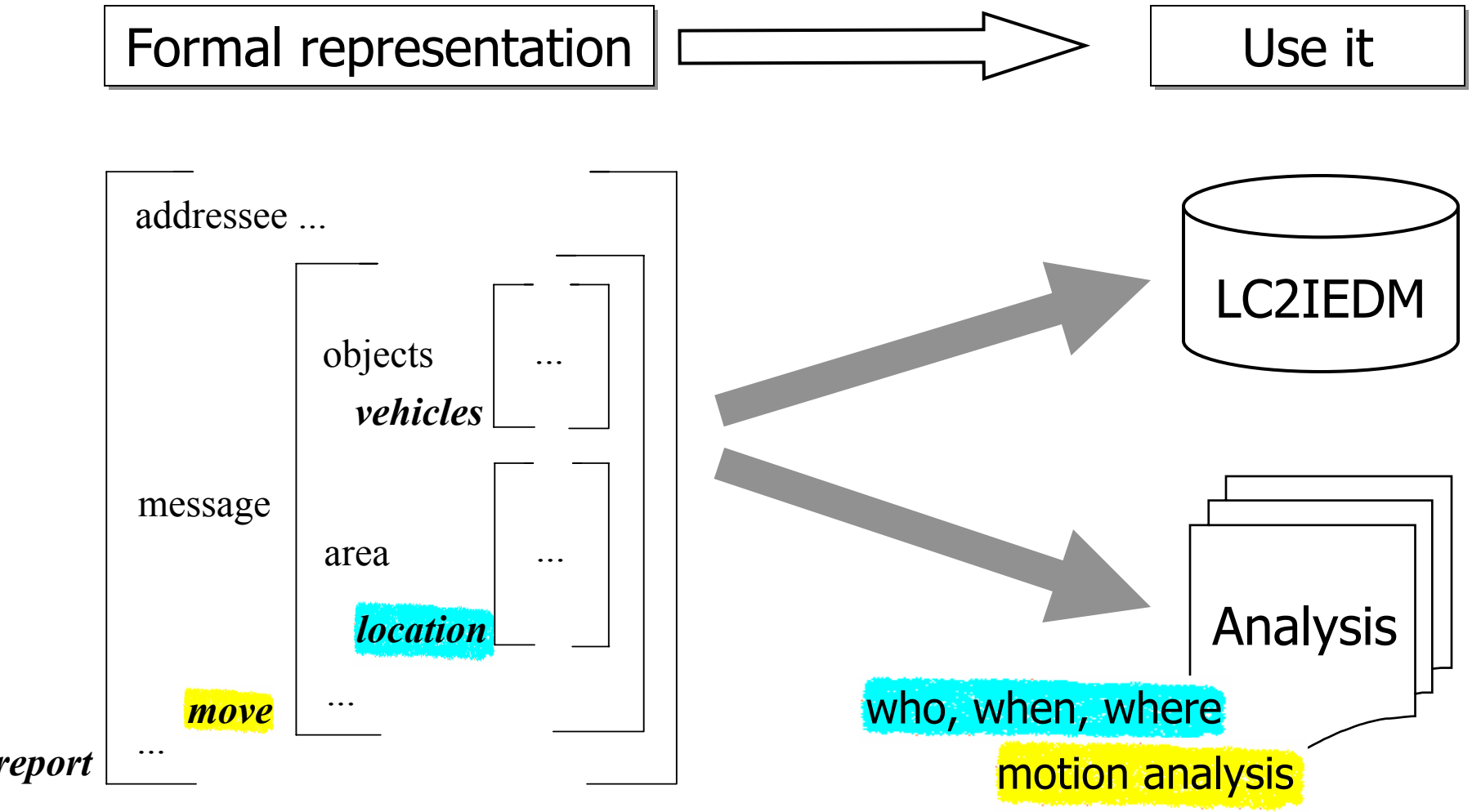
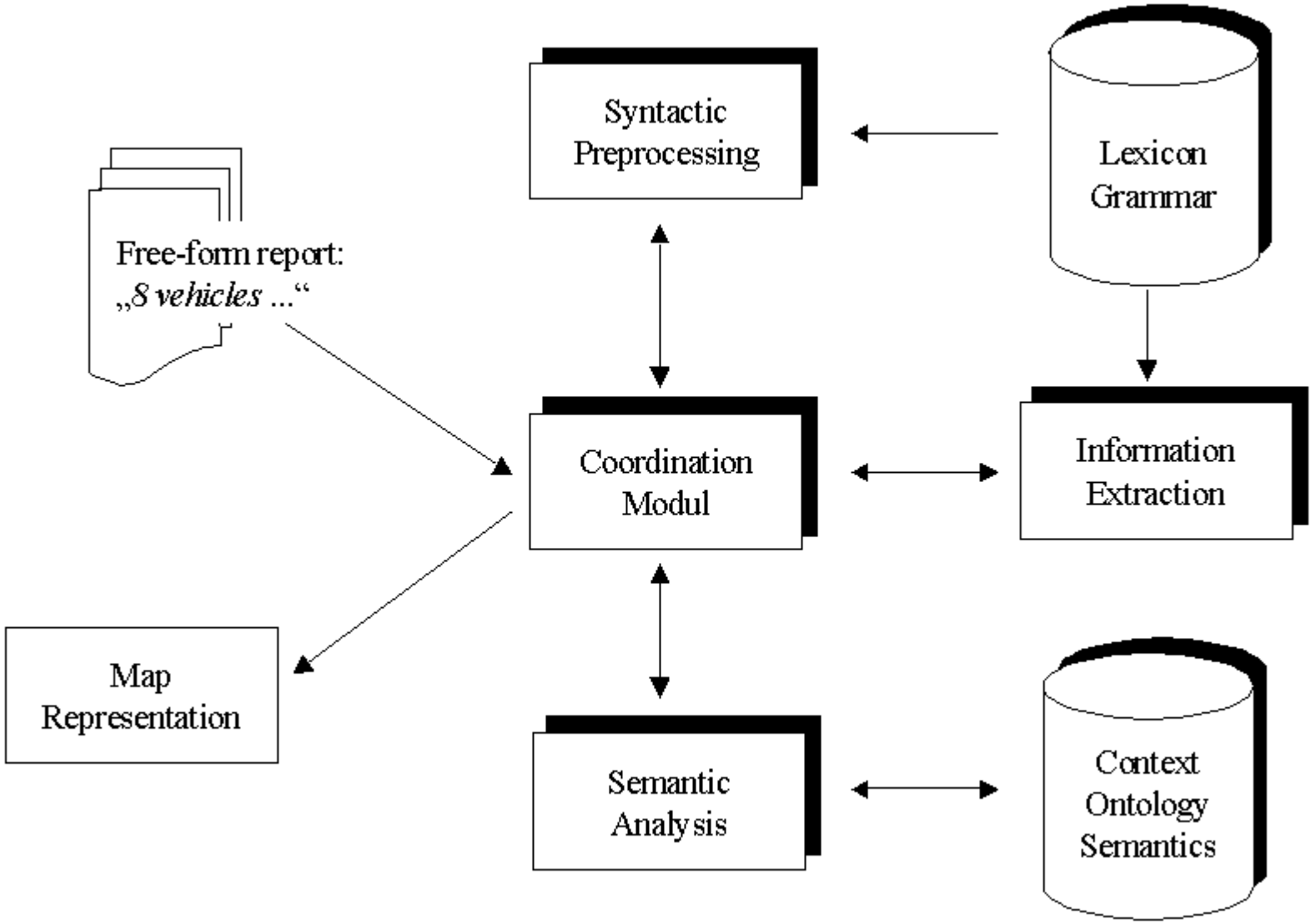
