

# Software Engineering 2012 – All Projects

# Cognitive Load: Data composition

---

Organization: CoLi

Contact: Asad Sayeed, Vera Demberg

Our overall agenda is to study the influence of language on cognitive overload: if the mind has finite resources, how much does language take up under what circumstances? In order to do this, we are designing car-simulator experiments in which subjects must "drive" using a game console while performing a language-related task (automatic flight booking using a dialogue system, listening to emails, and so on).

While the task is being performed, we will collect a variety of performance metrics, including physiological ones such as pupil dilation measurement and skin conductance.

Our need: we require the composition of this data into a single time-synchronized resource that is easy to analyze statistically, visualize, and distribute. This has a number of software challenges including data format design, UI design, and data stream composition.

- **Who we are:** Research group in M2CI and computational linguistics. Psycholinguistics and computer science.
- **What we're doing:** investigating the relationship between language complexity and mental workload.
  - Spoken dialogue systems for multitasking while driving (email checking, scheduling, talking GPS . . .)
  - Safety, efficiency: Can we create systems that adapt the complexity of the language to the driving environment?
- **But:** to answer this question, we have to know how to **measure** the effect of language complexity.

- **How we're doing it:** biometrics and performance analysis in simulated driving.
  - Linguistic analysis: complex vs. simple.
  - Driving simulator: easy or difficult courses, game console steering wheel.
  - Biometrics and psychometrics: pupil dilation, skin conductance.
  - Secondary task performance: flight booking, restaurant reservation...
- **What we need:** connecting, synchronizing, visualizing/analysing these data streams.
  - Many disparate devices and pieces of software to synchronize.
  - Corpus to publish: need all recorded data searchable, usable by researchers.



# Saarland University App (iPhone + Android)

---

Organization: CISPA

Contact: Christian Hammer and Sebastian Gerling

We would like to have a CISPA and Saarland University iPhone and Android app that provides guidance on campus and presents all information required by visitors, students, and employees. In particular, the app should

- show the menus of mensa and other campus restaurant (also as widget),
- have an interactive campus map showing the current position and providing
- additional information on all facilities (e.g. parking),
- have a campus event calendar providing schedules for current events,
- have a news section on hot topics about CISPA and Saarland University.

## Reliably Secure Systems

## Accountability



## Privacy

- Core functionality:
  - shows menus of mensa and other campus restaurant (also as widget),
  - interactive campus map showing the current position and providing additional information on all facilities (e.g. parking),
  - campus event calendar providing schedules for current events,
  - news section on hot topics about CISPAs and Saarland University.

**Customer: Philipp von Styp-Rekowsky  
Sebastian Gerling**

- Core functionality:
  - shows menus of mensa and other campus restaurant (also as widget),
  - interactive campus map showing the current position and providing additional information on all facilities (e.g. parking),
  - campus event calendar providing schedules for current events,
  - news section on hot topics about CISPAs and Saarland University.

**Customer: Christian Hammer**

# Automated Testing with Pex: Reports and Visualization

---

Organization: Software Engineering Chair

Contact: Konrad Jamrozik

APex is a prototype build on top of Pex, a tool for automated unit testing, developed by Microsoft Research, Redmond. Pex leverages Dynamic Symbolic Execution (DSA) to automatically and efficiently generate unit test suite achieving near-100% coverage of tested code.

The goal of the project will be to provide a rich format/visualization of the dumped data. Some ideas: dumping directly into compilable LaTeX tables, outputting gnuplot charts, outputting as XML and then transforming into HTML with XSLT, etc.



Organization: Software Engineering Chair

Contact: Konrad Jamrozik

Primary technologies:

.NET 4.0, C#, LaTeX || Gnuplot || XML + XSLT +  
HTML/CSS || ...?...

Supporting technologies:

Redmine, Mercurial, TDD, Code Contracts

The task will be to provide advanced reporting and charting capabilities to existing prototype, APex. APex is a prototype build on top of Pex, a tool for automated unit testing, developed by Microsoft Research, Redmond. Pex leverages Dynamic Symbolic Execution (DSA) to automatically and efficiently generate unit test suite achieving near-100% coverage of tested code.

APex in principle augments path conditions gathered by DSA to generate unit test suite not only providing high code coverage, but also fulfilling other criteria, like having high mutation score or covering boundary cases.

Currently APex in addition to generating unit test suite also dumps a lot of research-relevant information about its execution to text files, mostly ascii tables. The goal of the project will be to provide much richer format/visualization of the dumped data. Some ideas: dumping directly into compilable LaTeX tables, outputting gnuplot charts, outputting as XML and then transforming into HTML with XSLT, etc.

Current source code has over 85% unit test code coverage and it is expected that such coverage will be maintained while working on APex.



# Mining Software Archives with DiffCat and Moskito

---

Organization: Software Engineering Chair

Contact: Kim Herzig

DiffCat is a tool to detect non-essential changes in version histories. Non-essential changes are refactorings that leave the source code semantics unchanged (e.g. renaming a class variable).

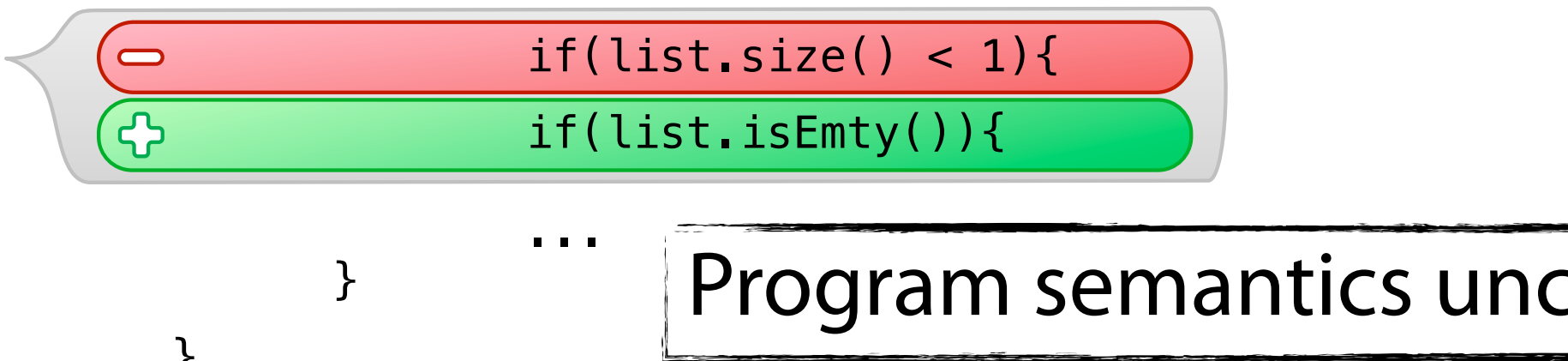
Your job, if you accept it, is to transform the functionality of DiffCat into a Java library that can be easily integrated into non Eclipse applications---more precise we want to integrate DiffCat's functionality in our Chair's mining framework called Moskito. A solution might be to transform DiffCat into some kind of service providing API interfaces to use this service. You are free to reuse the DiffCat tool as it is. DiffCat and their underlying frameworks are open source and can be adapted. So, this job is more about finding a clever solution to integrate an Eclipse product into a non-Eclipse application.



# Non-Essential Changes

<http://www.cs.mcgill.ca/~swevo/diffcat/>

```
3      public class C {
4          public C() {
5              List<String> list = new List<String>();
6              ...
7          }
8          if(list.size() < 1){
9              if(list.isEmpty()){
10             ...
11         }
12     }
13     ...
14     ...
15     ...
16     ...
17     ...
18     ...
19     ...
20     }
21 }
```



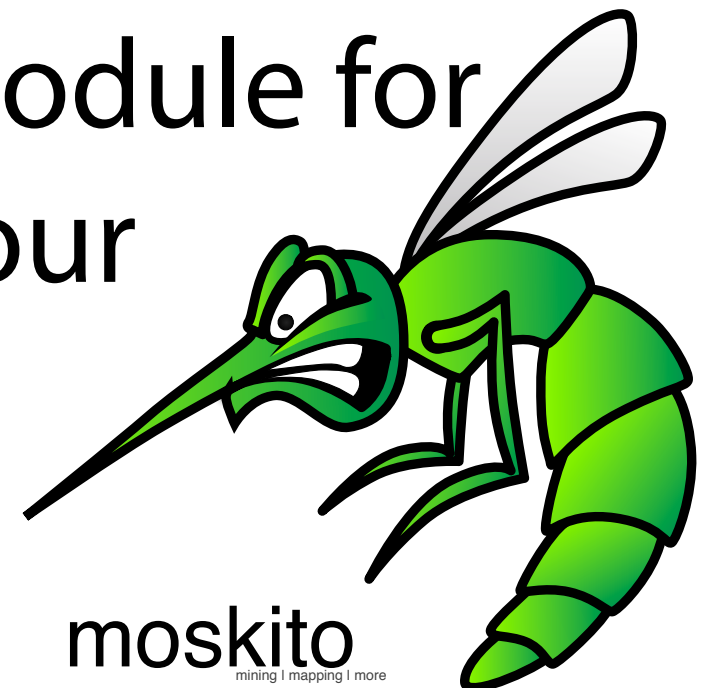
Program semantics unchanged!

**DiffCat** tool detects such *non-essential* changes.

# Non-Essential Changes

*as Mozkito module*

- **Diffcat** is an Eclipse product requiring many other plugins
- Design and implement a standalone tool that can detect non-essential changes.
- Design and implement a Diffcat-module for our mining framework that runs your standalone tool.



# Partial Program Analysis for C/C++

---

Organization: Software Engineering Chair

Contact: Kim Herzig

Analyzing source code changes and their dependencies requires accurate type information about object instances involved in the applied source code changes. This task is easy only if the source code is compilable.

Your task is to implement a partial program analysis tool for C/C++ using the LLVM framework and its C/C++ specific front-end: clang. The tool must be usable from Java and should allow our mining framework written in Java to analyze C/C++ source code changes by identifying full qualified C/C++ class, method, and functions definitions and calls changed by each individual source code change.

# Partial Program Analysis (PPA)

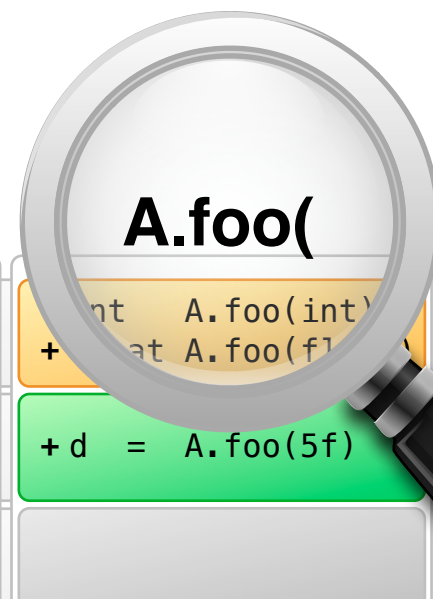
Easy! Compile and lookup!

Fall back to AST!

[www.sable.mcgill.ca/ppa/](http://www.sable.mcgill.ca/ppa/)

What if the current version is not compilable?

Not all type info available!



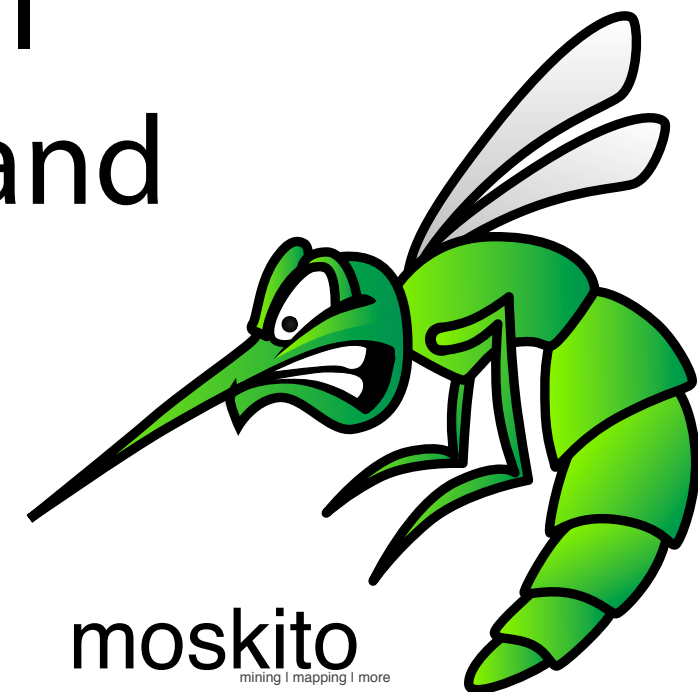
What type is **A** of?

File 1	+ int A.foo(int)		+ int A.foo(int) + ... at A.foo(f1		
File 2	+ void B.bar(int)		+ d = A.foo(5f)		
File 3		+ x = B.bar(5)		+ ... B.bar(5) + ... A.foo(5f)	
File 4			+ d = A.foo(d)	+ e = A.foo(-1f)	
	Change Set (CS1)	Change Set (CS2)	Change Set (CS3)	Change Set (CS4)	Change Set (CS5)

Project History: sequence of code changes

# PPA For C++

- Design and Implement PPA tool for C/C++
- Use LLVM and Clang
- Given a source code change (Java Object) your framework should identify full qualified C/C++ classes, methods and definitions.



# Automated Debugging in Eclipse

---

Organization: Software Engineering Chair

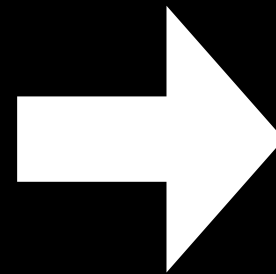
Contact: Jeremias Röβler

BugEx is an approach that aims at helping developers understand a failure. Starting from a failing test case, many more test cases are generated to narrow down important runtime aspects of the failure (see <http://www.st.cs.uni-saarland.de/bugex> ).

To bring the approach as close to the developer as possible, BugEx should be available in the form of an Eclipse Plugin. Some of the features include a progress monitor, a configuration panel, and jumping to the appropriate code locations upon clicking.

# BugEclipse

BugEx Eclipse Plugin



(c) Copyright Eclipse contributors and others, 2000, 2009. All rights reserved. Java and all Java-related trademarks and logos are trademarks or registered trademarks of Sun Microsystems, Inc. in the U.S., other countries, or both. Eclipse is a trademark of the Eclipse Foundation, Inc.



