Pavol Cerny

Bor-Yuh Evan Chang

Sriram Sankaranarayanan

Programming Languages and Verification at the University of Colorado Boulder

PLV

PLV research, right?

PLV research at CU has ***breadth***!

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How do we assist reasoning about programs?

program analysis, developer tools

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How do we get reliable, secure software?

verification, model checking

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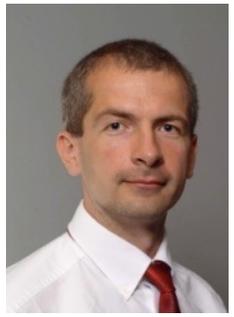
How do we let computers code for us?

synthesis

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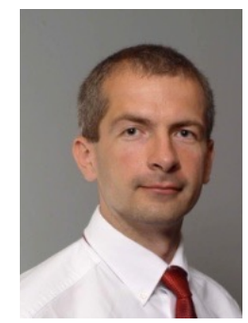

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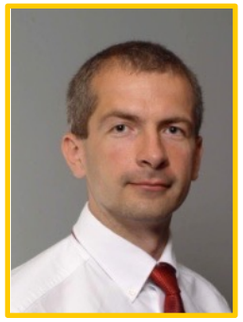


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PLV researchers at CU *collaborate*!

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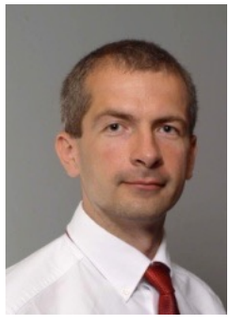

program analysis

verification

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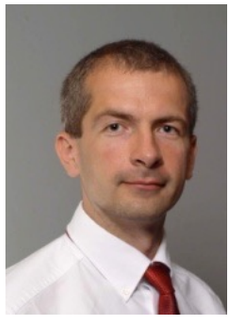
synthesis



Concurrency Synthesis

You?

program analysis

verification

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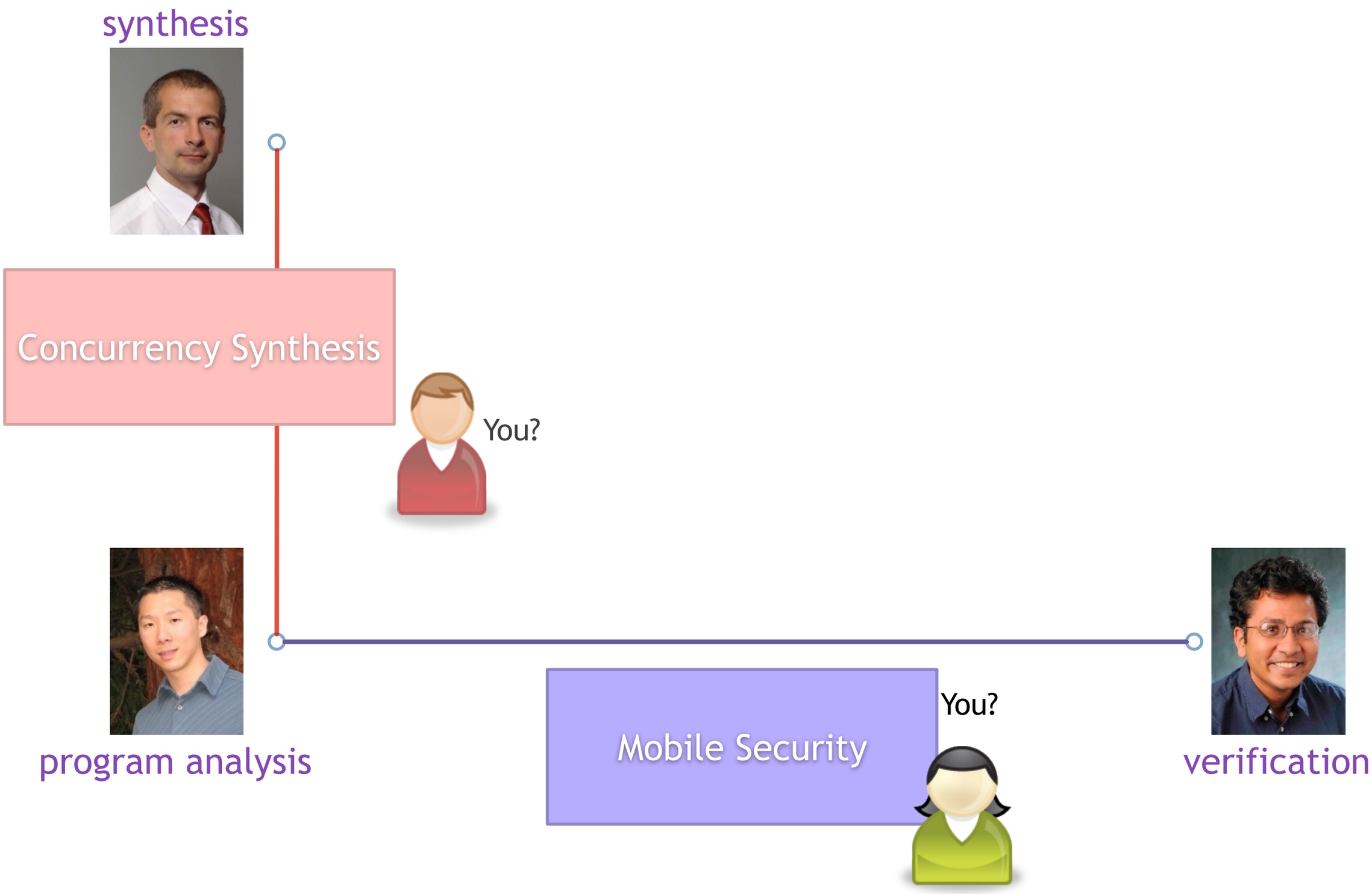