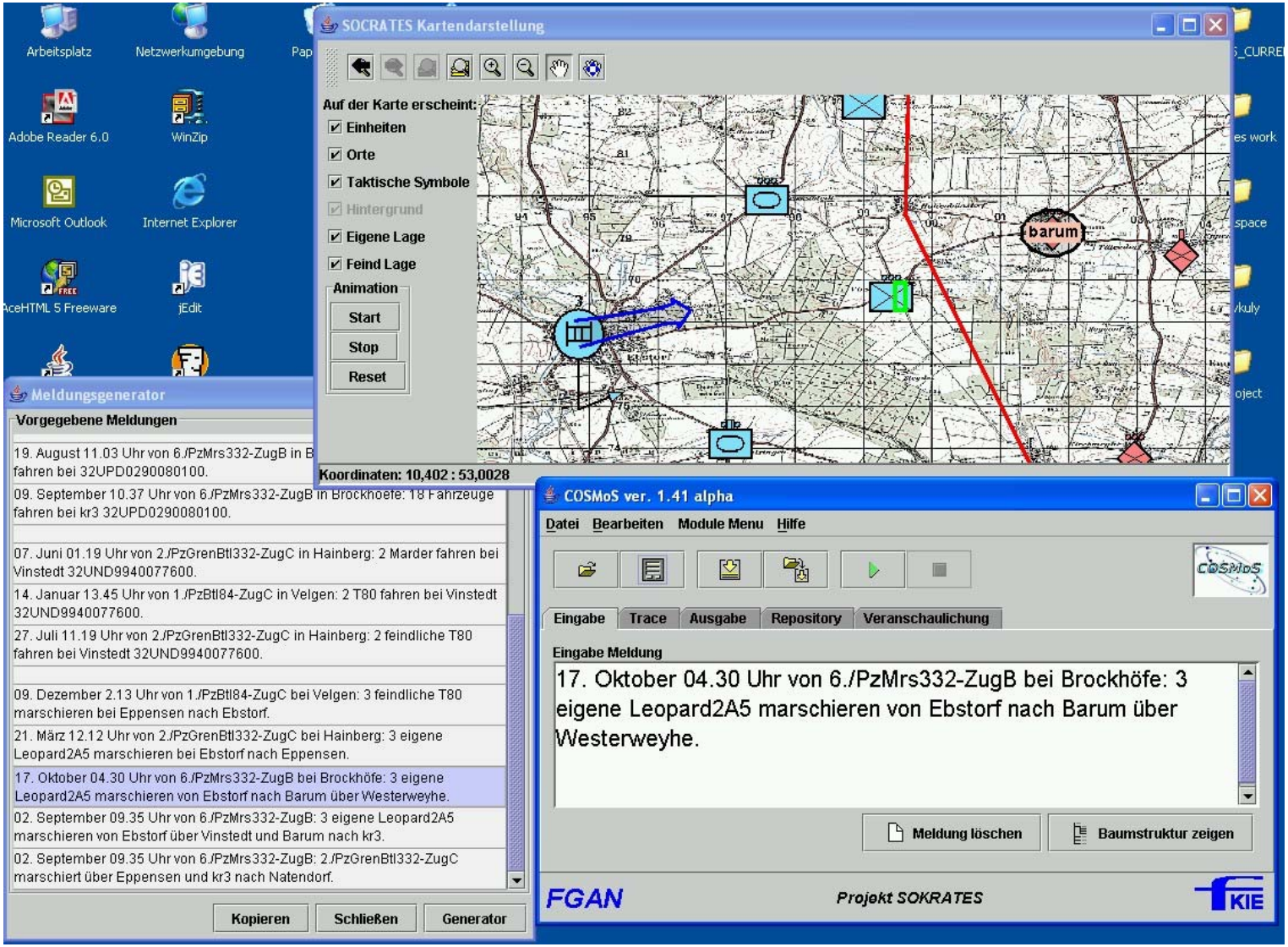