Java - bugex/src/main/java/de/unisl/cs/st/bugex/BugEx.java - Eclipse - /Users/roessler/Documents/JavaPathFinder/workspace

Package E | Type Hier | Navigator

bugex [1205:5ce664de499e@default(tip)]

- src/main/java
  - de.unisl.cs.st.bugex
    - AlternativeFailureFactsRanker.java
    - BestTests.java
    - BugEx.java
    - CascadingTestFitnessFunction.java
    - Configuration.java
    - CrashPointFinder.java
    - DiagnosisGenerator.java
    - DynamicTimeWarp.java
    - ExistingTestsBranchesCorrelator.java
    - ExistingTestsConditionsCorrelator.java

```

package de.unisl.cs.st.bugex;

import java.lang.Thread.UncaughtExceptionHandler;

@SuppressWarnings("restriction")
public class BugEx implements SignalHandler, UncaughtExceptionHandler {

    public static enum Termination {
        NORMAL(0), USER_ABORTED(0), USER_ABORTED_IMMEDIATE(1), UNK

    private final int status;

    private Termination(int status) {
        this.status = status;
    }
  
```

Outline

- de.unisl.cs.st.bugex
  - import declarations
  - BugEx
    - Termination
      - main(String...) : void
      - removeDoublets(List<Method>) : List<Method>
      - calledFinish : boolean
      - config : Configuration
      - exporter : ResultsExporter
      - factsRanker : SelfAdjustingFactRanker<? extend
      - failingTest : String
      - logger : Logger

To display the call hierarchy, select one or more methods, classes, fields, or initializers, and select the 'Open Call Hierarchy' menu option. Alternatively, you can drag and drop the member or members onto this view.

Writable | Smart Insert | 1 : 1



Java - bugex/src/main/java/de/unisl/cs/st/bugex/BugEx.java - Eclipse - /Users/roessler/Documents/JavaPathFinder/workspace

Package Explorer: bugex [1205:5ce664de499e@default(tip)]  
src/main/java  
de.unisl.cs.st.bugex  
AlternativeFailureFactsRanker.java  
BestTests.java  
BugEx.java  
CascadingTestFitnessFunction.java  
Configuration.java  
CrashPointFinder.java  
DiagnosisGenerator.java  
DynamicTimeWarp.java  
ExistingTestsBranchesCorrelator.java  
ExistingTestsConditionsCorrelator.java

```
package de.unisl.cs.st.bugex;

import java.lang.Thread.UncaughtExceptionHandler;

@SuppressWarnings("restriction")
public class BugEx implements SignalHandler, UncaughtExceptionHandler {

    public static enum Termination {
        NORMAL(0), USER_ABORTED(0), USER_ABORTED_IMMEDIATE(1), UNK...

    private final int status;

    private Termination(int status) {
        this.status = status;
    }
}
```

To display the call hierarchy, select one or more methods, classes, fields, or initializers, and select the 'Open Call Hierarchy' menu option. Alternatively, you can drag and drop the member or members onto this view.

Writable | Smart Insert | 1 : 1

TODO

# Possible Features

- Progress Monitor
- Configuration Panel
- View for different types of Explanations
- Behavior on code change



Jeremias Rößler

<http://www.st.cs.uni-saarland.de/~roessler/>  
[roessler@cs.uni-sb.de](mailto:roessler@cs.uni-sb.de)



BugEx

<http://www.st.cs.uni-saarland.de/bugex/>

# Automated Debugging for Everyone

---

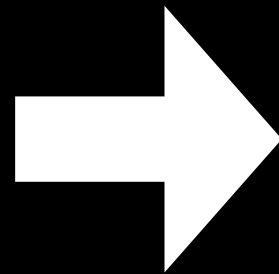
Organization: Software Engineering Chair

Contact: Jeremias Röβler

BugEx is an approach that aims at helping developers understand a failure. Starting from a failing test case, many more test cases are generated to narrow down important runtime aspects of the failure (see <http://www.st.cs.uni-saarland.de/bugex> ).

To allow for an easy online evaluation of the approach, we would need a WebApp/ WebGUI. Special challenges in that context are the time BugEx needs to produce a result (up to one hour) as well as the size of the input: BugEx has a failing test case and a program as input. That program can be of arbitrary size which is a challenge for uploading.

# BugEx Online





# Challenges

- Upload-Size
- Analysis duration
- Displaying Results

# Smart Reuse of Semantic Service Plans for Business Process Modeling

---

Organization: DFKI

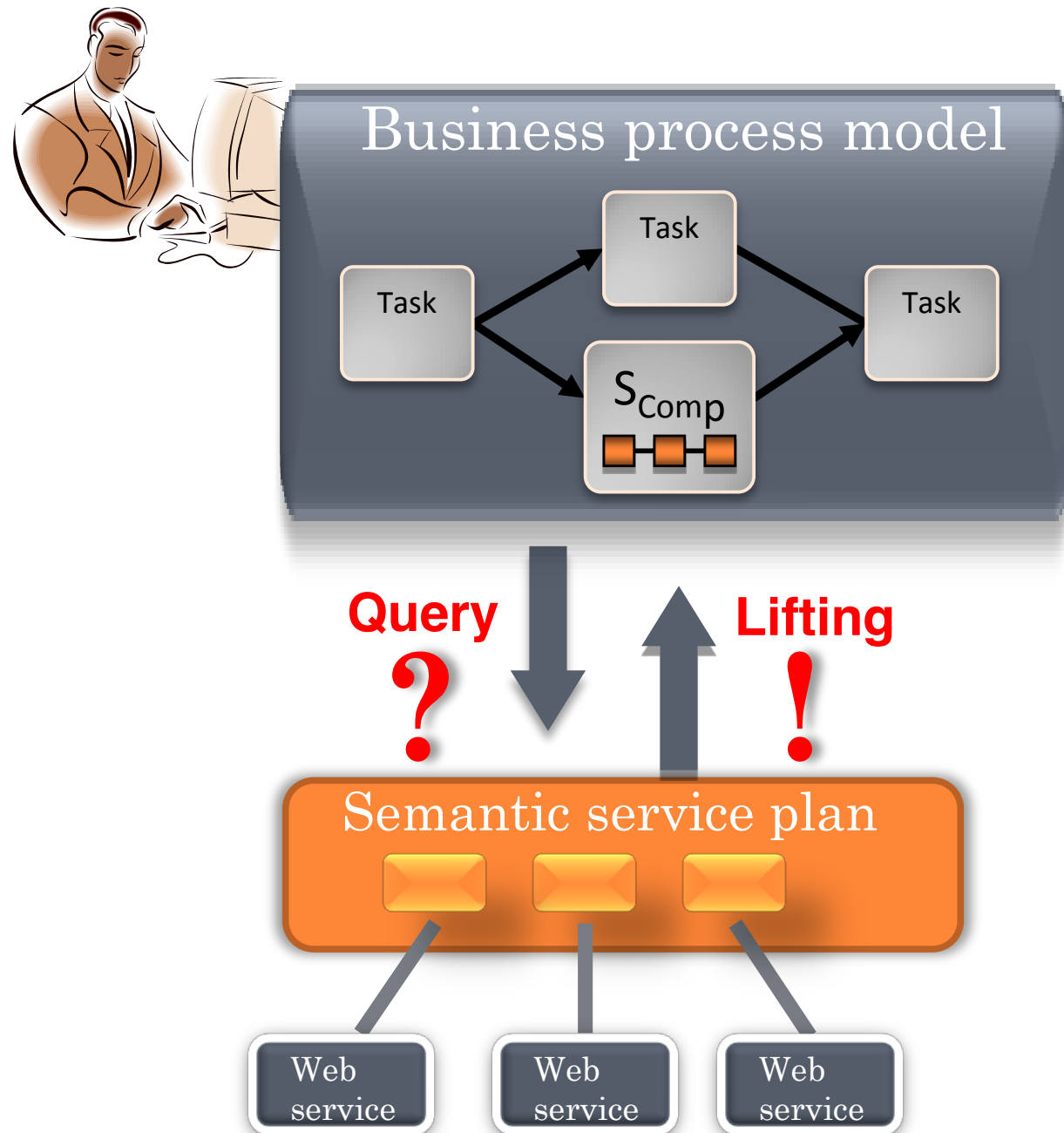
Contact: Matthias Klusch

Service-oriented realization of complex business processes (in service-oriented architectures, SOA) in terms of their orchestration in service workflows still remains a rather tedious hand-crafted work. Each business process which workflow is described in BPMN (Business Process Modeling Notation) may be realized by one or more appropriate Web services (REST or WSDL/SOAP-based).

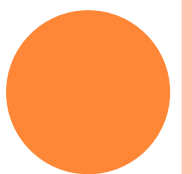
This project designs and implements an approach for automatically integrating ("lifting") a generated service plan in OWL-S into a service-oriented business process workflow in BPMN. The service plan should be refinable by a business process modeller with the tool according to given business requirements. The resulting new or modified process including the semantic annotation shall be exported in a format which allows business process modeling tools like Oryx/ SemOryx or, in particular, ARIS to import it. In other words, the envisioned tool shall enable process modeller to efficiently reuse generated service plans in OWL-S for process modeling in BPMN.



# SEMANTIC SERVICE-ORIENTED REFINEMENT OF BUSINESS PROCESSES

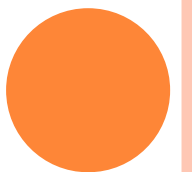


- **Business process model** in BPMN.
- Service-oriented realisation of model through **planning of semantic services** with OWLS-Xplan 2.0.
- “**Lifting**” of generated service plan to **business process level** for ***BPMN model refinement.***



# TASK

- **Enhance** a given business process modeling tool with planning support for semantic services using OWLS-Xplan2 *for process refinement*
  - *Semantic annotation of BPMN process model elements*  
(BPMN tasks, subprocesses, gateways, etc.)
  - *Query formulation:* Specify initial and goal state for the planner
  - *Lifting of generated plan sequence to business process model*
  - *Refinement* of lifted service sequence (plan) with modeling tool
  - *Export format of service plan for different BPMN tools* (ARIS, Oryx)
- **Summary:** Tool shall enable reuse of generated semantic service plans with OWLS-Xplan for process modeling in BPMN.



# Increasing Software Quality: High Quality Assertion Support in Eclipse

---

Organization: Software Engineering Chair

Contact: Sascha Just

By using pre- and postconditions, developers can specify the intended behavior of their code in place. Having proper constraints on your inputs and output of a method makes debugging a much easier task.

We developed a Java library called `kanuni` that comes with a large set of annotations for parameters, variables and return values with predefined constraints (e.g. `@NotNull` or even more complex things like `@MinSize(min = 5)` or `@Directory(perm = { ACCESS, READ, WRITE })`) that can be used in Java source code.

Your task is to design and implement an Eclipse plugin that keeps track of the constraints and comes with two features: Your plugin should warn if the use of a variable is potentially invalid (e.g. due to a missing not-null constraint) and offer a quick-fix (like "Add `@NotNull` to the parameter 'p'.). It will be sufficient if your plugin successfully achieves this task for the `@NotNull` annotation and is designed in a flexible way to be extended to support further checks (like array indexes).

Library that provides access to a large variety of pre- and postconditions.

Violations result in detailed failure descriptions.

Comes with support for annotations like:

```
@NotNull           @Ascii  
@MinSize(min = 5)  @Positive  
@ContainsKey(key = "foo")  
@WritableDirectory
```

```
08
09 /**
10  * @throws NullPointerException if parameter <code>a</code> is <code>>null</code>.
11  *
12  */
13 public final @NotNull @Positive Integer bar(final @NotNull String a, final String b) {
14     String s = a;
15
16     if (foo(a)) {
17         s = b;
18     }
19
20     return s.length();
21 }
22
23
```

Potential null pointer access: the variable 's' may be null at this location.

*Track potential violations.*

```
08
09 /**
10  * @throws NullPointerException if parameter <code>a</code> is <code>>null</code>.
11  *
12  */
13 public final @NotNull @Positive Integer bar(final @NotNull String a, final String b) {
14     String s = a;
15
16     if (foo(a)) {
17         s = b;
18     }
19
20     return s.length();
21 }
22
23
```

- @ Add @NotNull to parameter 'b'.
- @ Add @NotNull to local variable 's'.
- | Surround with null pointer check.
- @ Add @SuppressWarnings 'null' to 'bar()'

*Offer Quick Fix for missing checks.*

```
08
09 /**
10  * @throws NullPointerException if parameter <code>a</code> is <code>>null</code>
11  * or if parameter <code>b</code> is <code>>null</code>.
12  *
13  */
14 public final @NotNull @Positive Integer bar(final @NotNull String a, final @NotNull String b) {
15     String s = a;
16
17     if (foo(a)) {
18         s = b;
19     }
20
21     return s.length();
22 }
23
```

*Document Pre-/Postconditions.*

# Markerless Motion Capture: Meta-data and more

---

Organization: MPI

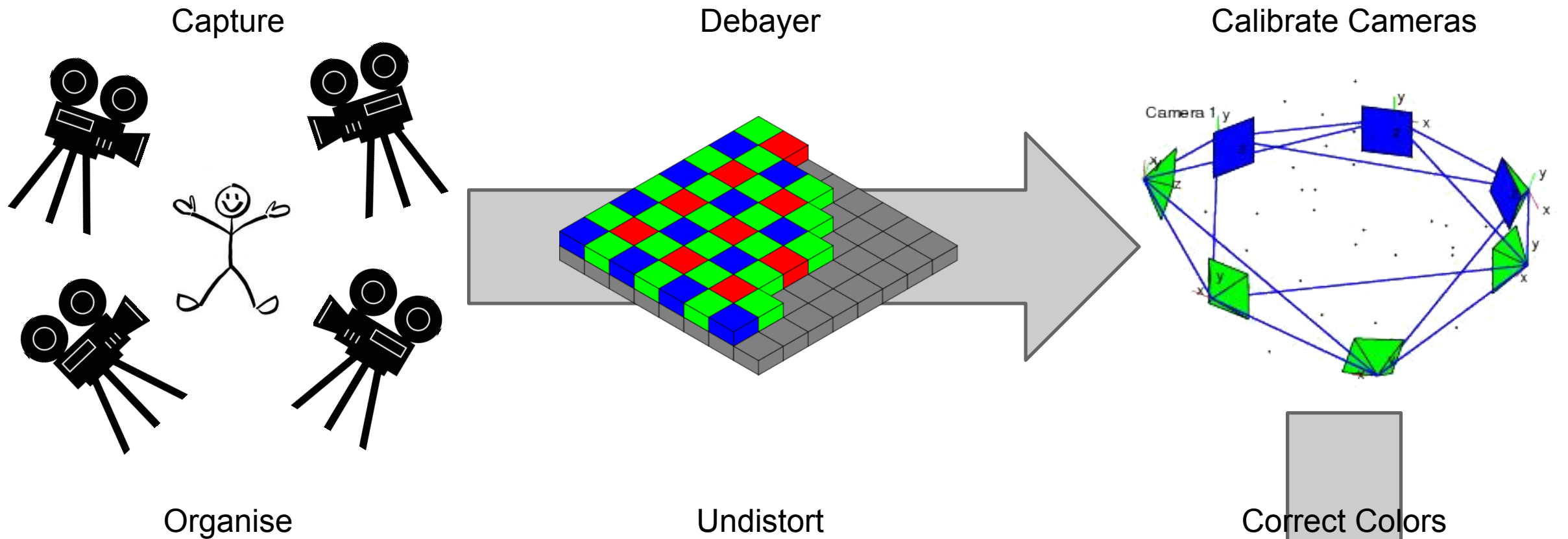
Contact: Nils Hasler, Gaurav Bharaj

We are working on Markerless Motion Capture, Dynamic 3D Scene Reconstruction, and Video Editing projects, to name just a few. All of these applications have in common that tremendous amounts of video data are required as input. Storing, organising, and processing the multi-view data is a challenge we are struggling with at the moment.

