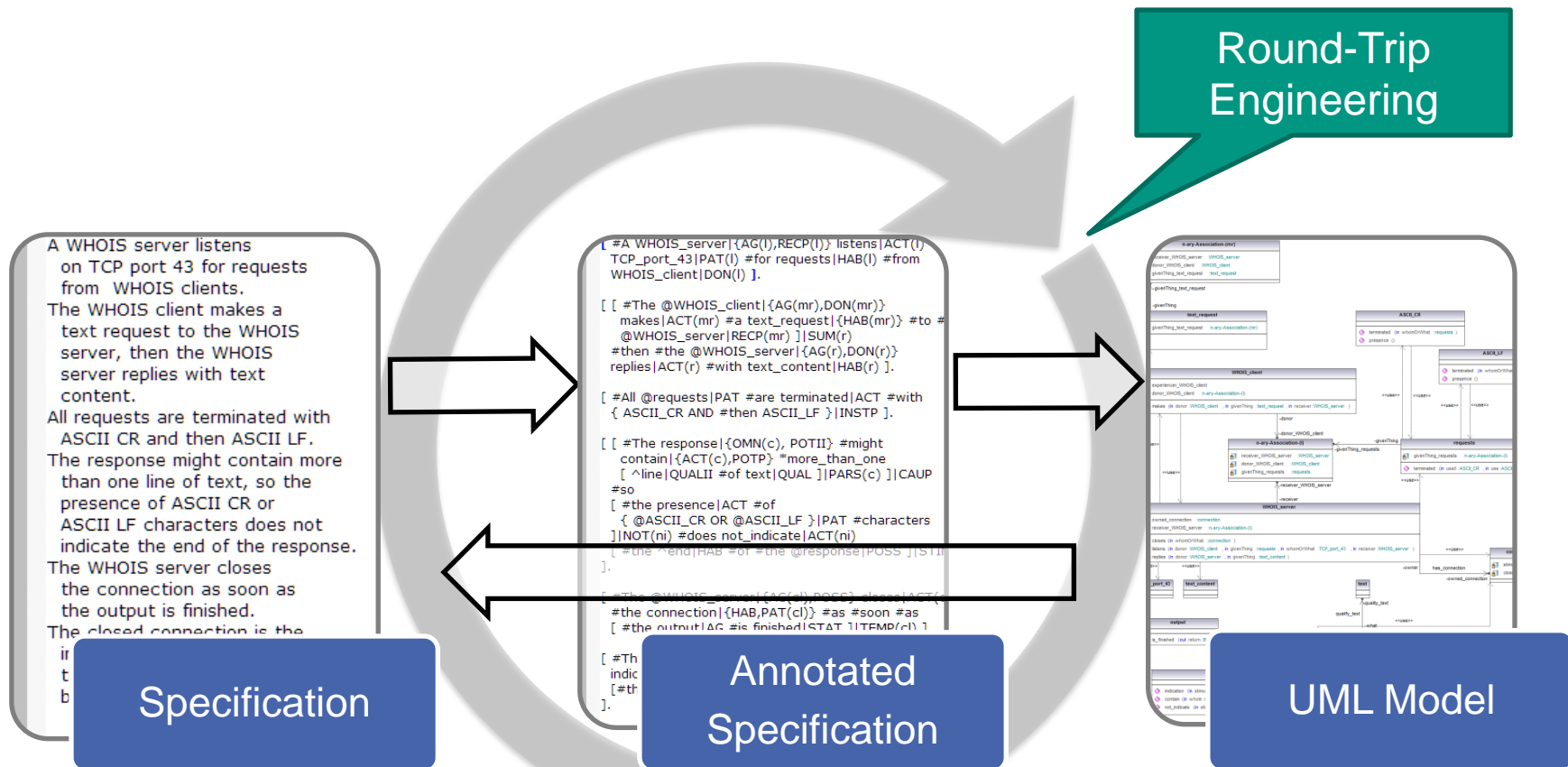# Synchronizing Domain Models with Natural Language Specifications

Mathias Landhäußer, Sven J. Körner, Walter F. Tichy

IPD Tichy, Department of Informatics

www.kit.edu

Model Creation from Natural Language

Round-Trip Engineering

Specification

Annotated Specification

UML Model

- Problem area: Model Creation from Text

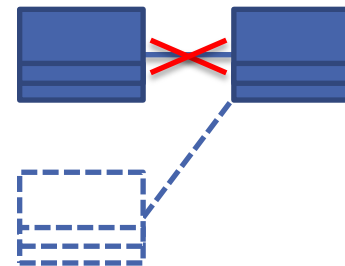- Challenge: Handling Modifications (on both sides)

