Centrum Wiskunde & Informatica

PHP AiR: Analyzing PHP Systems with Rascal

Mark Hills and Paul Klint

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http://www.rascal-mpl.org

Why look at PHP applications?

- Popular with programmers: #6 on TIOBE Programming Community Index, behind C, Java, Objective-C, C++, and C#, and 6th most popular language on GitHub
- Used by 78.8% of all websites whose server-side language can be determined, used in sites such as Facebook, Hyves, Wikipedia
- Big projects (MediaWiki 1.19.1 > 846k lines of PHP), wide range of programming skills, very limited tool support
- Hostile environments: most PHP code runs on the web

What are we trying to do?

- Big picture: develop a framework for PHP analysis
- Specifics:
  - Empirical software engineering
  - Software metrics
  - Program analysis (static/dynamic)
  - Developer tool support

Rascal to the Rescue!

- “Rascal is a domain specific language for source code analysis and manipulation a.k.a. meta-programming.” (http://www.rascal-mpl.org/)
- Language focus: program analysis, program transformation, domain-specific language creation
- Current projects across large numbers of domains, both within and outside academia
- Open source, over 30 committers worldwide

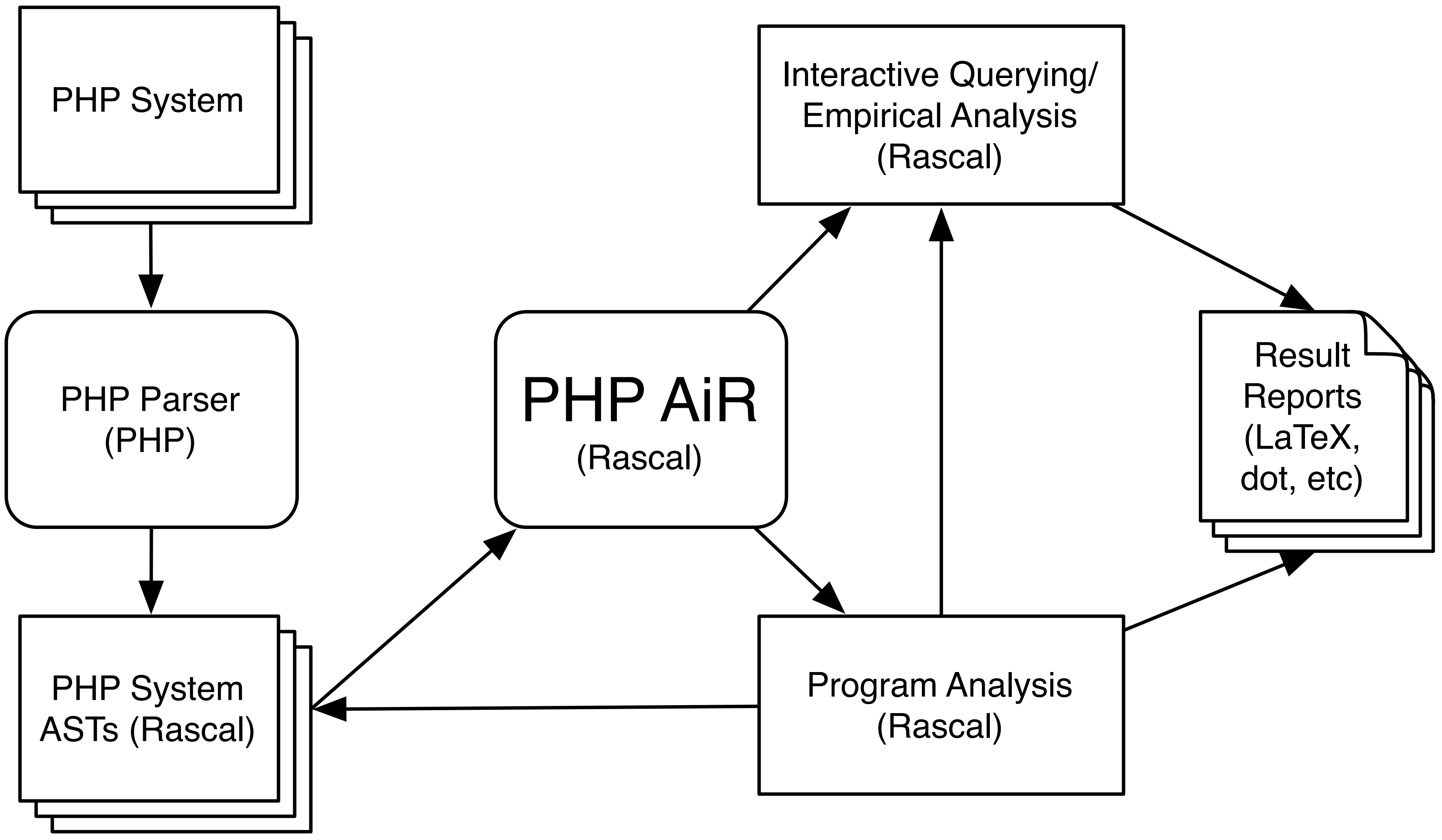
Why Rascal?