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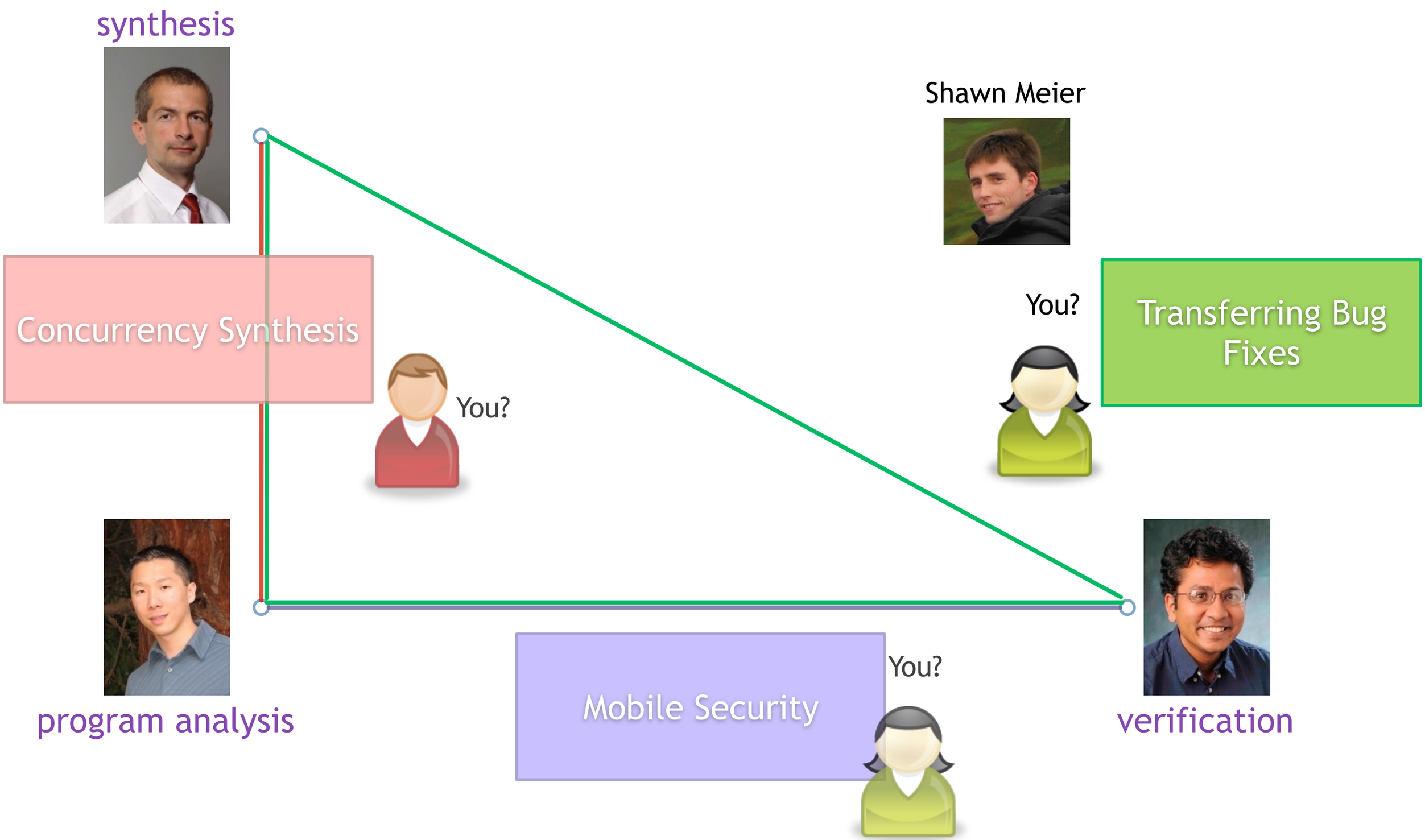