The Challenges

The Whois client makes a text request to the Whois server. […]
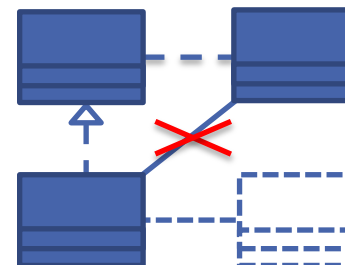
initial build of the model

The Thin client makes a text request to the Whois server. […]
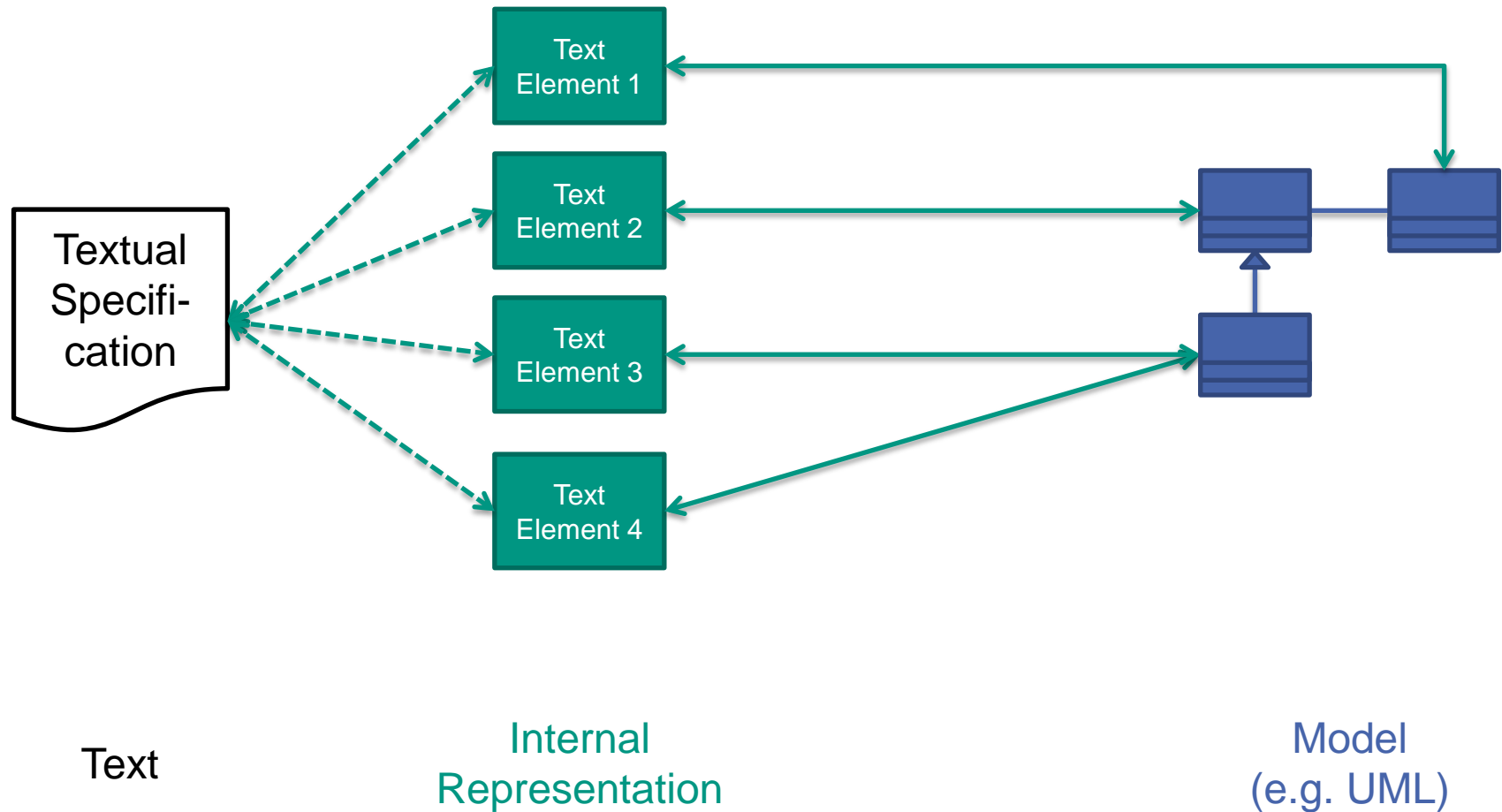
textual change leads to model update