- Built-in language support for matching & transforming code
- Rich data types: relations, maps, lists, sets, tuples, parse trees, higher-order functions
- Console supports interactive exploration
- Extensible with Java and Eclipse
- Empirical research support: code querying, statistical analysis, interaction with external data (e.g., code repositories, external databases), visualization

Design Decisions

- Parsing: roll our own, or use existing parsers?
- Where should we optimize?
    - Inside PHP AiR?
    - Inside Rascal?
    - Both?
- How do we cleanly access external data sources that hold analysis data we care about?

Result: PHP AiR (Analysis in Rascal)


PHP System
PHP Parser (PHP)
PHP System ASTs (Rascal)
PHP AiR (Rascal)
Interactive Querying/ Empirical Analysis (Rascal)
Program Analysis (Rascal)
Result Reports (LaTeX, dot, etc)

One Example: Empirical Study of PHP Feature Usage

- Perspective: Creators of program analysis tools
- What does a typical PHP program look like?
- What features of PHP do people really use?
- How often are dynamic features, which are hard for static analysis to handle, used in real programs?
- When dynamic features appear, are they really dynamic? Or are they used in static ways?

“An Empirical Study of PHP Feature Usage: A Static Analysis Perspective”, Hills, Klint, and Vinju, To Appear at ISSTA 2013.

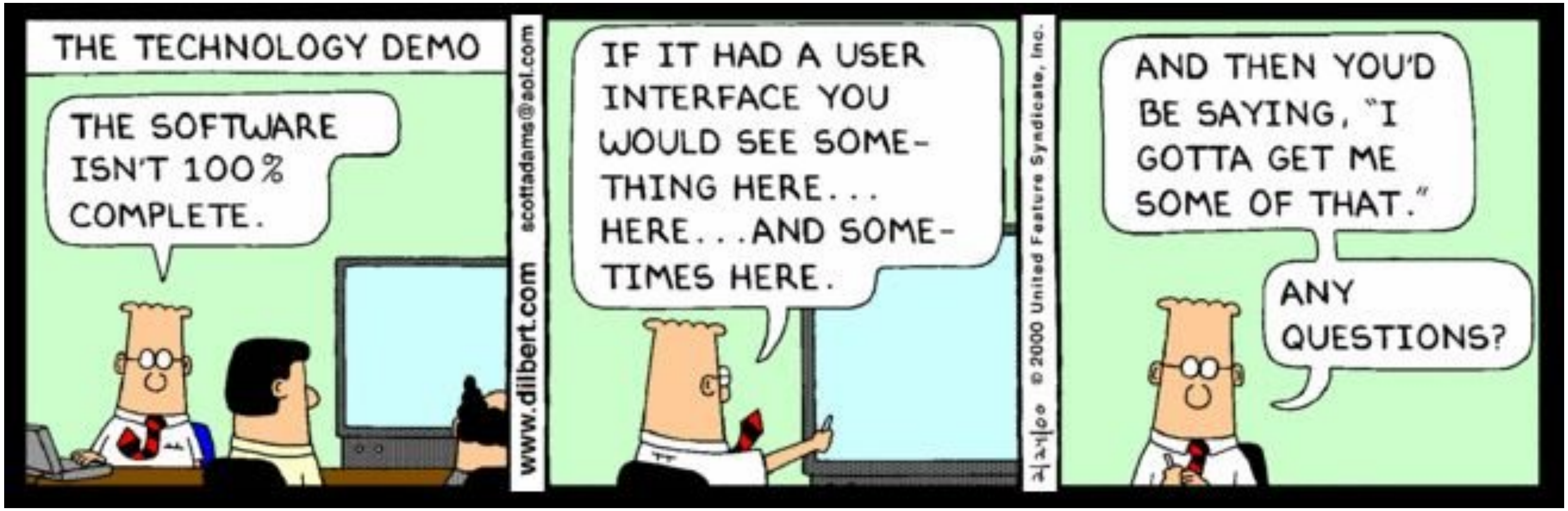
Lessons Learned

- Rascal data types and declarative programming lead to smaller, more expressive code
- Having source locations as a built-in datatype provides a powerful abstraction for referencing code
- Tool flexibility is important: an all or nothing approach to Rascal would slow us down (e.g., parsing)
- Scripting analyses eases reproducibility
- Performance is a persistent issue, and needs more work