A flexible and extensible framework that would allow us to tag videos with meta data, provide a search interface, and a way to automate as many of the preprocessing steps as possible would greatly improve the productivity of the entire Vision, Video & Graphics group at the MPI Informatik.



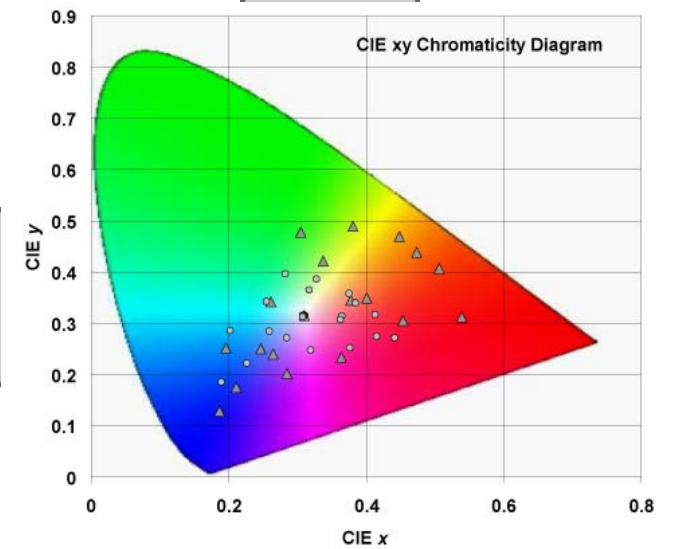
# Massive Multiview Video Capture



```

<setup>
  <date>2012-04-17</date>
  <take>
    <talent>Stickman</talent>
    <framerate>45</framerate>
    <action>jump</action>
    <consumer></consumer>
    <comments></comments>
    <location></location>
  </take>
</setup>

```



hasler@mpii.de, gbharaj@mpii.de

# ThreeDeeCity: 3D Meshes from Android phone videos

---

Organization: MPI

Contact: Art Tevs

An app (running on Android of course :) ) which creates 3D meshes from videos you take during a walk through the city. A user first makes a video of a short walk through the city. This video is then analyzed with structure-from-motion algorithms in order to detect and track feature points. Afterwards the textures are extracted from the video streams and projected back to those planes, making the 3D approximation of the city environment complete.

One important point here, is that the processing power of a phone might be not enough. Students might think about (or better they should do this) to port the processing part of the work to a server. Hence the phone just uploads the video to the server, which is then processed there.



# ThreeDeeStreet

Approximated 3D reconstruction of typical city's streets



Common look of these streets



A straight street can be approximated by three planes or a lengthy box.

**Your Job:** develop an (Android) App, which takes as input a video sequence of such a street and computes planes or a box approximating street's geometry. Planes should be placed in a global coordinate system (at least GPS accuracy).

# ThreeDeeStreet

Approximated 3D reconstruction of typical city's streets

## Possible Applications

- Research interests
  - Just to answer the question if and how well this is doable
- Augmented Reality
  - Wear Google-Glasses and project ads directly onto building facades
- Navigation of drones or quadrocopters in city environment
  - Maybe useful for surveillance, hence not sure if this is a right thing to work on 😊





# ThreeDeeStreet

Approximated 3D reconstruction of typical city's streets

## Requirements:

- The App must deal with limited hardware resources: cheap Android-Device or comparable embedded hardware (max 1GHz 32bit CPU, 512MB RAM, limited network bandwidth)
- The resulting geometry must be delivered with at least GPS accuracy (better if you can improve the accuracy to several centimeters)
- Try to be as robust as possible, to avoid clutter introduced by people, cars, trees, obstacles, ...
- Implement a library layer with a nice API, so that the main algorithm is usable without the app
- Try to make it as real-time as possible
- Implement in C/C++ (Android-NDK) or Java (Android-SDK)

## You would need to:

- Not be afraid of looking into research papers on corresponding computer vision topics
- Make familiar with structure from motion approaches and vision topics, i.e., Bundler, OpenCV
- Make familiar with programming on limited devices

## Additional points to consider:

- Is it possible to compute finer geometry, rather than few planes?
- Can we extract from the video footage the corresponding texture for the geometry?
- What are other possible applications?

# Pipelines for video processing

---

Organization: MPI

Contact: Miguel Granados

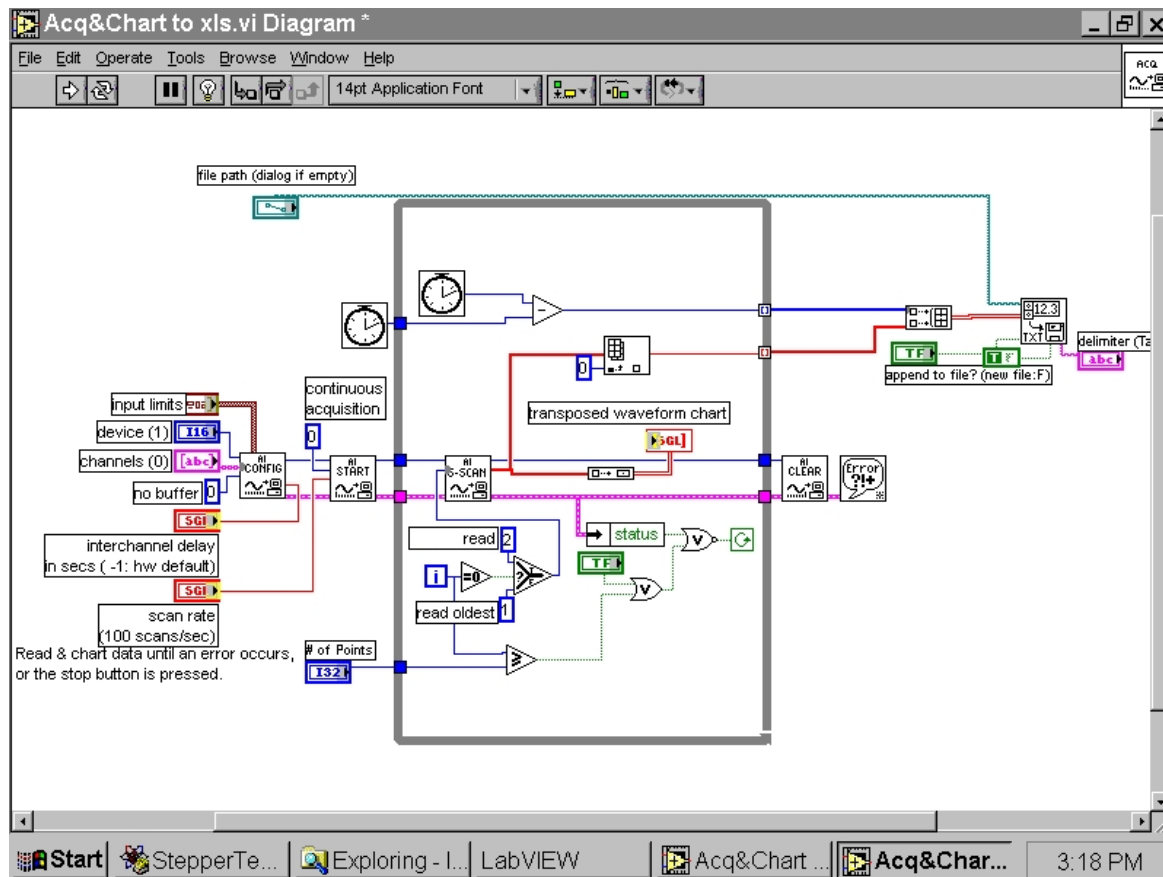
For speeding up our research in advanced video processing, we would like to develop an user interface for performing common operations in video.

In our projects, we often make use of different tools for various image and video processing tasks, but these tools are unaware of each other and we often spend a lot of time connecting outputs to inputs and providing configuration parameters. We would like to have an interface where we can draw a graph representing the work flow of a video processing pipeline, where the nodes represent operations, and the edges represent connections between inputs and outputs. The project would involve developing the user interface for editing the graph, an specification for storing the graph, and an programming interface specification for defining the interface between the external tools and the user interface, and for defining the format of the inputs and outputs.

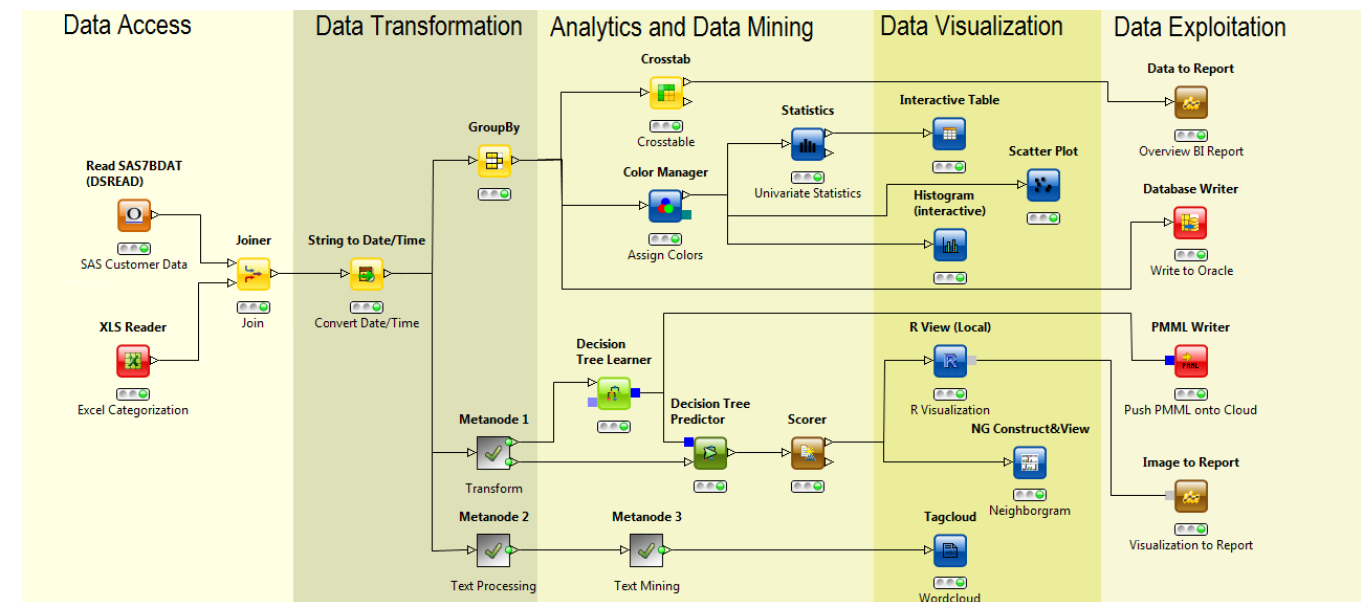
# Pipeline editor for advanced video processing

- Recurring problem in research
  - Several command-line programs and libraries work on the **same type input** (videos)
  - Format of input, output, and options **not standardized**
  - Thus, lots of **research time wasted** in performing I/O conversion
  - Effect of using different input, algorithms or options **not interactive**
- Solution?
  - A common **plug-in interface** where **programs** can connect to receive input, output, and options
  - A **common interface** to provide and receive **inputs and outputs**
  - An **interactive interface** for **connecting** inputs to programs and **visualizing** the result

# Examples of similar software



LabVIEW by Matworks  
For signal processing



KNIME Reporter by KNIME  
For data mining

# Graph Editor for Syntactic and Semantic Annotation of Natural Language

---

Organization: CoLi

Contact: Yi Zhang

We (computational linguists) are interested in the syntactic and semantic structures of natural language. There are several graph-based representations for various levels of linguistic structures, and plenty of existing annotated corpora. But we lack a GUI tool that can not only visualize the existing annotations, but also allows incremental edits (corrections) to be made onto multiple levels of the annotated structures.