[…] The Thin client is a Whois Client and has a Configuration.

model change leads to text change

Our Approach

Text

Internal
Representation

Model
(e.g. UML)

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering   IPD Tichy, Department of Informatics
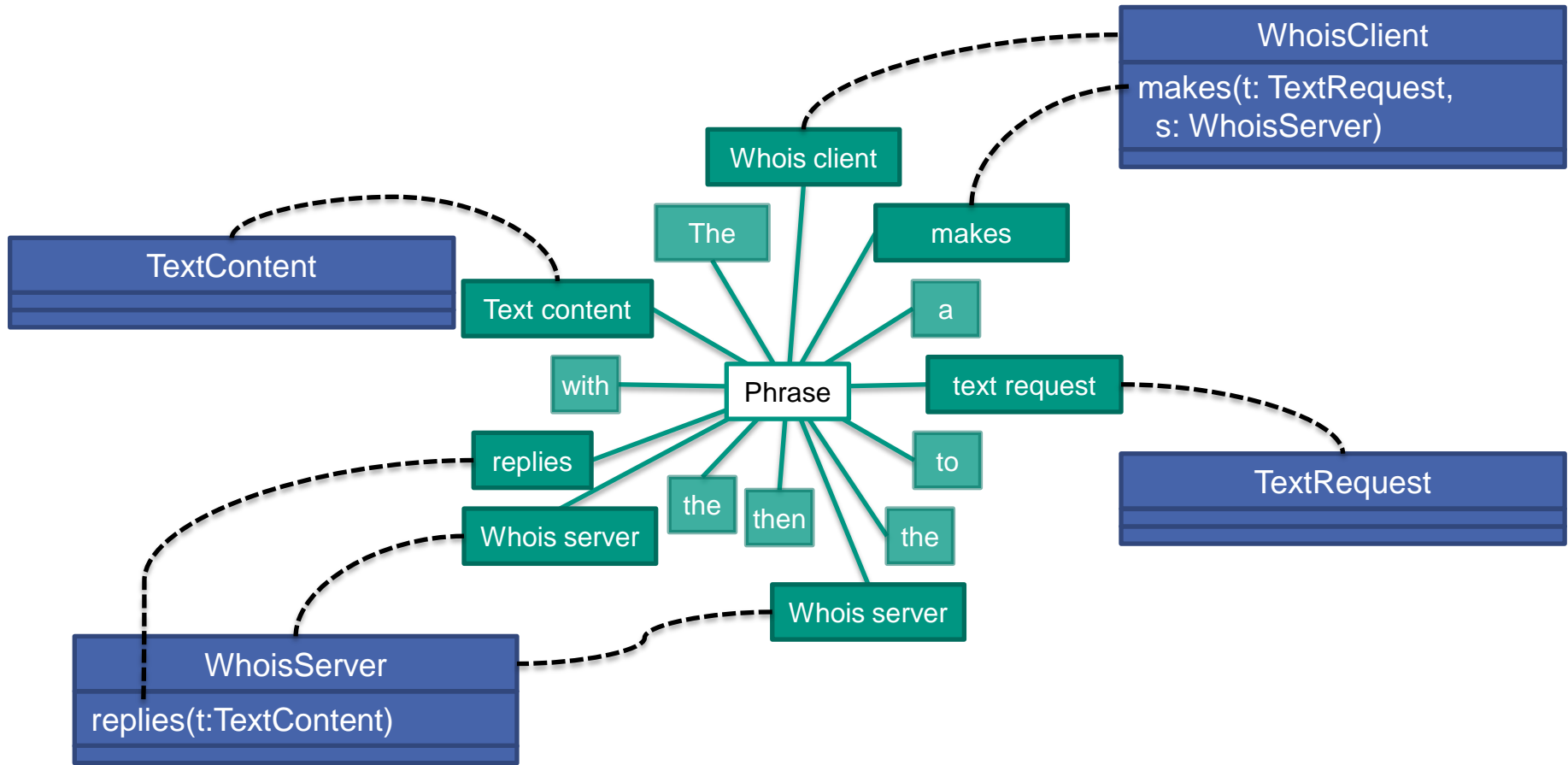
Our Approach by Example:
The Whois Server

The Whois client makes a text request to the Whois server;
then the Whois server replies with Text content.

