Automatic Report Processing

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Preliminary Remarks

With respect to forces, NCW demands

- clear and consistent understanding of command intent,
- shared situational awareness,
- competence at all levels of the force,
- trust (in subordinates, superiors, peers, information, and equipment)

cf. Alberts & Hayes (2003): *Power to the Edge*
Preliminary Remarks

The same holds for the IT-systems. NCW demands:

- **adaptability** to command intent,
- **interoperability** (to achieve shared awareness),
- **competence,**
- **reliability.**

To show:
IT-systems need **ontological** components to answer these demands.
Structure of the Talk

- Preliminary Remarks
- SOKRATES: A Report Processing System
- Examples
- Benefits
The SOKRATES-System for Report Processing

Input: reports written in natural language

• Five hostile battle tanks approaching.
• Five Bradyland howitzers moving from Nederveert to Helmond via Someren.
• Arrived at 31UFT785235.

Output:
• visualization of the report’s content on a map
• insertion of the content into a C2I EDM data base
The SOKRATES-System for Report Processing

- **Report**
  - Sentence Recognition
  - Information Extraction
  - Semantic Augmentation
    - Context Ontology Semantic
    - Lexicon Grammar
    - Post-Processing
      - Visualization on the map
      - Actualization of the data base

FGAN Informationstechnik und Führungssysteme
The SOKRATES-System for Report Processing

**Information Extraction**
transforms the report into a formal representation.

**Semantic Augmentation**
adds to the representation
by ontological exploitation of knowledge.

**Post-Processing**
visualizes the resulting content on a map and
stores the resulting content in a C2IEDM data base.
The SOKRATES-System for Report Processing
The SOKRATES-System for Report Processing

Information Extraction transforms the report into a formal representation.

051218ZSEP04
by 4./PzGrenBtl332-Zug C: Standing at Nederveert

```
<table>
<thead>
<tr>
<th>rep_d:</th>
<th>type: in_position</th>
</tr>
</thead>
<tbody>
<tr>
<td>agent:</td>
<td>type: unit</td>
</tr>
<tr>
<td>name:</td>
<td>4./PzGren...</td>
</tr>
</tbody>
</table>

... |
loc: | type: town |
name: | Nederveert |
```
The SOKRATES-System for Report Processing

<table>
<thead>
<tr>
<th>type</th>
<th>report</th>
</tr>
</thead>
<tbody>
<tr>
<td>sender:</td>
<td>type: unit</td>
</tr>
<tr>
<td>name:</td>
<td>4./PzGrenBtl332-Zug C</td>
</tr>
<tr>
<td>size:</td>
<td>PLT</td>
</tr>
<tr>
<td>reporting_datetime:</td>
<td>type: datetime</td>
</tr>
<tr>
<td>year:</td>
<td>2004</td>
</tr>
<tr>
<td>month:</td>
<td>9</td>
</tr>
<tr>
<td>day:</td>
<td>5</td>
</tr>
<tr>
<td>hour:</td>
<td>12</td>
</tr>
<tr>
<td>minute:</td>
<td>18</td>
</tr>
<tr>
<td>reporting_data:</td>
<td>type: in_position</td>
</tr>
<tr>
<td>agent:</td>
<td>type: unit</td>
</tr>
<tr>
<td>name:</td>
<td>4./PzGrenBtl332-Zug C</td>
</tr>
<tr>
<td>size:</td>
<td>PLT</td>
</tr>
<tr>
<td>location:</td>
<td>type: town</td>
</tr>
<tr>
<td>name:</td>
<td>Nederveert</td>
</tr>
<tr>
<td>qualifier:</td>
<td>exactly_at</td>
</tr>
</tbody>
</table>
The SOKRATES-System for Report Processing

Semantic Augmentation
adds to the representation by ontological exploitation of knowledge to allow for post-processing.

051218ZSEP04
by 4./PzGrenBtl332-Zug C:
Standing at Nederveert

| rep_d: type: in_position
| agent: type: unit
| name: 4./PzGren...
| ...
| loc: type: town
| name: Nederveert
| latitude: 5.753
| longitude: 51.284
Ontology

Gruber (1993): “An ontology is an explicit specification of a shared conceptualization.”