Formal representation
Use it
addressee ...
objects
...
vehicles
message
area
...
location
...
move
...
report
LC2IEDM
Analysis
who, when, where
motion analysis

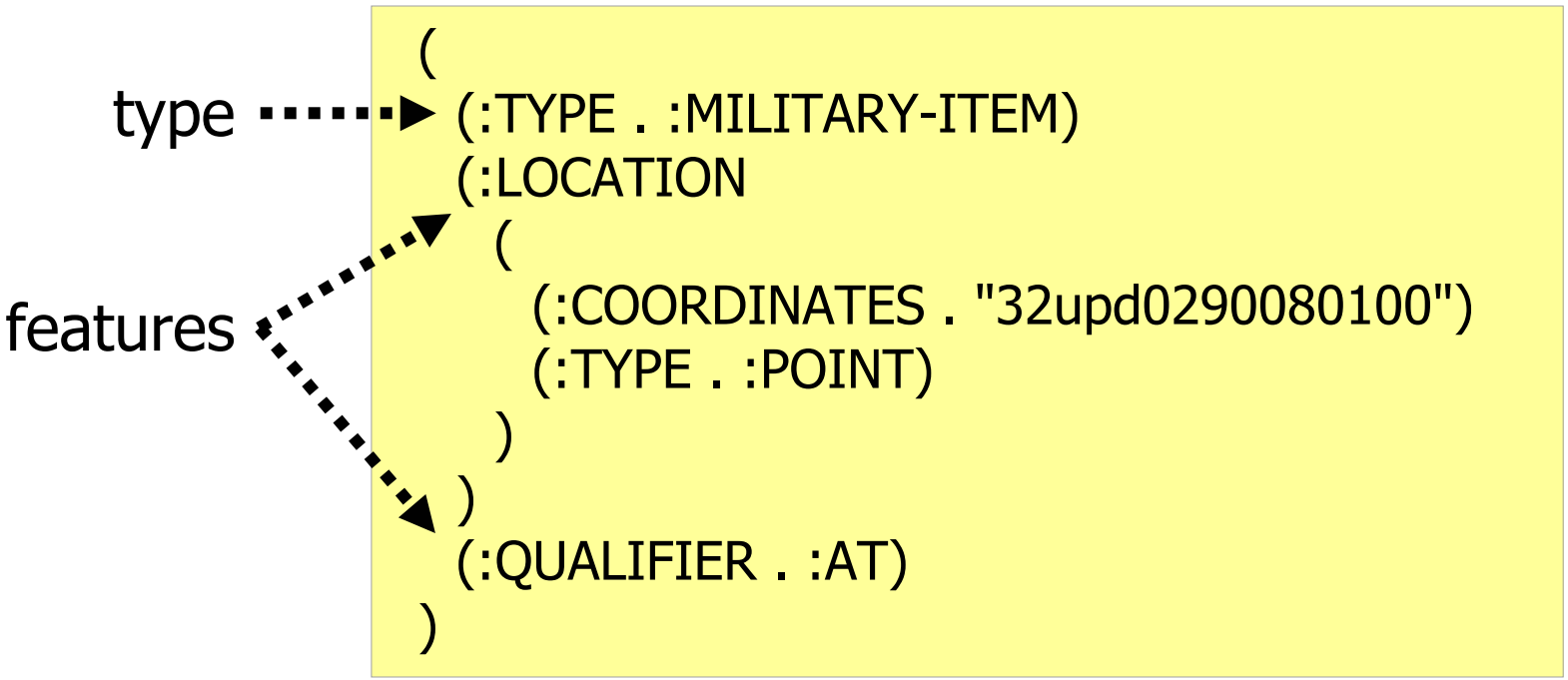
The research project Sokrates:

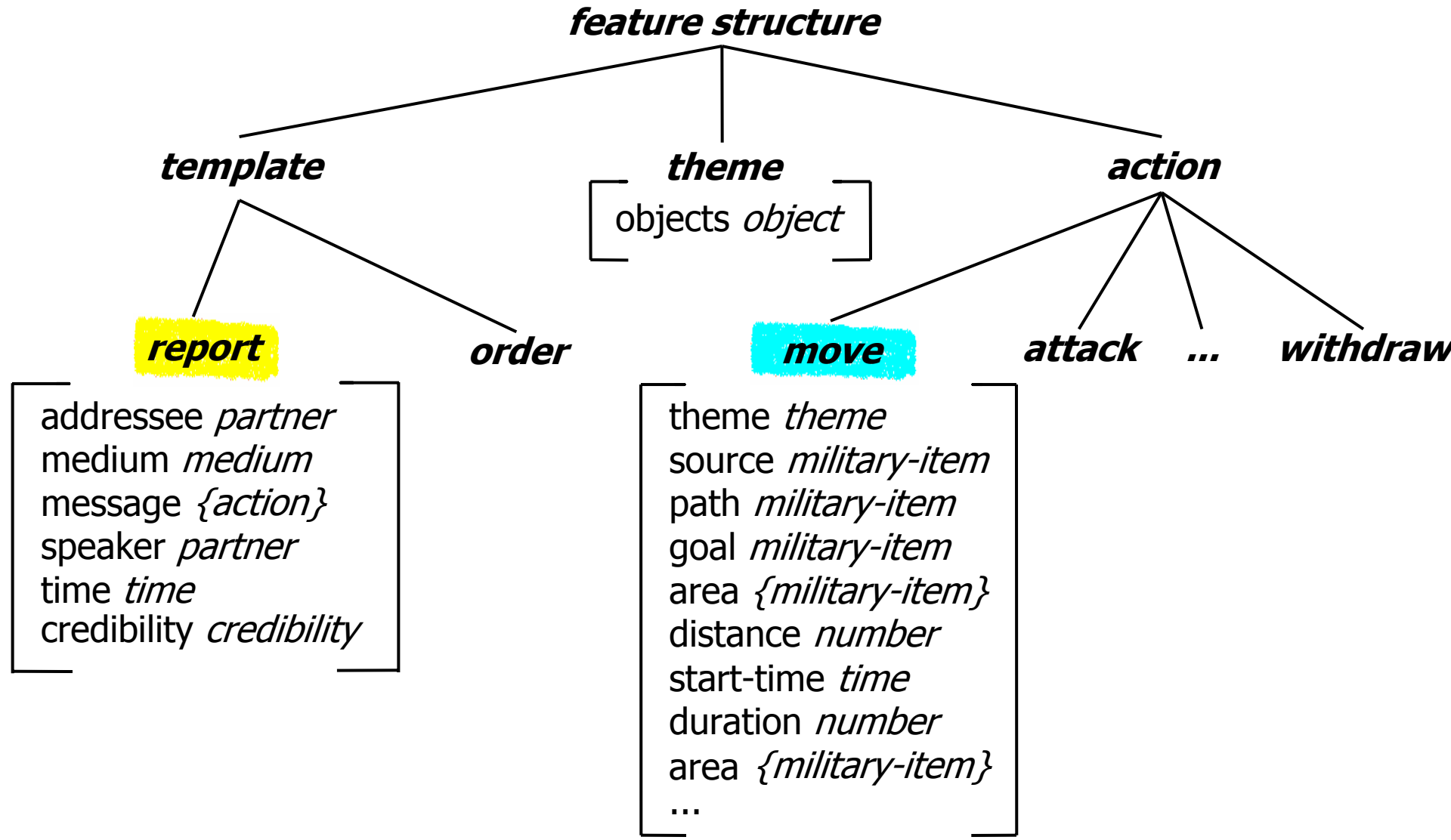
- The overall objective of the Sokrates project is to analyze written German battlefield reports (type **move**).
- The applicability of the information extraction technology in the military domain was shown.
- Combines IE with the semantic analysis, in which ontologies are used.
- The result of the analysis is stored in the LC2IEDM database. These stored results can be used for different purposes.
- One purpose is that location changes of units initiate automatically changes of tactical symbols on the tactical map.
- A prototype of the system was realized.