The Whois Case Study
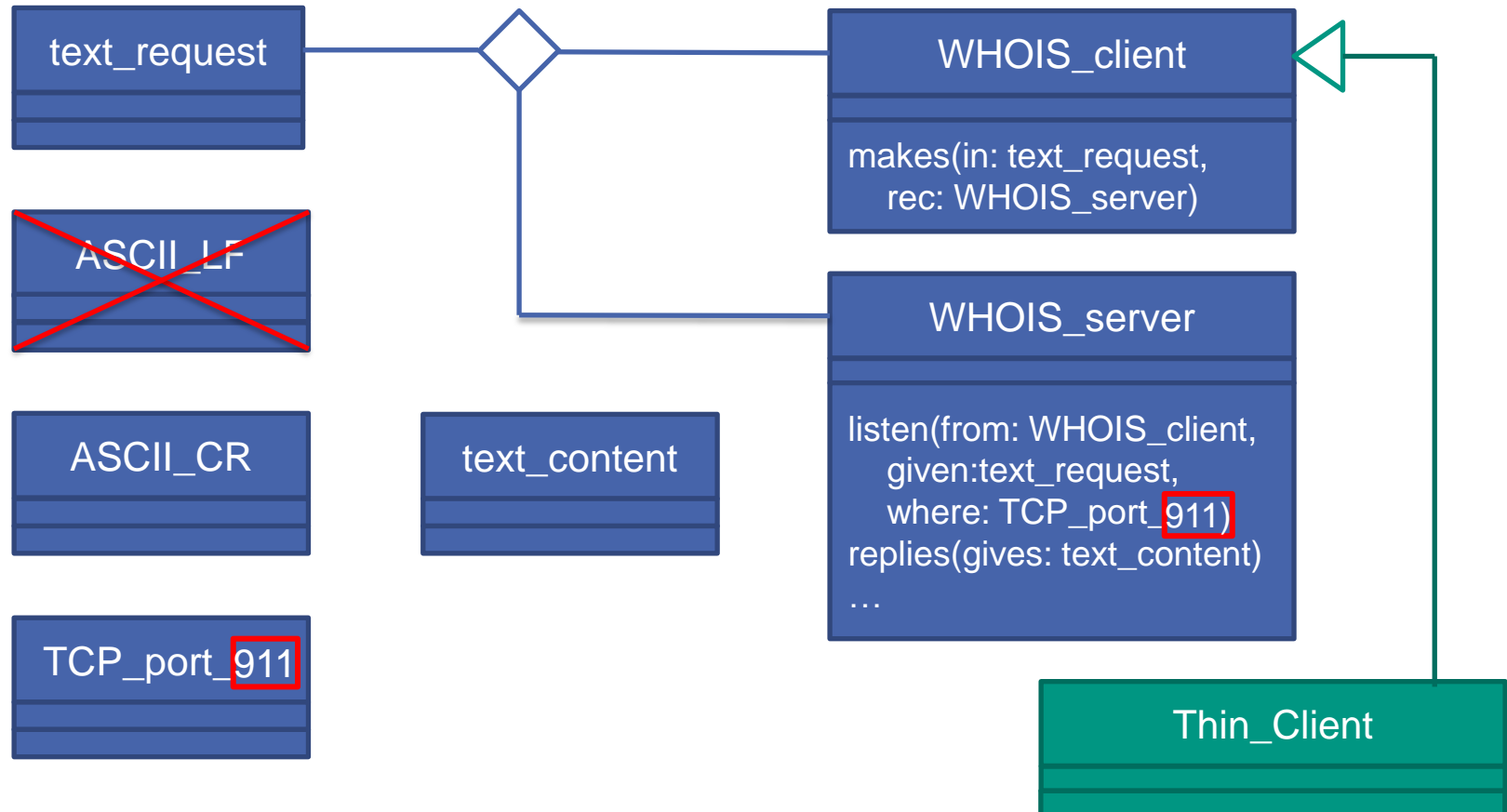
A WHOIS_server listens on TCP_port_43 for
text_requests from WHOIS_clients.

The WHOIS_client makes a text_request to the
WHOIS_server then the WHOIS_server replies with
text_content.

All text_requests are terminated with ASCII_CR and
then ASCII_LF.
[…]

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications   IPD Tichy, Department of Informatics
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

The Whois Case Study

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

IPD Tichy, Department of Informatics

The Whois Case Study

text_request

WHOIS_client

makes(in: text_request,
rec: WHOIS_server)

~~ASCII_LF~~

```
A WHOIS_server listens on TCP_port_43911 for text_requests from
WHOIS_clients.

The WHOIS_client makes a text_request  to the WHOIS_server then
the WHOIS_server replies with text_content.

All text_requests are terminated with ASCII_CR and then ASCII_LF.

A Thin client is a WHOIS client.

[...]
```

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

IPD Tichy, Department of Informatics

Evaluating Random Modifications

Case Study		Text Changes		Model Changes	
Text	Size	Updates	Deletions	Updates	Deletions
Cinema	153 Words	1/6 + 5 irrel.	6/7 + 1 irrel.	4/4	7/7
Timbered House	88 Words	3/3	2/7 + 5 irrel.	3/3	7/7
WHOIS Protocol	100 Words	8/8	2/2	5/6 + 1 incorr. crea/del	2/3

Irrelevant changes: Text parts that are not modeled.
Incorrectly detected model change: Change masked by deletion.