**explicit:**
Everything the system has to know must be represented in the system.

**shared conceptualization:**
In particular, even the information human beings do not communicate (since it is self-evident for us) has to be represented.
Ontology

ontology = taxonomy + associated attribute-value pairs + rules
Example

Platoon B: 3 *hostile T80 approaching*.

Information Extraction transforms report into formal representation.
Example

sender: type: unit
...
located: type: position
latitude: 53.00
longitude: 10.46
rep_d: type: move
dest:

Platoon B: 3 hostile T80 approaching.

Semantic Augmentation adds to the representation (here: adding of the move's destination).
Example

ontological rule:

\[
\text{set\_value}(M,[\text{rep\_d}, \text{dest}], L):= \\
\text{get\_value}(M,[\text{rep\_d}, \text{type}], \text{move}), \\
\text{get\_value}(M,[\text{rep\_d}, \text{subcat}], \text{approach}), \\
\text{get\_value}(M,[\text{rep\_d}, \text{agent}, \text{hostility}], \text{hostile}), \\
\text{get\_value}(M,[\text{sender}, \text{located}], L).
\]

sender: type: unit
... located: L

rep_d: type: move

dest:
**Example**

| sender: | type: unit                  |
|        | ...                        |
| located: | type: position            |
|         | latitude: 53.00            |
|         | longitude: 10.46           |

| rep_d: | type: move                |
|        | dest: type: position      |
|        | latitude: 53.00           |
|        | longitude: 10.46          |

Platoon B: 3 hostile T80 approaching.

**Semantic Augmentation** adds to the representation (here: adding of the move's destination).
Platoon B: 3 hostile T80 approaching.
Additional Remark

Some ontological processes (semantic augmentations) are facultative, e.g., the processes which infer
• a unit’s type
• its subtype
• its size
• its affiliation
from the type and the number of equipment reported.

These processes can be activated or shut down to adjust the system to situational requirements as well as to the needs and to the style of its operator.
Example

Platoon B: 3 hostile T80 approaching.

Semantic Augmentation adds to the representation (here unit determination).

reporting_data:

<table>
<thead>
<tr>
<th>type:</th>
<th>move</th>
</tr>
</thead>
<tbody>
<tr>
<td>agent:</td>
<td>type: unit</td>
</tr>
<tr>
<td>cat:</td>
<td>combat</td>
</tr>
<tr>
<td>arm_cat:</td>
<td>armour</td>
</tr>
<tr>
<td>mobility:</td>
<td>lndtrc</td>
</tr>
<tr>
<td>size:</td>
<td>plt</td>
</tr>
<tr>
<td>hostility:</td>
<td>hostile</td>
</tr>
<tr>
<td>theme:</td>
<td>type: battletank</td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>
**Example**

<table>
<thead>
<tr>
<th>reporting_data:</th>
<th>type: move</th>
</tr>
</thead>
<tbody>
<tr>
<td>agent: type: unit</td>
<td></td>
</tr>
<tr>
<td>cat: combat</td>
<td></td>
</tr>
<tr>
<td>arm_cat: armour</td>
<td></td>
</tr>
<tr>
<td>mobility : lndtrc</td>
<td></td>
</tr>
<tr>
<td>size: plt</td>
<td></td>
</tr>
<tr>
<td>hostility: hostile</td>
<td></td>
</tr>
<tr>
<td>theme: type: battletank</td>
<td></td>
</tr>
</tbody>
</table>

Platoon B: 3 hostile T80 approaching.
Example

Platoon B: 3 hostile T80 approaching.
Benefits

The system is **modular** by itself:

- It may run on a distributed environment, e.g., *the data base interaction module together with the data base.*

- Its modules can be substituted easily, e.g., *German IE-module ↔ English IE-module.*

It can be used as a module in C2 information systems.
Benefits

The system can be adjusted as required

- to the needs and to the style of the operator
- to situational demands

(the more reports coming in the more automaticity)
Benefits

The system enhances **interoperability** towards the **semantic level** (Alberts & Hayes: “the cognitive level”)

- *by transforming natural language*
  - into APP-6A conform map
  - into C2IEdM data base entries

- *by analyzing the data with respect to their semantics*

This is only possible by using **ontological** means.
Benefits

Modularity and Adjustability add to **AGILITY**, especially to **Resilience** and **Adaptation**;

**INTEROPERABILITY** stands for itself.