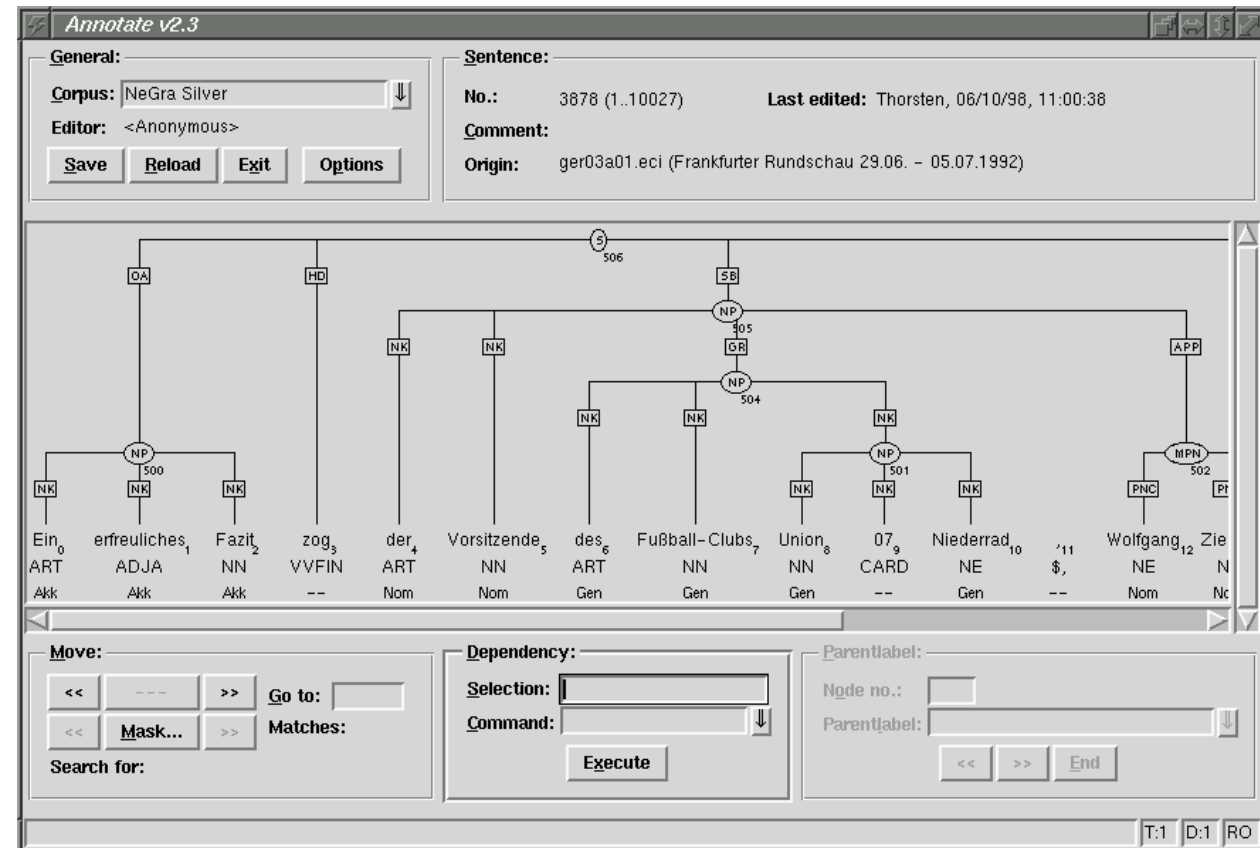
An intuitive user interface will allow us to explain the annotations to the non-experts, while a careful design of the data storage scheme will keep the necessary linguistic details. Several existing pieces of software can already achieve bits and pieces of the functionalities we want, and can serve as the starting points for this project. But an integrated redesign of the editor architecture is desirable.



# Salvaging @nnotate

Once upon a time ...

- ▶ **@nnotate** was a sophisticated tool designed for syntactic annotation of natural language sentences
- ▶ One of the best platform for large-scale treebank development



But ...

- ▶ It no longer compiles out-of-box due to dependency on deprecated libraries
- ▶ Software documentation is incomplete
- ▶ Maintenance and support have long stopped

# Goals

- ▶ Evaluate the exact “code rot” situation
- ▶ Re-identify the core functionalities
- ▶ Produce a salvage plan
- ▶ Bringing basic functionalities back
- ▶ Software documentation

More info about **@nnotate** can be found at  
[http://www.coli.uni-saarland.de/projects/sfb378/  
negra-corpus/annotate.html](http://www.coli.uni-saarland.de/projects/sfb378/negra-corpus/annotate.html)

Yi Zhang <yzhang@coli.uni-sb.de>

# Shape analysis: Exploring shape and posture variations

---

Organization: MMCI

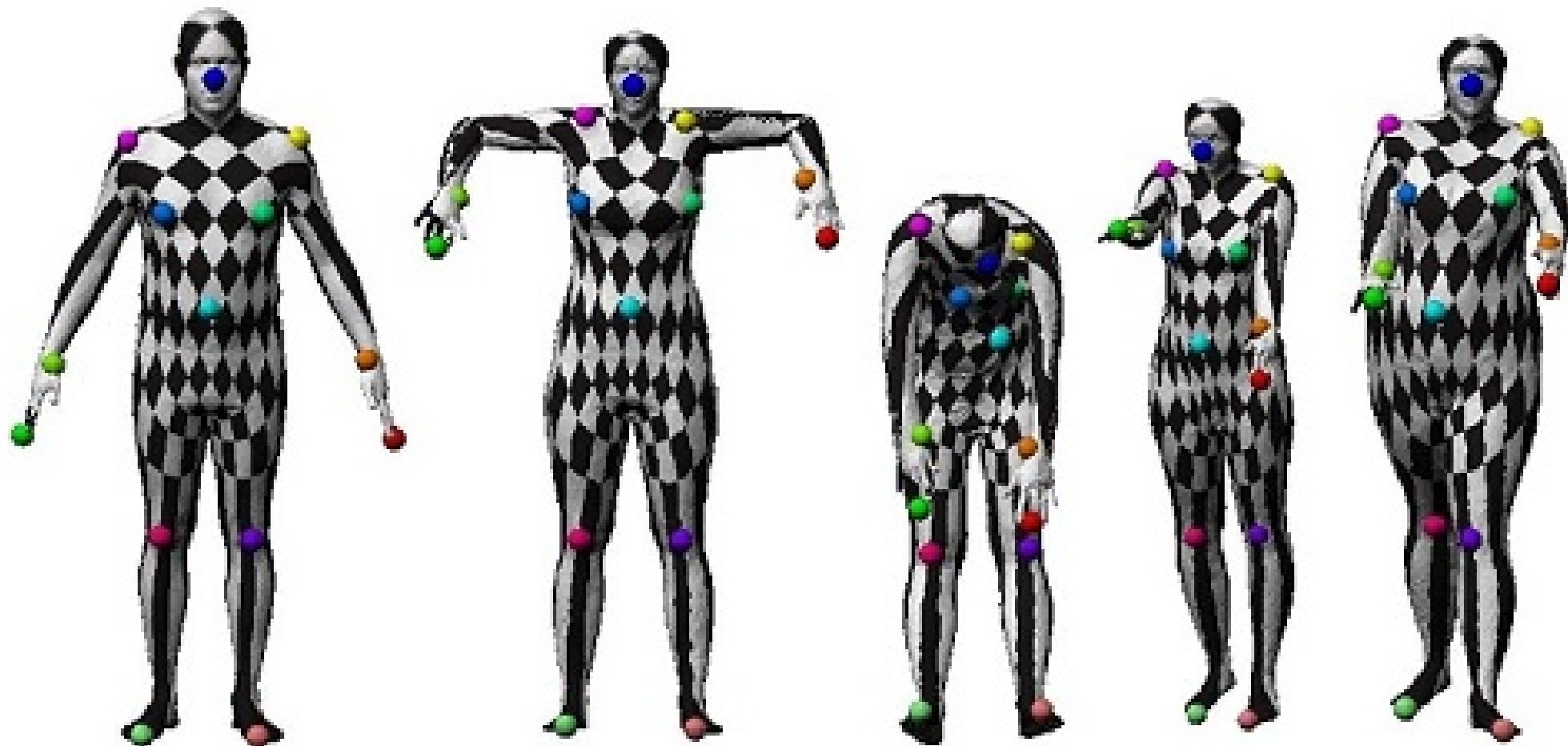
Contact: Stefanie Wuhrer

We currently have access to a database of registered full human body scans. We are interested in a graphical user interface that allows us to explore the shape and posture variations present in the database. More specifically, the shape and posture variations should be decoupled by modeling the transformation of each triangle as a transformation related to shape followed by a transformation related to posture.

The shape and posture transformations can then be analyzed separately using principal component analysis (we have C++ code available for this). Once these computations are completed, we would like to be able to interactively explore the main components of the shape and posture variations in a graphical user interface. Ideally, the code should be written in C++ and compile using Microsoft Visual Studio 2010.

# Project Idea for Software Engineering Course SS 2012

- We are interested in analyzing non-rigid shapes
- In this project, we are interested in computing and visualizing statistical properties of human shapes
- We have access to a parameterized database of 3D human models



# Open3dMap: Crowd-sourced peer-to-peer 3D mapping

---

Organization: DFKI

Contact: Sebastian Wendland

OpenStreetMap has used CrowdSourcing to create some of the best 2D-maps of our planet. We now plan to extend OSM into a 3D model that can easily be updated and improved by anyone.

Challenge: Is it possible to combine the distributed, ad-hoc nature of P2P with the low-latency, high-throughput capabilities of CDNs and the independence of mirrors, while providing unique URLs, all in the spirit of CrowdSourcing?



# 3D Internet

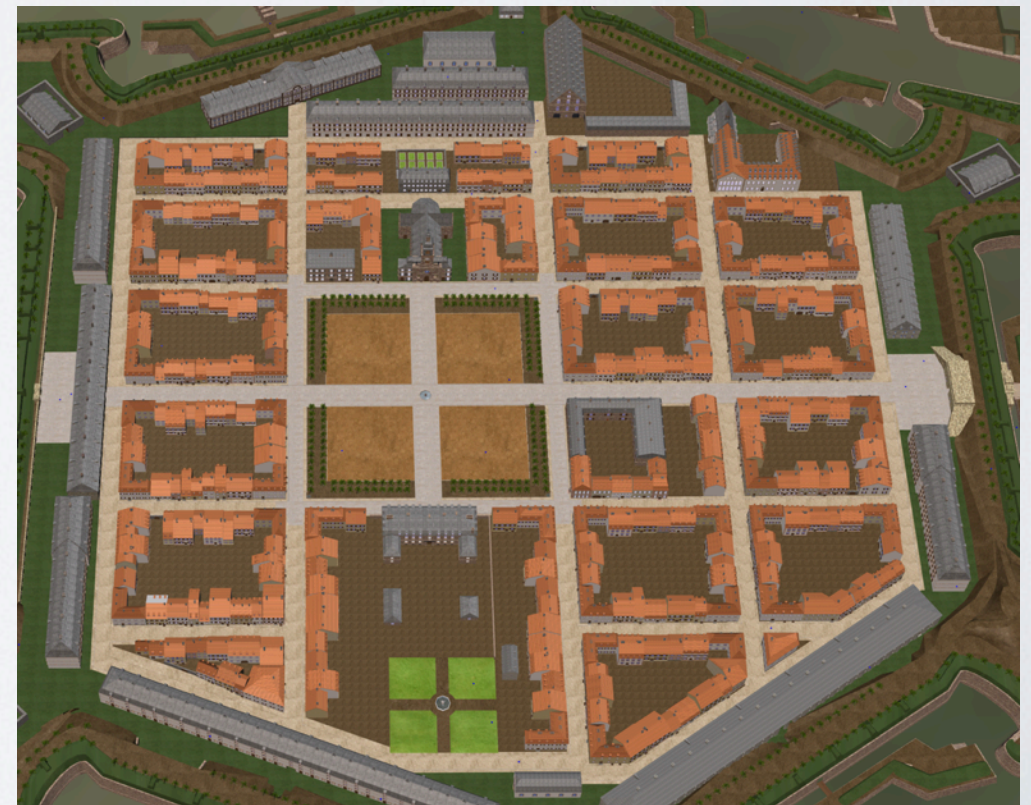
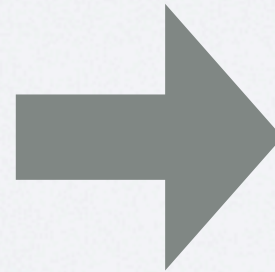
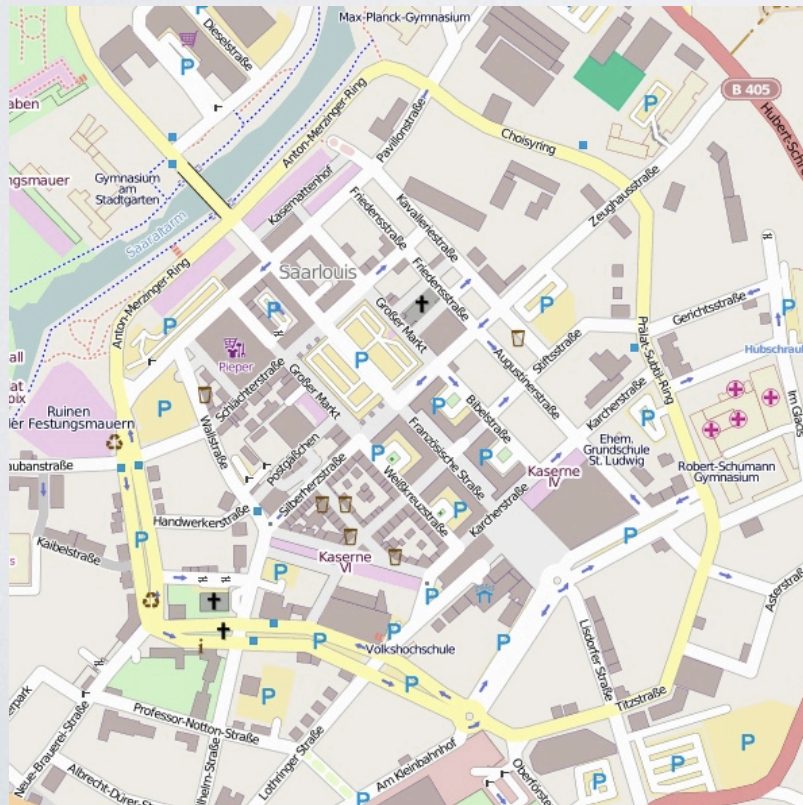


UNIVERSITÄT  
HEIDELBERG



OSM

OSM-3D





# Problem:

No existing storage system fulfills the requirements of OSM-3D:

- ▶ Billions of objects totaling in the petabyte range
- ▶ Unique address for each object
- ▶ Open, free and community driven architecture

# Challenge:

Develop a storage system that combines:

- ▶ The simplicity and ease of use of mirrors
- ▶ The ad-hoc nature of P2P networks
- ▶ With the speed of CDNs



# Type-checks to enforce resource-aware policies on cryptographic protocols

---

Organization: Cryptography Chair

Contact: Fabienne Eigner

Most online services rely on the use of cryptographic protocols: we all want to be assured that credit card information sent to Amazon is 'safe' and that the card is only charged if we actually buy something. We also want to be sure that if we buy a DVD, Amazon charges our card only once.