Syntactic Preprocessing
Lexicon Grammar
Free-form report:
„8 vehicles ...“
Coordination Modul
Information Extraction
Map Representation
Semantic Analysis
Context Ontology Semantics


SOCRATES Kartendarstellung
Auf der Karte erscheint:
Einheiten
Orte
Taktische Symbole
Hintergrund
Eigene Lage
Feind Lage
Animation
Start
Stop
Reset
barum
Koordinaten: 10,402 : 53,0028
Meldungsgenerator
Vorgegebene Meldungen
19. August 11.03 Uhr von 6./PzMrs332-ZugB in B fahren bei 32UPD0290080100.
09. September 10.37 Uhr von 6./PzMrs332-ZugB in Brockhoefe: 18 Fahrzeuge fahren bei kr3 32UPD0290080100.
07. Juni 01.19 Uhr von 2./PzGrenBtl332-ZugC in Hainberg: 2 Marder fahren bei Vinstedt 32UND9940077600.
14. Januar 13.45 Uhr von 1./PzBtl84-ZugC in Velgen: 2 T80 fahren bei Vinstedt 32UND9940077600.
27. Juli 11.19 Uhr von 2./PzGrenBtl332-ZugC in Hainberg: 2 feindliche T80 fahren bei Vinstedt 32UND9940077600.
09. Dezember 2.13 Uhr von 1./PzBtl84-ZugC bei Velgen: 3 feindliche T80 marschieren bei Eppensen nach Ebstorf.
21. März 12.12 Uhr von 2./PzGrenBtl332-ZugC bei Hainberg: 3 eigene Leopard2A5 marschieren bei Ebstorf nach Eppensen.
17. Oktober 04.30 Uhr von 6./PzMrs332-ZugB bei Brockhöfe: 3 eigene Leopard2A5 marschieren von Ebstorf nach Barum über Westerweyhe.
02. September 09.35 Uhr von 6./PzMrs332-ZugB: 3 eigene Leopard2A5 marschieren von Ebstorf über Vinstedt und Barum nach kr3.
02. September 09.35 Uhr von 6./PzMrs332-ZugB: 2./PzGrenBtl332-ZugC marschiert über Eppensen und kr3 nach Natendorf.
Kopieren
Schließen
Generator
COSMoS ver. 1.41 alpha
Datei Bearbeiten Module Menu Hilfe
Eingabe
Trace
Ausgabe
Repository
Veranschaulichung
Eingabe Meldung
17. Oktober 04.30 Uhr von 6./PzMrs332-ZugB bei Brockhöfe: 3 eigene Leopard2A5 marschieren von Ebstorf nach Barum über Westerweyhe.
Meldung löschen
Baumstruktur zeigen
FGAN
Projekt SOKRATES
FKIE

- Representation of meaning by typed feature structures (FS)
- A FS consists of a set of features (name + value) and a type:




feature structure
template
theme
objects object
action
report
order
move
attack
...
withdraw
addressee partner
medium medium
message {action}
speaker partner
time time
credibility credibility
theme theme
source military-item
path military-item
goal military-item
area {military-item}
distance number
start-time time
duration number
area {military-item}
...