06/05/2012   Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications   IPD Tichy, Department of Informatics
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

Findings, Limitations & Future Work

■ Deletions can lead to text orphans (could be cleaned up automatically)

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications   IPD Tichy, Department of Informatics
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering
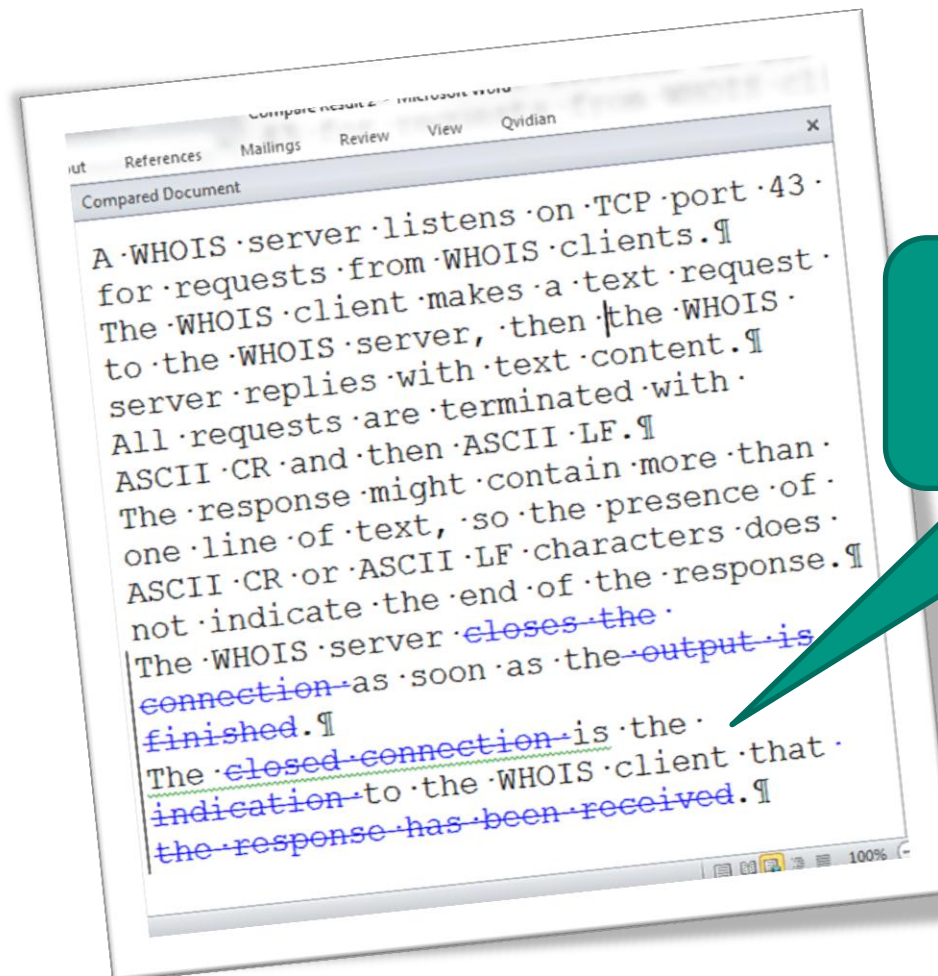
Findings, Limitations & Future Work

- Deletions can lead to text orphans (could be cleaned up automatically)

- Language synthesis is rudimentary (there are solutions for this to be integrated though)

- Current support for class diagrams only: Investigate whether (and how) other diagram types can be covered

- Studies with stakeholders and software architects need to show how sophisticated synchronization of text and models need to be

06/05/2012   Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications   IPD Tichy, Department of Informatics
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

THANK YOU!
QUESTIONS?

Landhäußer, Körner, Tichy | Synchronizing Domain Models with Natural Language Specifications
RAISE'12 – Workshop on Realizing Artificial Intelligence Synergies in Software Engineering

IPD Tichy, Department of Informatics