These kind of security properties can be expressed using 'authorization policies'. Proving that a protocol adheres to a specific policy by hand is a mess! Type systems (known from programming languages) have been discovered to be useful tools to enforce authorization policies.

The last of the previous examples ('buy one, pay one') has been out of the scope of existing type systems. We have developed a new type system for this class of security properties, and are looking for your help to implement the system as an automated type-checker.

# The Language-based Security Group: About us

- People:
  - Dr. Matteo Maffei (Head of the group)
  - Fabienne Eigner (PhD student and project advisor)  
[eigner@cs.uni-saarland.de](mailto:eigner@cs.uni-saarland.de)
- Research interests of LBS:
  - cryptographic protocols
  - formal methods
  - program analysis
  - semantics of programming languages
  - type theory
  - concurrency theory
  - security of distributed systems

Find us at <http://www.lbs.cs.uni-saarland.de>

# Buy one, pay one: A type-checker to enforce resource-aware policies on cryptographic protocols

- Most online services rely on the use of cryptographic protocols:
  - imagine you want to buy a CD from Amazon
  - the cryptographic protocol should ensure that:

My credit card info is 'safe'!

My credit card is charged only when I buy something!

If I buy **one** cd, Amazon charges my card only **once**!

- **Authorization policies** can be used to express these kind of security properties using logical formulas

- **WE**: developed a new type system which can be used to show that a protocol fulfills such an authorization policy
- **YOU**: implement the system as an automated type-checker

# Making statistical queries on databases safe: Type-checking for differential privacy

---

Organization: Cryptography Chair

Contact: Fabienne Eigner

How many students in Programming 1 got an 'A' in their midterm? How many people in Germany suffer from diabetes, and how many of them are members of your insurance?

Such statistical information about data collected in databases is often released to the public. On the one hand, disclosing this kind of information is often desirable for analyzing trends, performing marketing studies, or conducting research. On the other hand, this information leakage may also seriously compromise the privacy of the entries in the databases. For instance, releasing information about whether or not Peter got an 'A' in the midterm would clearly not be considered as a 'safe' query.

The notion of differential privacy is a well-established concept to define the safety of such statistical queries.

We have developed a type system that can be used to prove that a query is differentially private and are now looking for a team that helps us implement the system as an automated type-checker.

# Making statistical queries on databases safe: A type-checker for differential privacy

- Databases are everywhere!
- Releasing statistical information about their content is often desirable:

How many students in Prog 1 got an 'A' in their midterm?



How many people in Germany suffer from diabetes?

How many of them are members of your insurance?

- **Differential privacy** measures the safety of such a query ("how much information about a specific entry is leaked")

- **WE**: developed a type system that can be used to enforce that a query is differentially private
- **YOU**: implement the system as an automated type-checker

# Database for Lipid Imaging Mass Spectrometry Data

---

Organization: Bioanalytical Chemistry

Contact: David Gode

Current databases such as the Human Metabolome database or Lipid Maps do provide detailed information on target compounds such as molecular structure, exact mass, PubChem or the Independent Chemical Identifier (InChI) etc. No information, however, is available on the nature of the experimental determination of the compounds from biological samples. A thorough literature search is essential for scientists in these cases – a task that can be very challenging, additionally complicated by the rapidly growing number of publications.

This challenge is easier accomplished for new scientific fields because of the limited number of relevant papers. Imaging mass spectrometry is a relatively young discipline, being an ideal test ground for a new database, which does not yet exist but is urgently needed. This new field allows us to exhaustively cover the entire available literature and develop a state-of-the-art database.

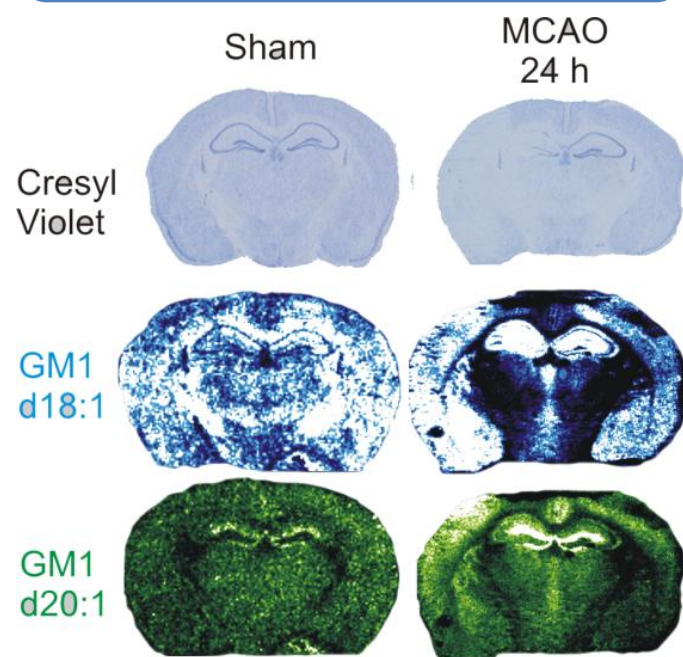
It is vital to implement an interface for automated searching and importation of citation data based on the DOI (digital object identifier) system. The database should be rolled out at first as an intranet version but should offer the flexibility to be adapted for web-based use in the future.



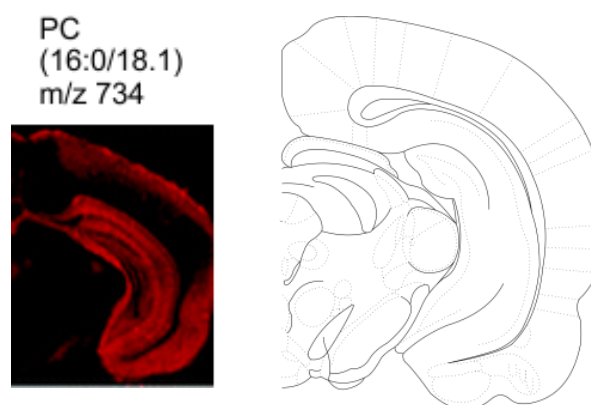
# Complexity of IMS and the resulting data



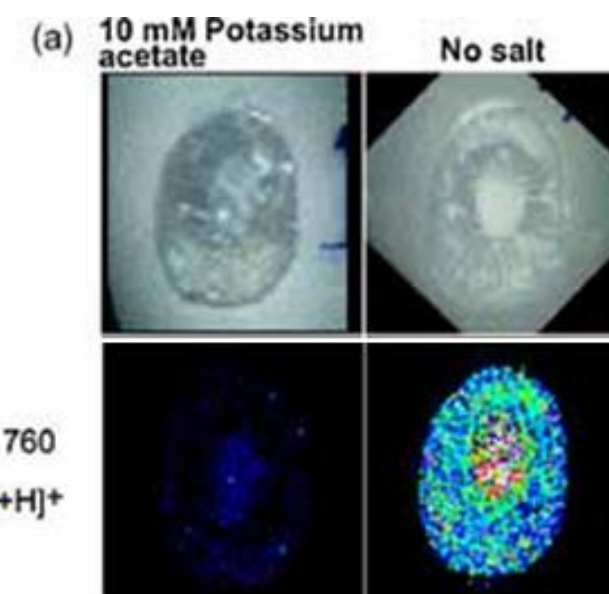
Spatially distinct changes in correlation with a disease



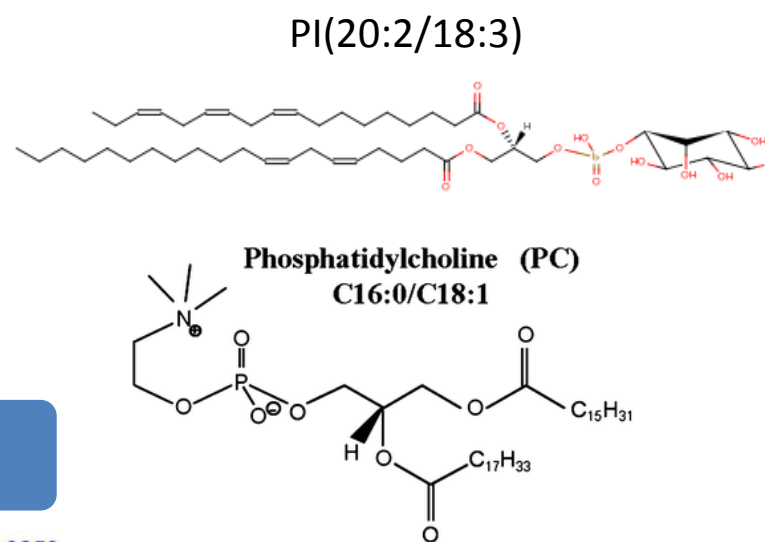
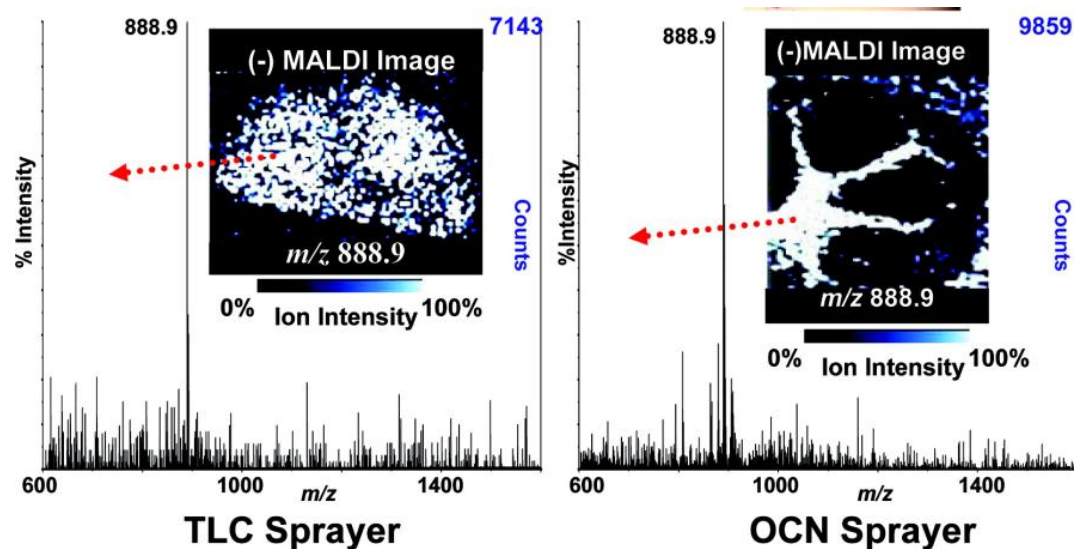
Anatomical structure



Effect of matrix substance, additives, organic solvent

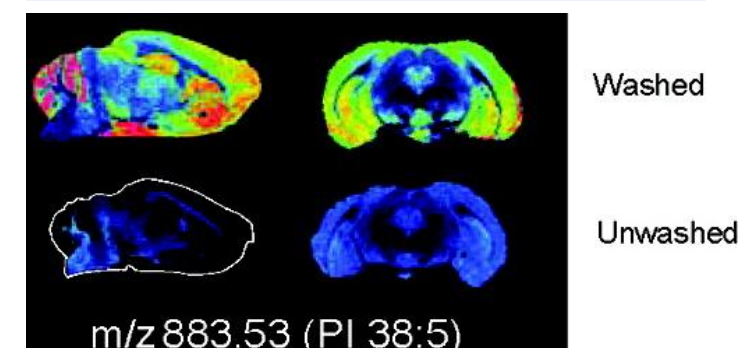


Effect of coating technique



Structure identifiers, systematic and common names, exact mass, category/main class/sub class, ...

Effect of sample treatment





# Project Proposal

## Software Engineering SS 2012



- A database that contains and connects all available experimental and biological information related to lipid species would greatly help the planning of experiments.
- Imaging mass spectrometry (IMS) is a young discipline, being an ideal test ground for a new database.

### Milestones:

- Discussion of reasonable relations of data and overall design aspects.
- Programming of a database that allows web-based use in the future.
- Implementation of the DOI system for automated import of citation data.
- Assessing the feasibility of implementing bioinformatics tools available from lipidmaps.
- Implementation of an auto-complete function from database content.

# Integration of Robotic Mapping in the NIFTi project with Google maps

---

Organization: DFKI / Language Technology

Contact: Shanker Keshavdas

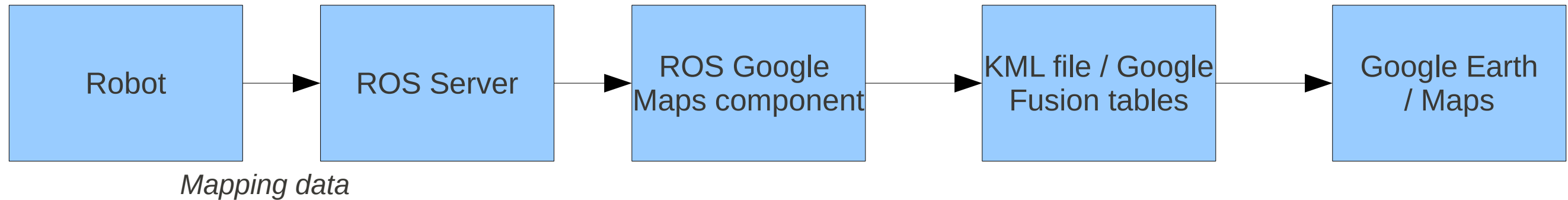
In our project NIFTi ([www.nifti.eu](http://www.nifti.eu)), we use a robot to maneuver through Urban Search and Rescue (USAR) environments to help firefighters find and rescue victims. We would like the information to be gathered by the robot to be integrated with real-time geo-spatial information from Google map services to get a better understanding of the rescue scenario. We have a basic system that can be used to convert geo-referenced data from the robot in ROS (a robot middleware), into the KLM format and Google Fusion tables that can be displayed on Google Maps and Google Earth respectively.

We would like

1. To convert more data structures from ROS into either/both KLM data or/and Google Fusion Tables.
2. To have a simple GUI that can display and modify this data.
3. To bring more autonomy in the system by considering problems in connection/data loss etc.
4. If time permits, to make this into an android application. Perhaps even start by making it an android application.