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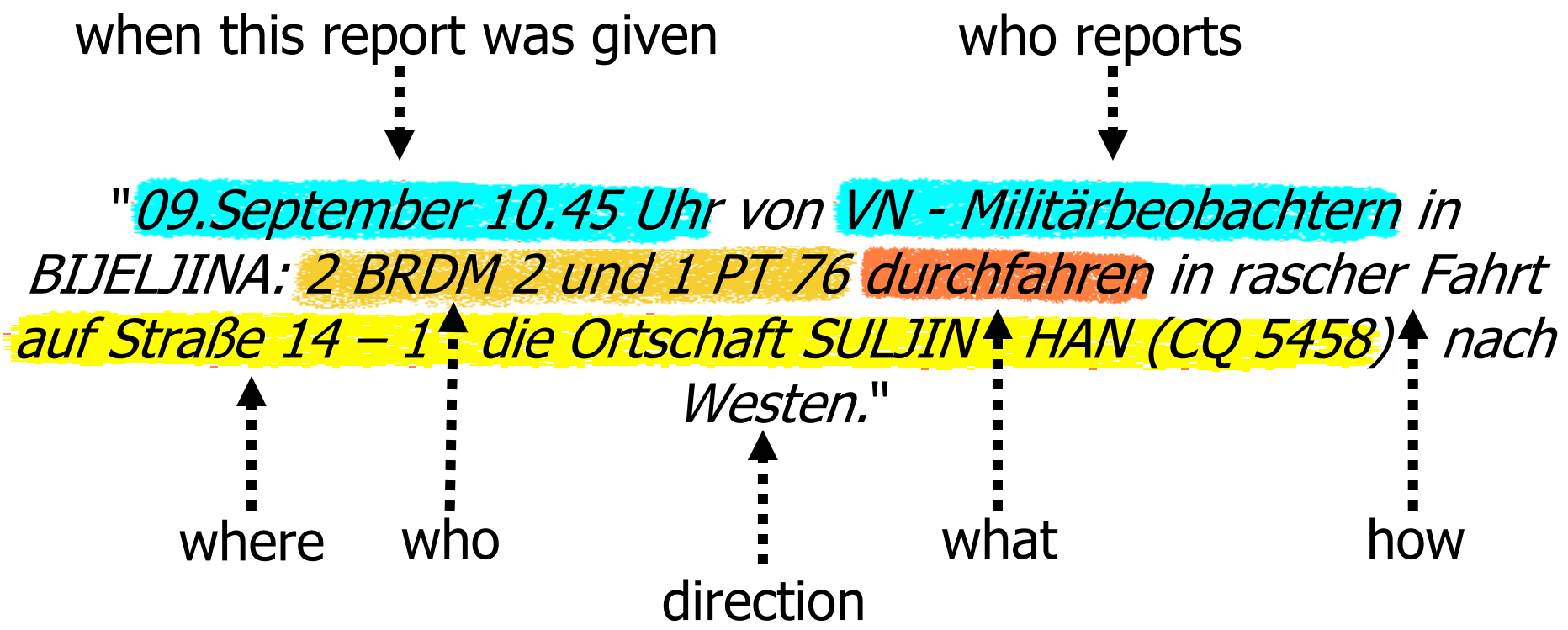

when this report was given
who reports
"09.September 10.45 Uhr von VN - Militärbeobachtern in BIJELJINA: 2 BRDM 2 und 1 PT 76 durchfahren in rascher Fahrt auf Straße 14 – 1 die Ortschaft SULJIN HAN (CQ 5458) nach Westen."
where
who
direction
what
how

part	***09.September 10.45 Uhr***
phrase	date
feature structure A	((:TYPE . :TIME) (:MINUTE . 45) (:HOUR . 10) (:MONTH . 9) (:DAY . 9))
synt. funct.	
feature structure B	(:TIME ((:TYPE . :TIME) (:MINUTE . 45) (:HOUR . 10) (:MONTH . 9) (:DAY . 9)))

← syntactical phrase

← FS of the phrase

← syntactical function

← in FS **move**

part	***von VN - Militärbeobachtern***	***in BIJELJINA:***
phrase	who reports	location of who reports
feature structure A	((:TYPE . :UNIT) (:NAME . "VN-Militärbeobachter") (:ABBREVIATION . "VN-MilBeob"))	((:TYPE . :TOWN) (:NAME . "bijeljina") (:QUALIFIER . :EXACTLY-AT))
synt. funct.		
feature structure B	(:SPEAKER ((:TYPE . :UNIT) (:NAME . "VN-Militärbeobachter") (:ABBREVIATION . "VN-MilBeob") (:LOCATED ((:TYPE . :TOWN) (:NAME . "bijeljina") (:QUALIFIER . :EXACTLY-AT) ...	