HOW'S THE DEBUGGING GOING?
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PLV is about compassion!

Do you Android?

Do you Android?

Do you Android?

Do you Android?

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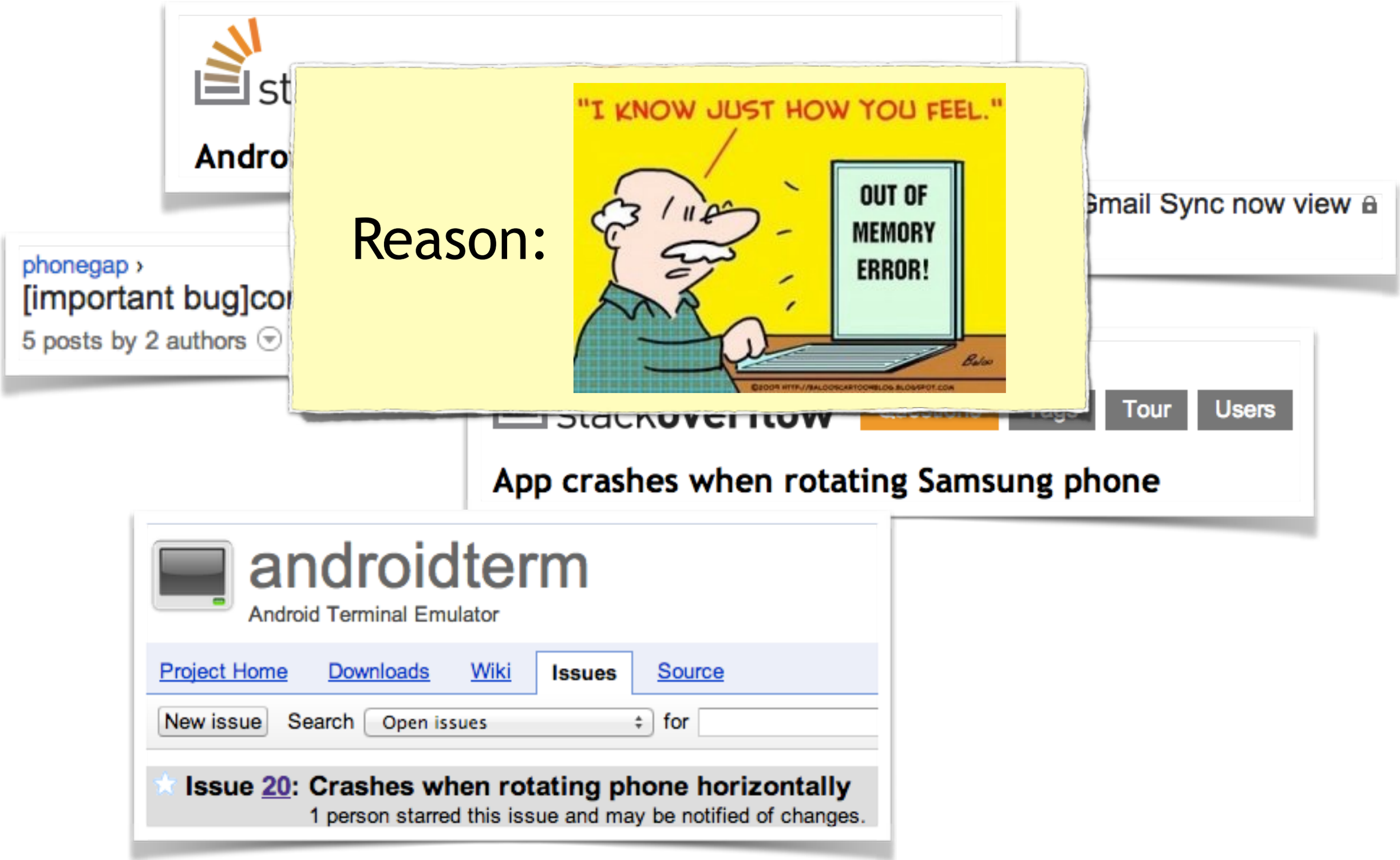