# Integration of Robotic Mapping With Google Maps/Earth

## Current System



## ROS : Robotic Operating System ([www.ros.org](http://www.ros.org))

- Open source meta-operating system used for communication between robots and related devices and software
- Extensive documentation and start up tutorials available
- Only necessary to know the message subscription/publishing system
- Working language : C++
- “ROS Google maps component” is at an initial working stage

## ROS Google maps component

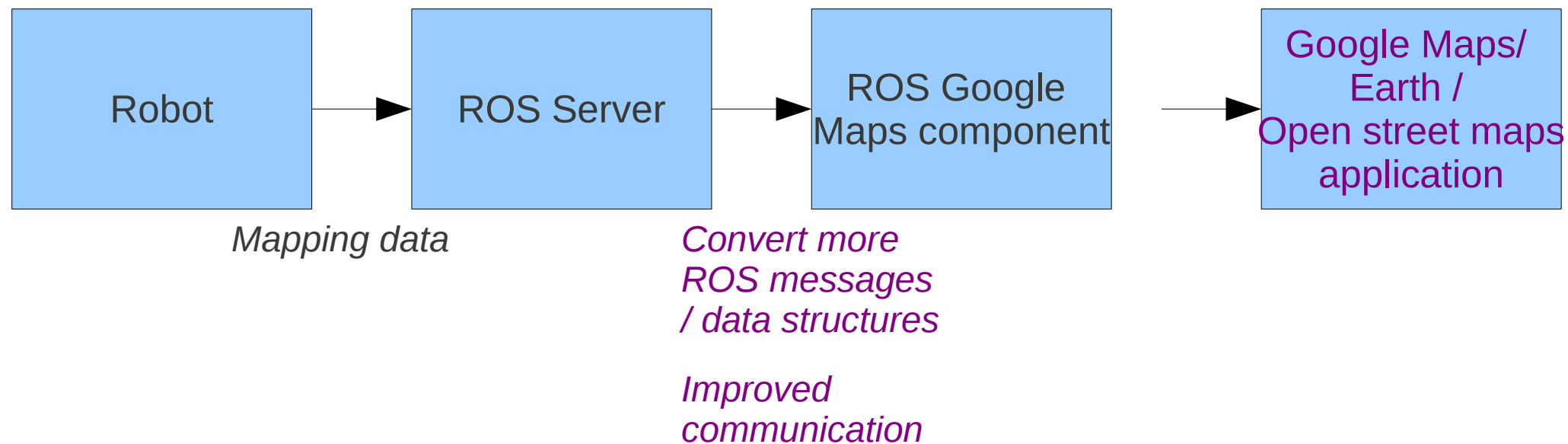
- Reads relevant messages from ROS Server
- Writes output to KLM file / Google fusion tables

## KML data / Google Fusion tables

- KML (Keyhole Markup Language) is a file format to display geographical data on geographical browsers such as Google Maps, Google Earth and Open Street Maps
- Google Fusion tables is a data management tool used to visualize charts, graphs and even KML data

# Integration of Robotic Mapping With Google Maps/Earth

## Proposed System



### Read and convert more ROS messages

- Read geographical messages in ROS and visualize them appropriately
- Example: Waypoints, Specific areas, Markers etc.

### GUI that can display the geographical data

- You can use Google Maps/ Earth API or Open street maps API or any other Geographical Information System
- Simple visualization options (hide/select etc.)
- Warning: These APIs may be in other languages (not C++), which means they may not be easily configurable with the ROS component

### Improve autonomy in communication

- Consider signal strength / loss in data etc.

### Portability to android devices

- A solution with portability to android devices would be an added extra, but not a necessity.

# HBKsaar: Visual Arts Scheduling Software

---

Organization: Academy of Fine Arts Saar / Digital Media

Contact: Prof. Dr. Burkhard Detzler

The media gallery of the Academy of Fine Arts Saar offers artists and researchers a unique opportunity to explore the cultural constitution of (public) space. Designed as a media facade as well as an interactive audio-visual environment, the screen serves as an experimental site of projection as well as reflection, an instrument both to create and conceptually explore new forms of aesthetic communication.

On a regular basis, artists and researchers are invited to create their own iteration of the general curatorial perspective.

The goal of this project is to create a management software for scheduling what videos are displayed on what video screens at what time.

# HBKsaar: Visual Arts Scheduling Software

---





# Dynamic MapReduce Cluster Management Tool

---

Organization: Information Systems Chair

Contact: Jorge Quiane

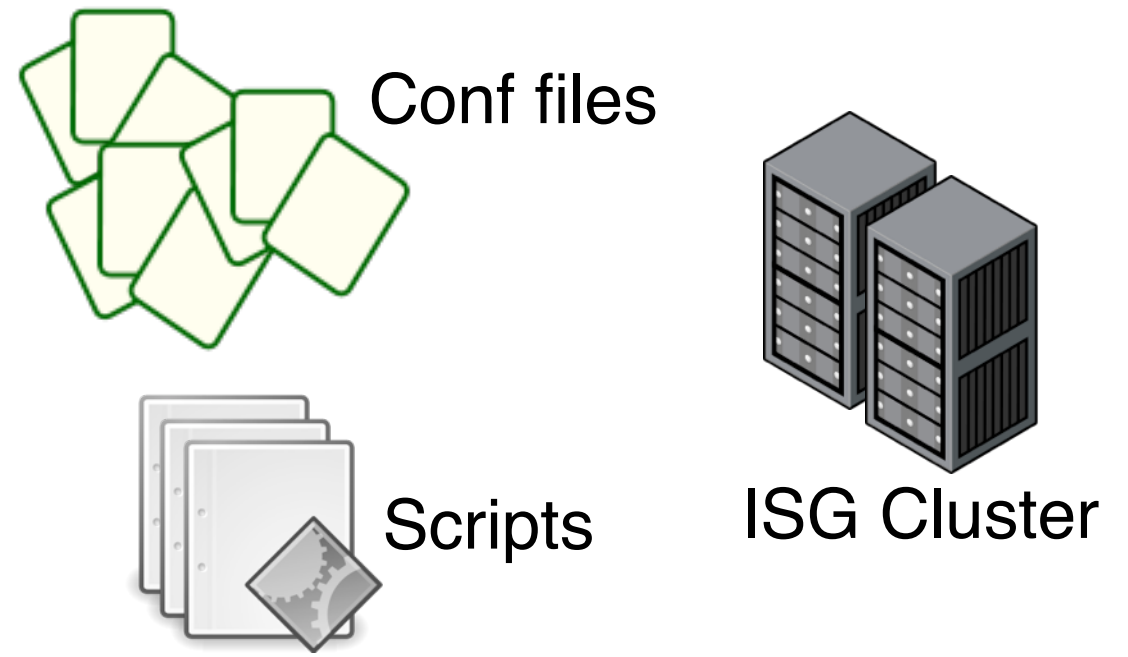
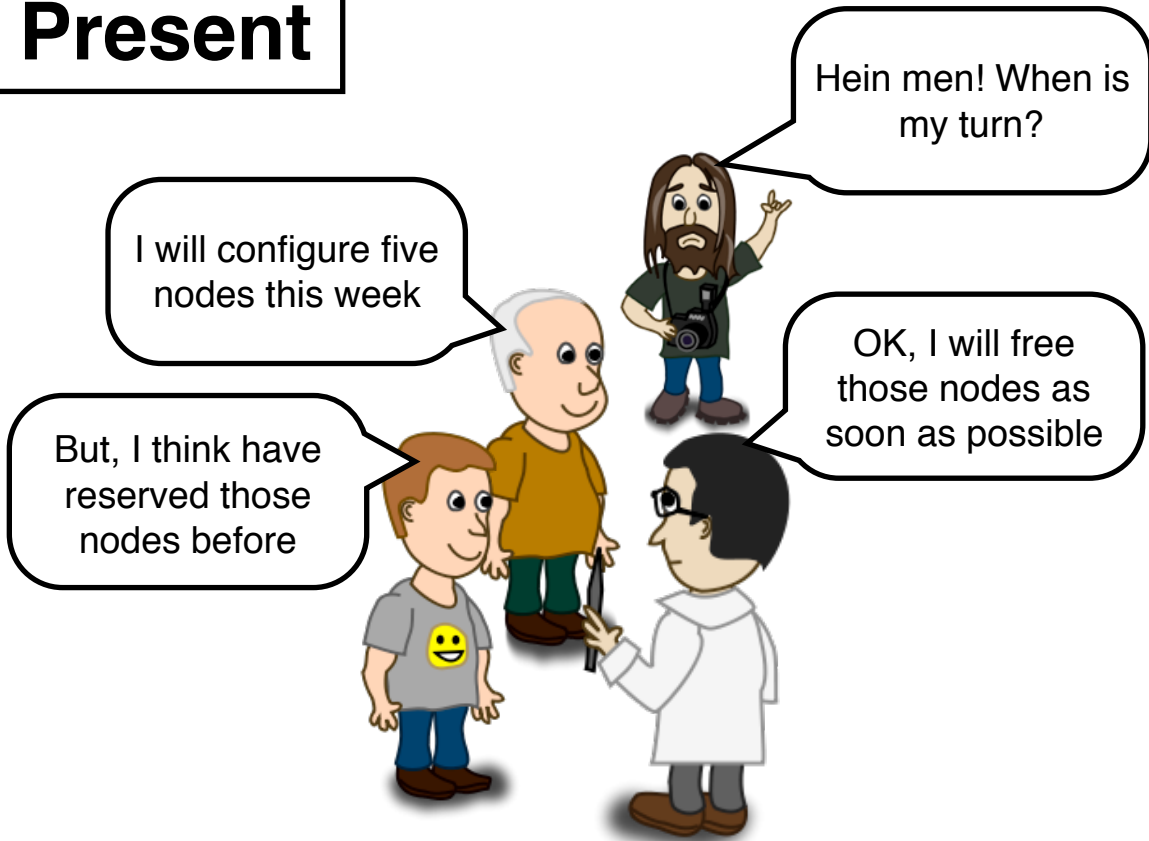
Our group is doing research on distributed database systems. For this, we need to run experiments on a cluster of servers. Since we have only one cluster but multiple people who want to run experiments for different projects, we need a way to schedule and coordinate the usage of the cluster.

Additionally, setting up and configuring the cluster for experiments is currently very painful, because one typically needs to write a certain number of scripts and edit many XML configuration files for each node. We want a nice GUI that allows us to control and configure the cluster.

The focus here is on Hadoop, but it should be generic enough to be extendable for other distributed systems. In contrast to existing solutions, the tool you create should allow multiple users to reserve nodes for a certain time slot and to see who currently holds a reservation on a node.