part	***2 BRDM 2***	***und***	***1 PT 76***
phrase	NP-1	conj	NP-2
feature structure A	((:TYPE . :TANK) (:ABBREVIATION. "brdm-2") (:COUNT . 2))	:SET	((:TYPE . :TANK) (:ABBREVIATION . "pt76") (:COUNT . 1))
synt. funct.	subject		
feature structure B	(:OBJECTS (:SET (((:TYPE . :TANK) (:ABBREVIATION . "brdm-2") (:COUNT . 2)) ((:TYPE . :TANK) (:ABBREVIATION . "pt76") (:COUNT . 1))) …		

part	***durchfahren***	***in rascher Fahrt***
phrase	VP	PP
feature structure A	(:TYPE . :MOVE)	((:VALUE . :FAST) (:TYPE . :PROPERTY))
synt. funct.	predicate	adverbial
feature structure B	(:TYPE . :MOVE)	(:QUALIFIERS (:SET (((:VALUE . :FAST) (:TYPE . :PROPERTY)))))

part	***auf Straße 14 - 1***	***die Ortschaft SULJIN HAN (CQ 5458)***
phrase	PP	NP
feature structure A	((:TYPE . :WAY) (:NAME . "14-1") (:QUALIFIER . :ON))	((:LOCATION ((:COORDINATES . "cq5458") (:TYPE . :POINT))) (:NAME "suljin han") (:TYPE . :TOWN))
synt. funct.	adverbial	object
feature structure B	(:AREA (:SET (((:TYPE . :WAY) (:NAME . "14-1") (:QUALIFIER . :ON)) ((:LOCATION ((:COORDINATES . "cq5458") (:TYPE . :POINT))) (:NAME "suljin han") (:TYPE . :TOWN)))))	

part	***nach Westen.***
phrase	PP
feature structure A	((:QUALIFIER . :TOWARDS) (:DIRECTED-TO . :WEST) (:TYPE . :DIRECTION))
synt. funct.	adverbial
feature structure B	(:GOAL ((:QUALIFIER . :TOWARDS) (:DIRECTED-TO . :WEST) (:TYPE . :DIRECTION)))

Equipment:

- Examples: "Auto", "Bus", "LKW", "PKW", "Panzer","Haubitze", "Wiesel", "Marder", "Leopard", "AML – 90", "BRDM 2", "BM - 22 Mehrfachraketenwerfer 220 mm", "2 feindliche T80", "Fahrzeug", ...

```
(
  (:TYPE . :TANK) (:COUNT . 2)
  (:NAME . "t80") (:ABBREVIATION . "t80")
  (:QUALIFIERS
    (:SET
      (
        :HOSTILE
      )
    )
  )
)
```

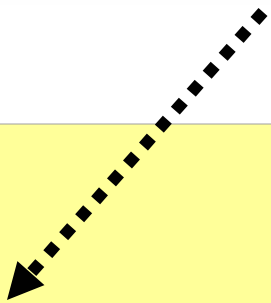
Units:

- Examples: "Infanteriezug", "PzMrsKp (GE) in Wriedel (Zug bei Brockhoefe (32UND8610075100))", ...

```
(:SPEAKER
  ( (:SECOND-PARTNER
      ( (:NAME . "Zug") (:TYPE . :UNIT) (:SIZE . :PLT) (:ABBREVIATION . "Zug")
        (:LOCATED
          ( (:TYPE . :TOWN) (:NAME . "brockhoefe") (:LOCATION … ) (:QUALIFIER . :AT)))))
    (:FIRST-PARTNER
      ( (:NATIONALITY . :GE) (:ARM-CAT . :ARMOUR) (:SIZE . :COY)
        (:NAME . "Panzer Mörser Kompanie") (:TYPE . :UNIT)
        (:LOCATED
          ( (:TYPE . :TOWN) (:NAME . "wriedel") (:QUALIFIER . :EXACTLY-AT)))))
    (:TYPE . :MULTIPLE-PARTNER)
  )
)
```

Locations:

- Examples: "CQ 123456", "BANOVICI (YK 1234)", "die Straßenkreuzung kr3", "kr5 (CQ 072368)", "kr3", "Stellung 1.3 (CQ 072368)", "Straßenkreuzung (CQ 072368) südlich MILESKIJ (CQ 0737)", ...



```
(
  (:QUALIFIERS
    (:SET
      (
        ( (:TYPE . :TOWN) (:NAME . "mileskij") (:QUALIFIER . :SOUTH-OF)
          (:LOCATION ( (:COORDINATES . "cq737") (:TYPE . :POINT))))
      )
  )
  (:LOCATION ( (:COORDINATES . "cq72368") (:TYPE . :POINT)))
  (:TYPE . :CROSSING)
)
```