Related Work (PHP Frameworks)

- PHP-sat & PHP-tools
- PHP CodeSniffer (standards conformance)
- PHP Copy/Paste Detector (only exact copies)
- PHPDepend, PHPLoc (metrics)
- PHPMD (metrics, simple bugs)
- php, HipHop (analysis & compilation)

Demo: PHP AiR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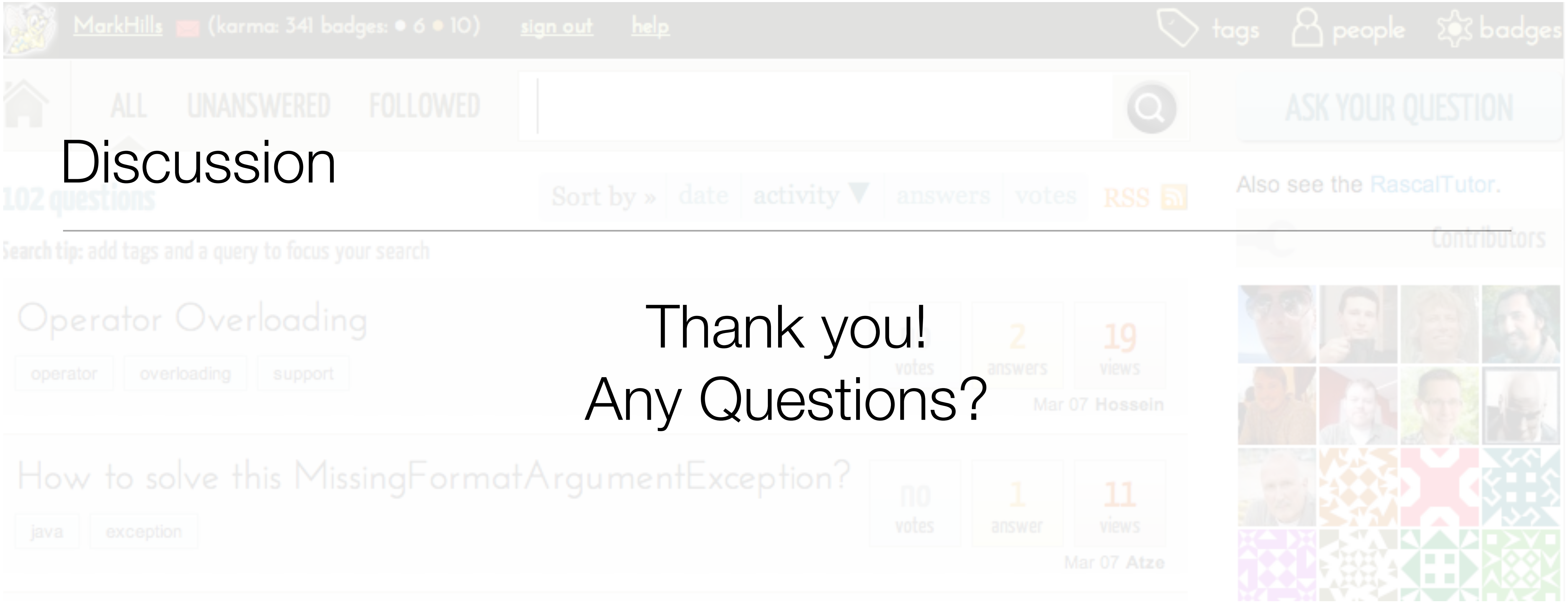
AND THEN YOU'D BE SAYING, "I GOTTA GET ME SOME OF THAT."
ANY QUESTIONS?

Discussion


MarkHills (karma: 341 badges: ● 6 ● 10) sign out help

tags people badges

ALL UNANSWERED FOLLOWED

ASK YOUR QUESTION

102 questions

Sort by » date activity ▼ answers votes RSS

Search tip: add tags and a query to focus your search

Also see the RascalTutor.

Contributors

Operator Overloading

operator overloading support

votes 2 answers 19 views

Mar 07 Hossein

How to solve this MissingFormatArgumentException?

java exception

no votes 1 answer 11 views

Mar 07 Atze

Thank you!
Any Questions?

- Rascal: http://www.rascal-mpl.org
- SWAT: http://www.cwi.nl/sen1
- Me: http://www.cwi.nl/~hills