# Dynamic MapReduce Cluster Management

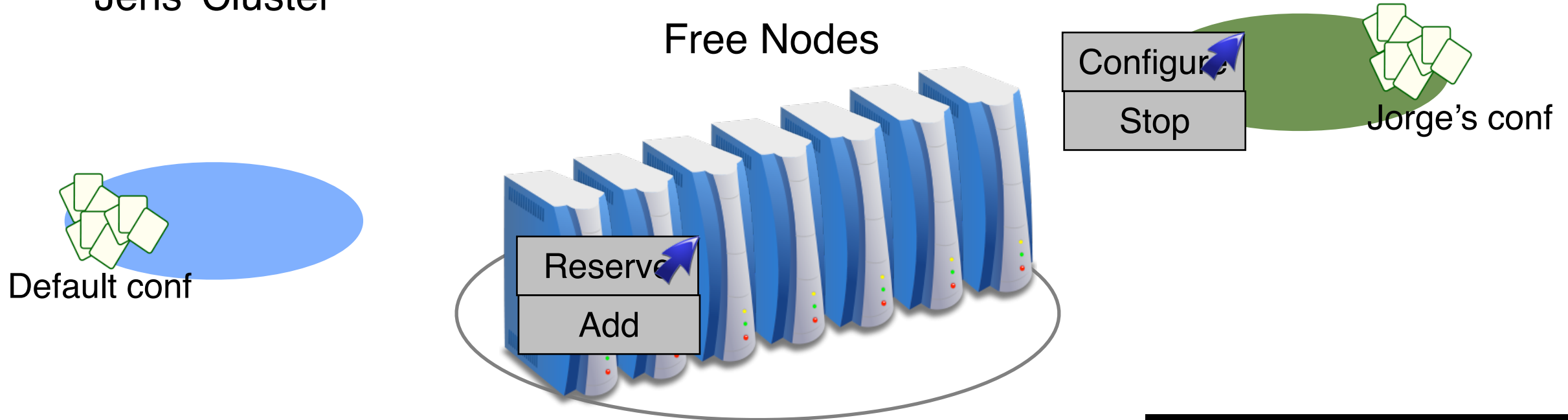
## Present



Jorge's Cluster

## Future

Jens' Cluster



Information System Group

# Databases Benchmark Running Framework

---

Organization: Information Systems Chair

Contact: Jorge Quiane

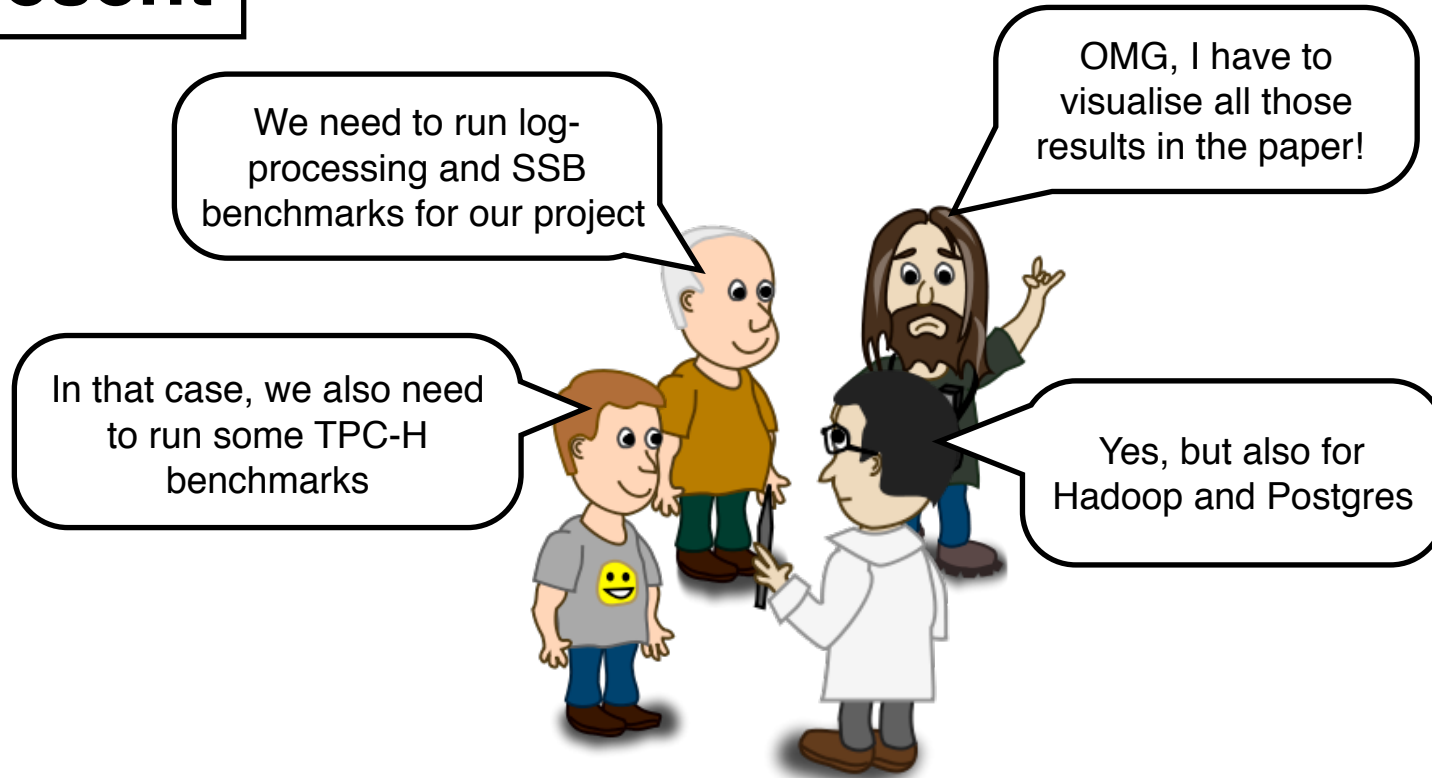
Our group is doing research on distributed database systems. For this, we need to run experiments on a cluster of servers. Since we have only one cluster but multiple people who want to run experiments for different projects, we need a way to schedule and coordinate the usage of the cluster.

Additionally, setting up and configuring the cluster for experiments is currently very painful, because one typically needs to write a certain number of scripts and edit many XML configuration files for each node. We want a nice GUI that allows us to control and configure the cluster.

The focus here is on Hadoop, but it should be generic enough to be extendable for other distributed systems. In contrast to existing solutions, the tool you create should allow multiple users to reserve nodes for a certain time slot and to see who currently holds a reservation on a node.

# Benchmarking Running Framework

## Present



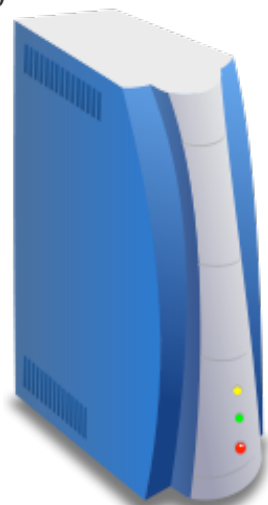
- Several benchmarks
- Several systems
- Many possible setups

**Easily execute experiments and produce graphs for each possible experimental setup!**

## Future



# Jenkins



benchmarks

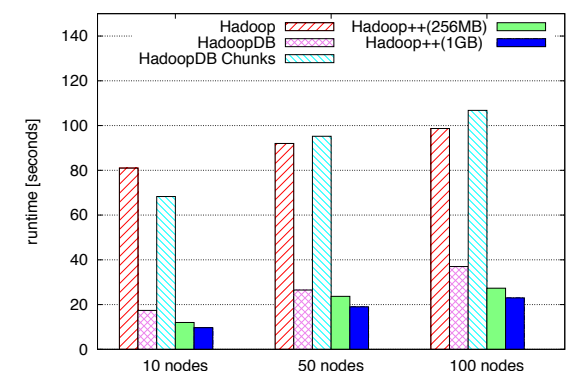
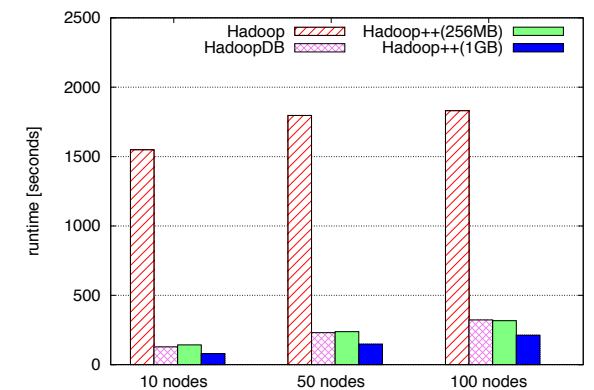


systems



schedule experiments

## BenchFramework



**Information System Group**

Part 2 from Thursday, 18 April 2012

# Tag It: Environmental tagging for Android phones

---

Organization: MPI

Contact: Art Tevs

Tag your environment (real world) with some text snippets or url links. This should be implemented as an app running on Android. A user, who would like place a tag, starts the app and aims with his phone on anything in his environment.

A second user, who would like to find such a tag, just need to go to the stored GPS coordinates and use his phone to look around for the tags. The phone app should be able in realtime to compare the feature points coming from the phone's camera with those found in the online database. Whenever the match is found, the tag is displayed.

You can think on this idea as a modern "Schnitzeljagd".



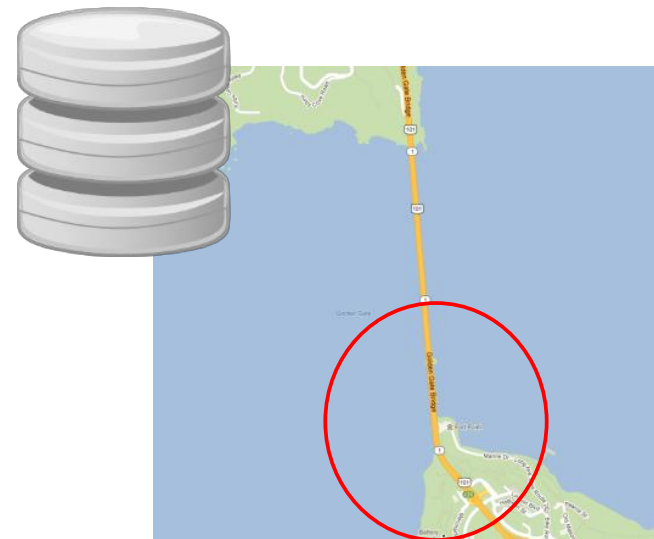
# TagIt

A modern Schnitzeljagd-App

Shoot a picture



Upload to DB with  
(uncertain) localization  
information



Somebody else will  
look for it, by pointing  
the phone around



**Your Job:** develop an Android App, which takes a picture and put all information required to describe that picture together with uncertain localization information to a database. Another person can point around with the phone in order to find the object taken with the picture again.

**You tag It - They look for It !**

# TagIt

A modern Schnitzeljagd App

## Requirements:

- The app must deal with limited hardware resources: cheap Android-Device phones
- The app must be as robust as possible, i.e., almost no false-positives !!!
- Try to make it as real-time as possible
- Implement in C/C++ (Android-NDK) or Java (Android-SDK)

## You would need to:

- Not be afraid of looking into research papers on corresponding computer vision topics
- Make familiar with image registration, feature matching, bags of features, etc., (OpenCV)
- Make familiar with programming on limited devices

## Additional points to consider:

- You might incorporate orientation sensors found on Android phones
- What are other possible applications?

# Intelligent Road Sign

---

Organization: DFKI

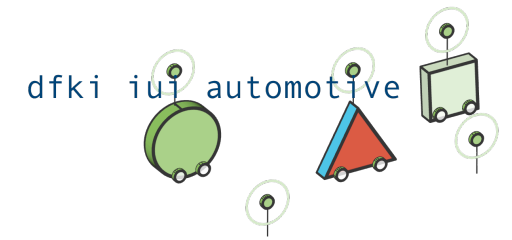
Contact: M. Mehdi Moniri

We want to develop a road sign which enables the vehicles to compute their position and orientation relative to it. The Vehicle then transmits this information to the road sign, so that they both can reconstruct the road situation in real time.

This task can be divided into different work packages:

- calculation of the position and orientation in real time  
(using available technologies like AR Tags)
- managing the communication between the road sign and the vehicle
- reconstructing the 3D road situation in real time

# Intelligent Road Sign



- Organization: Automotive Intelligent User Interface, DFKI

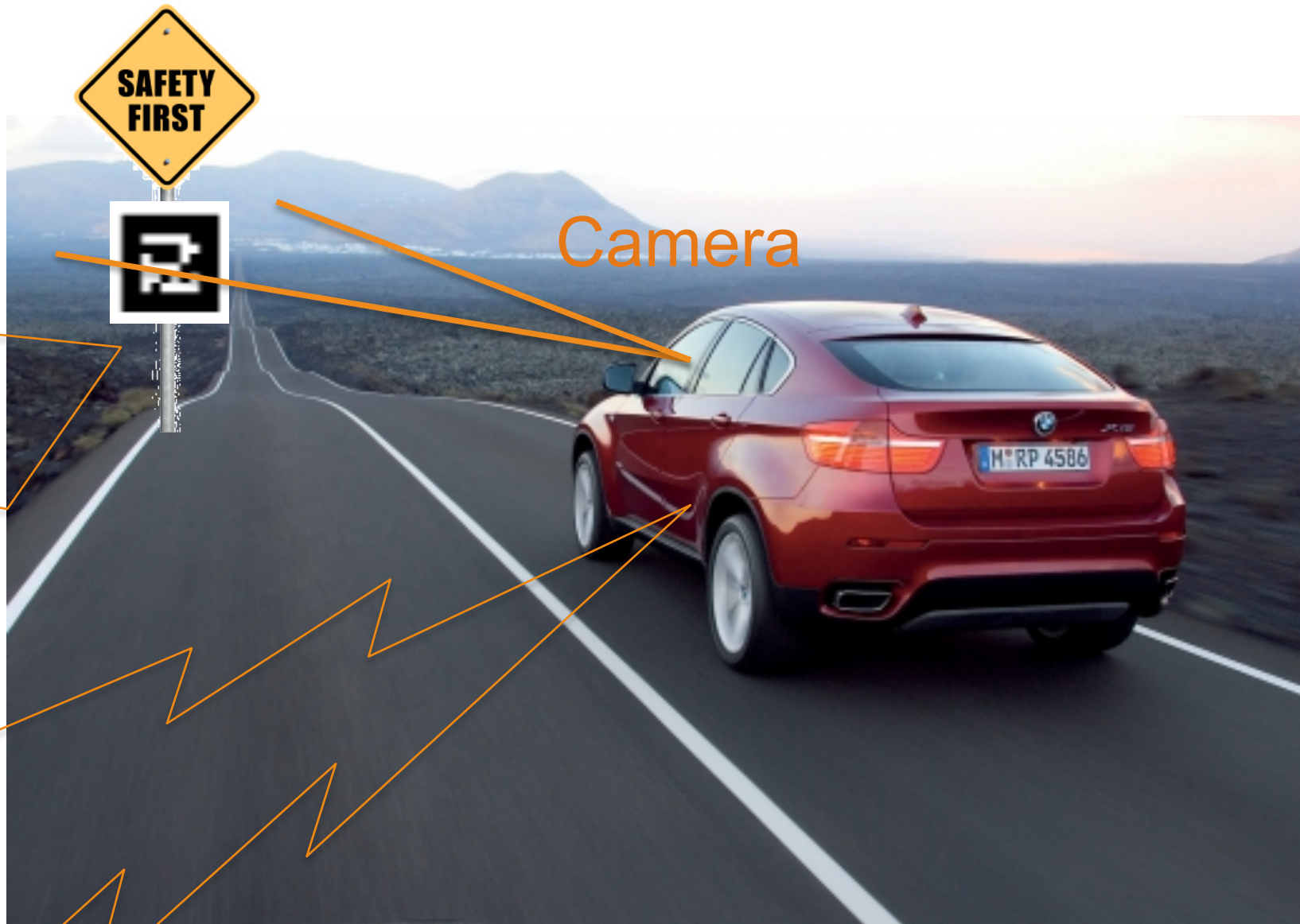
A road sign which enables the vehicles to compute their position and orientation relative to it. The Vehicle transmits this information to the road sign, so that they both can reconstruct the road situation in real time.

This task can be divided into different work packages:

- calculation of the position and orientation in real time (using available technologies like AR Tags)
- managing the communication between the road sign and the vehicle
- reconstructing the 3D road situation in real time

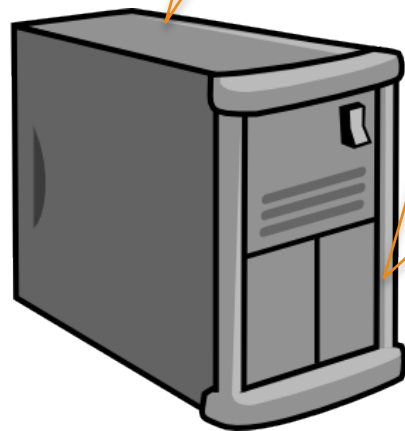


# Intelligent Road Sign



Camera

3D reconstruction!



Tests on the Campus with our cars!

Contact: M. Mehdi Moniri



# Extending I, Librarian

---

Organization: Compiler Construction Chair

Contact: Christoph Mallon

"I, Librarian" is an application to build an annotated library of PDFs. Its roots are in bioinformatics and we would like to have some extensions to make it more suitable for us. One important feature is to hand it a PDF and have its meta-information extracted automatically. There is some support to determine the DOI of a PDF, but I currently cannot handle cases, which are important to us.

For example, it should detect that a PDF was published at ACM and make a query there to determine its DOI and other meta-information to fill in information for its database. The same should be done for IEEE, Springerlink and other sources.