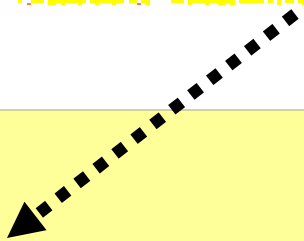
Nominal phrases:

- Examples: "1 LKW", "neun Busse", "1 beschädigter Panzer", 1 serbisches Fahrzeug", "1 großer LKW", 1 eigener Leo", "1 zerstörter T80", "11 kroatische Fahrzeuge", "zwölf wiesel 1 tow", "Vier alte leopard 1a5", "2 AML - 90 und 1 BRDM 2" "2 feindliche T80", "1 funktionsuntüchtiger bm - 22 mehrfachraketenwerfer 220 mm", "2 AML - 90 und 1 BRDM 2", ...

```
(
   (:TYPE . :TANK)
   (:ABBREVIATION . "bm22")
   (:QUALIFIERS (:SET (:DAMAGED)))
   (:COUNT . 1)
)
```

Prepositional phrases:

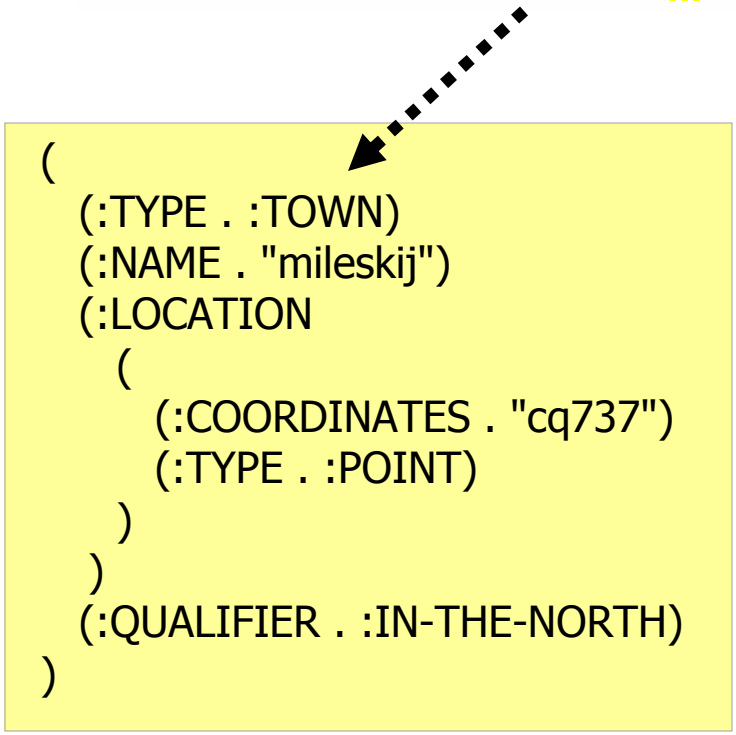
- Examples: "bei Ebstorf (CQ 123456)", "bei kr7 (32UPD0290080100)", "nach Osten", "in Richtung Straßenkreuzung (CQ 072368)", "in Stellung 1.3 (CQ 123456)", "von Ebstorf (CQ 123456) über Banovici (YK 45678) nach Berlin (CQ 56789)", "auf Straße 14 – 1", "bis Ebstorf (CQ 123456)", "durch Ebstorf (CQ 123456)", ...



```
(
  (:TYPE . :TOWN)
  (:NAME . "ebstorf")
  (:LOCATION ((:COORDINATES . "cq123456")(:TYPE . :POINT)))
  (:QUALIFIER . :THROUGH)
)
```

Other phrases:

- Examples: "östlich der Straßenkreuzung (CQ 072368)", "in schneller Fahrt", "im Norden von MILESKIJ (CQ 0737)", ...



```
(
  (:TYPE . :TOWN)
  (:NAME . "mileskij")
  (:LOCATION
    (
      (:COORDINATES . "cq737")
      (:TYPE . :POINT)
    )
   )
  (:QUALIFIER . :IN-THE-NORTH)
)
```

- A short introduction to the promising field of information extraction (IE) through an example was given.
- Our research project Sokrates was presented.
- In the main part of the talk, the formalism (feature structures) to represent the meaning of free-form battlefield reports was described in detail.