# What is I, Librarian?

- ▶ I, Librarian is a PDF organizer
- ▶ Hand it papers, annotate them
- ▶ It can automatically fetch them (given DOI) and extract certain information, too
- ▶ Stored papers can be searched using different criteria
- ▶ A group of people can share their efforts to preprocess literature

# What needs to be done?

- ▶ Automatic extraction works well for PubMed, but we need ACM, IEEE, Springerlink
  - ▶ This includes fetching the paper given a DOI, extracting metainformation...
- ▶ Some bugs need to be fixed
  - ▶ RIS export works, BIBTEX gives empty result
  - ▶ Giving it a DOI works, a DOI-URL results in an exception
  - ▶ Metainformation is not always correctly extracted (e.g. wrong publishing date)
- ▶ Some features would be nice
  - ▶ If paper has no keywords, check for occurrence of known keywords in the paper and make suggestions
  - ▶ Show BIBTEX entry on the page about the paper to ease getting it (currently only download as file is available)
  - ▶ Reimplement batch import for papers (currently only works for localhost or needs Flash)

# Advanced Automatic Repository Creation for Redmine

---

Organization: Intel Visual Computing Institute

Contact: Frank Wassmuth

Redmine is a flexible project management web application using the Ruby on Rails framework. It is cross-platform and cross-database. The Intel Visual Computing Institute uses Redmine to keep track of its various software and documentation projects.

After creation of a new project Redmine can automatically create a version controlled repository out of the box. However this automatic creation is rather inflexible. The type of the repository (Subversion / Git / Mercurial / ...) is fixed by the system administrator beforehand. Users cannot choose their desired flavor of version control. Your job is to extend Redmine's functionality to enable users to choose their desired brand of version control, as well as enable the backend scripts to create repositories according to the user's choice.

# Advanced Automatic Repository Creation for Redmine



- Uses Ruby on Rails framework
- Support for many SCM systems out of the box
- Limited support for automatic creation of repositories
  - SCM Flavor fixed by system administrator
  - Sometimes users want to use uncommon SCMs (e.g. Darcs)



# Your Job / What to do

- Enable Redmine

  - to retrieve the user's desired SCM flavor

  - to create a corresponding repository

- This includes:

  - Update graphical user interface

  - Extend backend database schema

  - Extend repository creation scripts

  - Enable the administrator to configure certain aspects of repository creation

  - ...

# You Don't Know Your Code: Programming for Pupils

---

Organization: Computer Science Dept.

Contact: Karim Rezeg

We would like to create a community-oriented programming system. Pupils get programming challenges over the web, can submit their programs, have them automatically tested and get skill points for it or can review each other's programs.

Requirements include:

- Web frontend where pupils can upload their code, receive funny and motivating results, see a high score and can compete with each other
- Backend which enables the tutor team to create challenges and change the text of the test results in a way that the automatically generated feedback is funny and motivating at the same time
- To adopt open source software system (Praktomat?) which receives source code for different assignments and tests the code automatically on functionality and software engineering criteria



MONDOBOX.COM

# YOUR CODE

Netscape: Practice of Programming: Review Submission

File Edit View Go Window Help

Bookmarks Go To: <http://www.acme.edu/practomat/>

### Submitted solution

This is the solution as submitted by Jimmy Corrigan.

```
PROCEDURE gcd(a,b: CARDINAL): CARDINAL;
(*compute gcd*)
BEGIN
  WHILE a <> b DO
    IF a > b THEN a:= a-b
    ELSE b:= b-a
    END
  END;
  RETURN(a);
END gcd;

VAR x,y,z,n: CARDINAL;
```

w? >>> Please indent the 'IF' alternatives

### Assessment grades

Please use the following grades for your assessment:

- A – yes; I would actively recommend this
- B – yes; but I would suggest some improvements
- C – no; only if several improvements are made
- D – no; I would actively oppose this

**Does this program fulfil the assignment?** ^ A v B v C v D  
Please use 'f?' to mark problematic code, use 'f!' to mark well-done code.

**Are components and procedures well documented?** ^ A v B v C v D  
Please use 'd?' to mark problematic code, use 'd!' to mark well-done code.

**Is the program structure illustrated by consistent indentation and white space?** v A ^ B v C v D  
Please use 'w?' to mark problematic code, use 'w!' to mark well-done code.

**Is following the control flow simplified by small, well-structured functions?** ^ A v B v C v D  
Please use 's?' to mark problematic code, use 's!' to mark well-done code.

**Are identifiers consistently used and well-chosen?** v A ^ B v C v D  
Please use 'i?' to mark problematic code, use 'i!' to mark well-done code.

**Is each component (function, variable, type) chosen as local as possible?**  A v B v C v D

100%

# Programming for pupils



We would like to create a community-oriented programming system. Pupils get programming challenges over the web, can submit their programs, have them automatically tested and get skill points for it or can review each other's programs.

Organization:

- Computer Science Department
- Cluster of Excellence

Contact:

- **Karim Rezeg** – responsible for MMCI Special Missions  
<[krezeg@mmci.uni-saarland.de](mailto:krezeg@mmci.uni-saarland.de)>



# Requirements



- **web frontend** where pupils can upload their code, receive funny and motivating results, see a high score and can compete with each other
- **backend** which enables the tutor team **to create challenges** and change the text of the test results in a way that the automatically generated feedback is funny and motivating at the same time
- **to adopt open source software system (Praktomat?)** which receives source code for different assignments and **tests the code automatically** on functionality and software engineering criteria

# Visualization of an adaptive hybrid error coding scheme

---

Organization: Telecommunications Lab.

Contact: Manuel Gorius

The telecommunications lab has developed media transport protocols operating an Internet channel very near to its theoretical limits. To achieve this, the parameters of a hybrid error coding scheme have to be continuously calculated and dynamically adapted.

Your task will be to design and implement a user interface for the calculation of the parameter sets. It will comprise plausibility and eligibility checking of the input (which is the channel state information), validity of the output and visualization of the output for different channel states. The visualization (graphically or in tables) should include a sorting so that similar inputs and or similar outputs can be grouped and potential correlations can be detected.

# Predictable Reliability

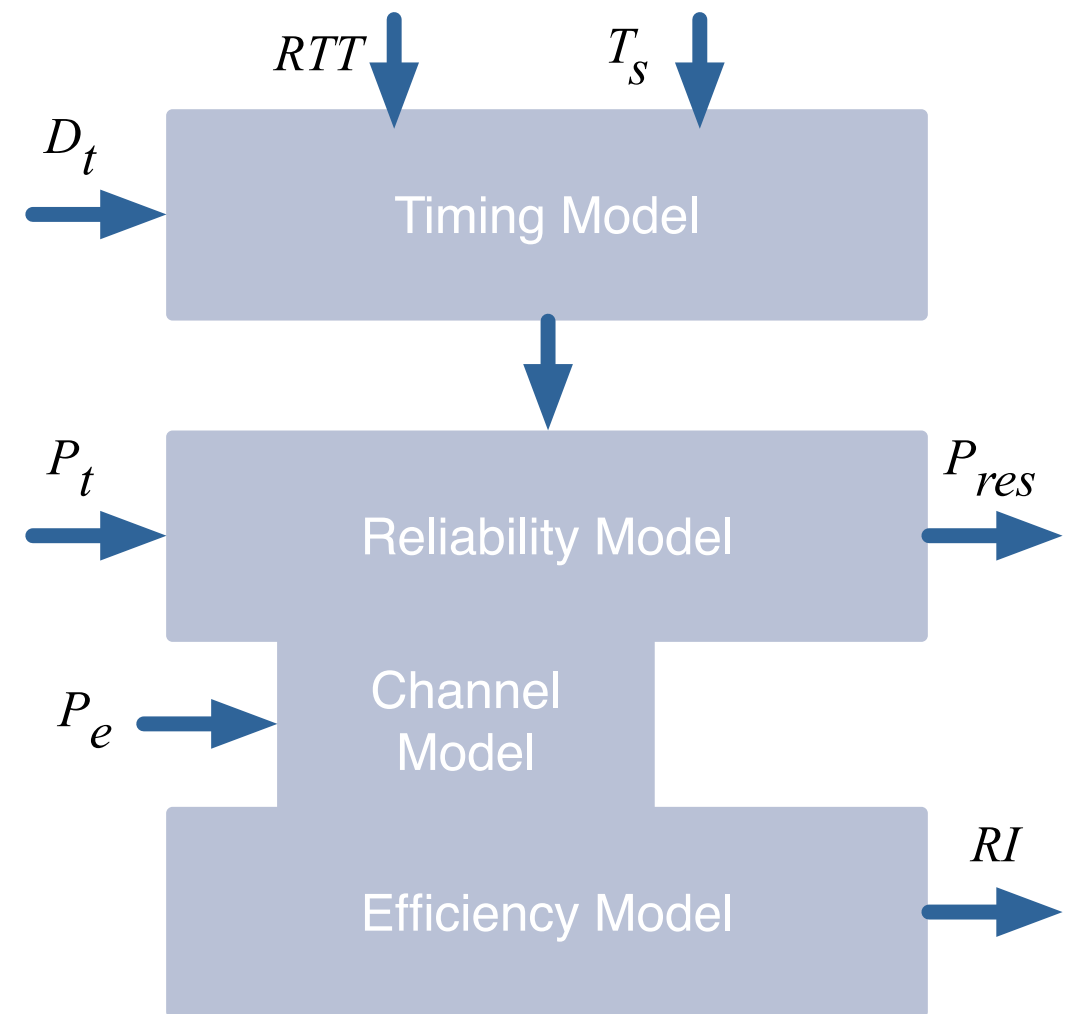


## Motivation

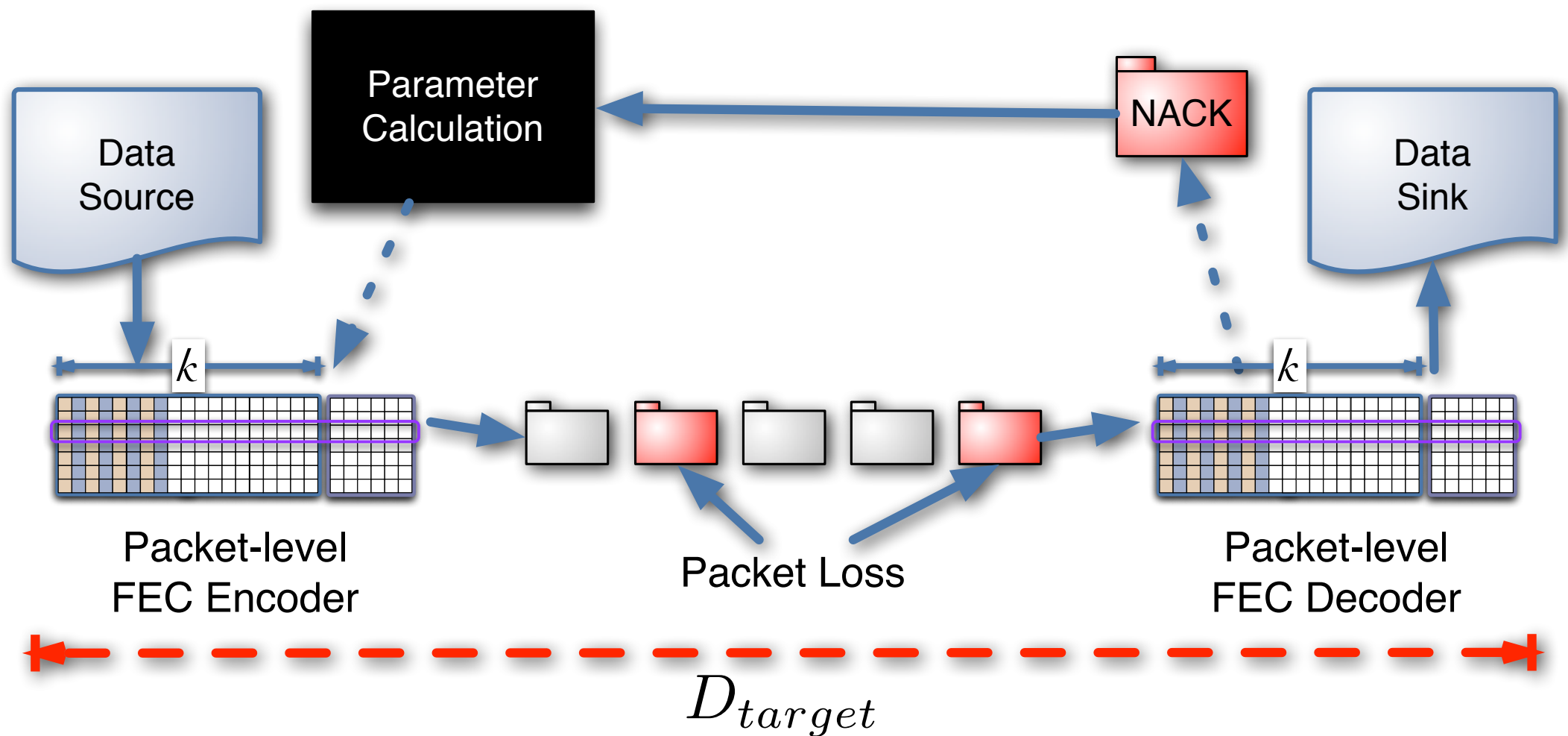
- ▶ IP media delivery: **strict time constraint** but **loss-tolerance**
- ▶ Spend application's **time budget** “predictably”

## Predictably Reliable Protocol ...

- ▶ ... meets **delay constraint** ( $D_t$ ) ...
- ▶ ... and **reliability constraint** ( $P_t$ ) ...
- ▶ ... under current **RTT**, **packet loss rate** ( $P_e$ ), **packet interval** ( $T_s$ ) ...
- ▶ ... with minimum **redundancy information** ( $RI$ ) and **residual erasure rate** ( $P_{res}$ )



# Predictably Reliable Real-time



# Visualization of Open Street Map Routing Services

---

Organization: MPI Informatics

Contact: Adrian Neumann

In the Algorithm Engineering lecture the students will write algorithms to quickly find fastest paths in Open Street Map data. They are asked to agree among themselves on a common API for their software.

Your job will be to use (and criticize!) this API to write a graphical front-end that supports requests a la Google Maps. How exactly you realize this, with a website, a desktop application or even something for mobile devices, is mostly up to you. We believe the hard part will be the coordination with the students from the Algorithm Engineering course.

It is strongly preferred that you *\*don't\** participate in the Algorithm Engineering lecture simultaneously.



# OpenStreetMap Routing

- Algorithm Engineering students provide API for routing services
- You write a GUI: roughly the same features as Google Maps
- The hard part: Getting the API you need