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State of practice for debugging leaks ...

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24 MARCH 2011

Memory Analysis for Android Applications

[This post is by Patrick Dubroy, an Android engineer who writes about programming, usability, and interaction on his personal blog. — Tim Bray]

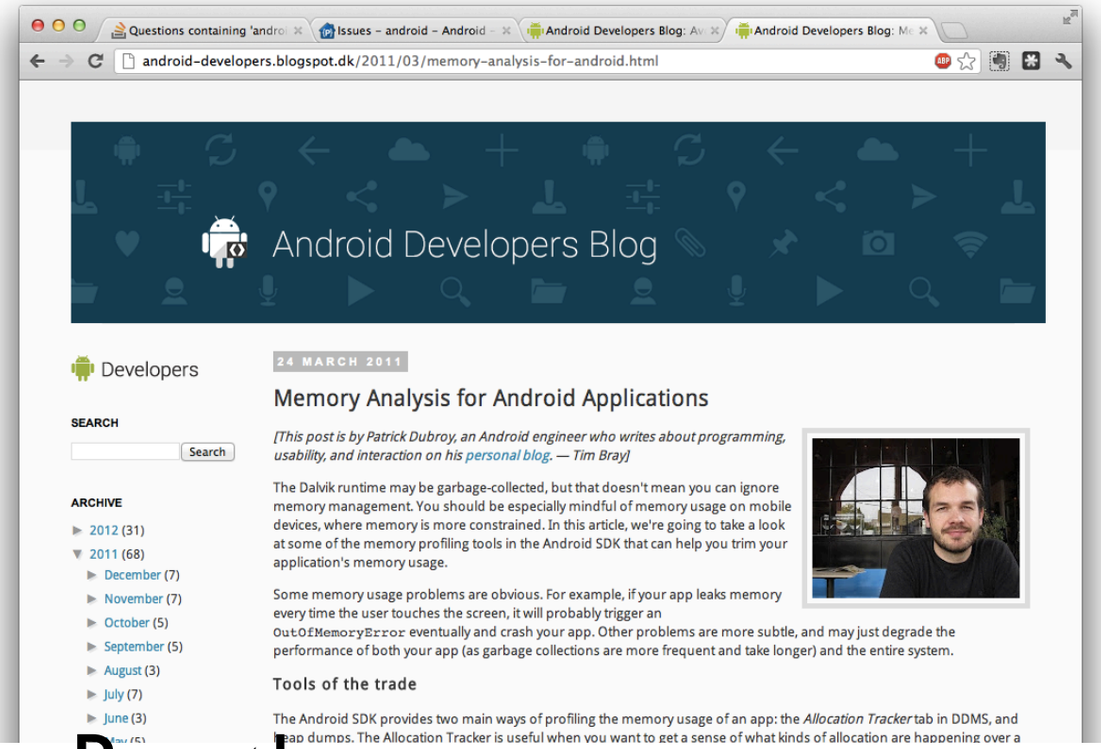
The Dalvik runtime may be garbage-collected, but that doesn't mean you can ignore memory management. You should be especially mindful of memory usage on mobile devices, where memory is more constrained. In this article, we're going to take a look at some of the memory profiling tools in the Android SDK that can help you trim your application's memory usage.

Some memory usage problems are obvious. For example, if your app leaks memory every time the user touches the screen, it will probably trigger an `OutOfMemoryError` eventually and crash your app. Other problems are more subtle, and may just degrade the performance of both your app (as garbage collections are more frequent and take longer) and the entire system.

Tools of the trade

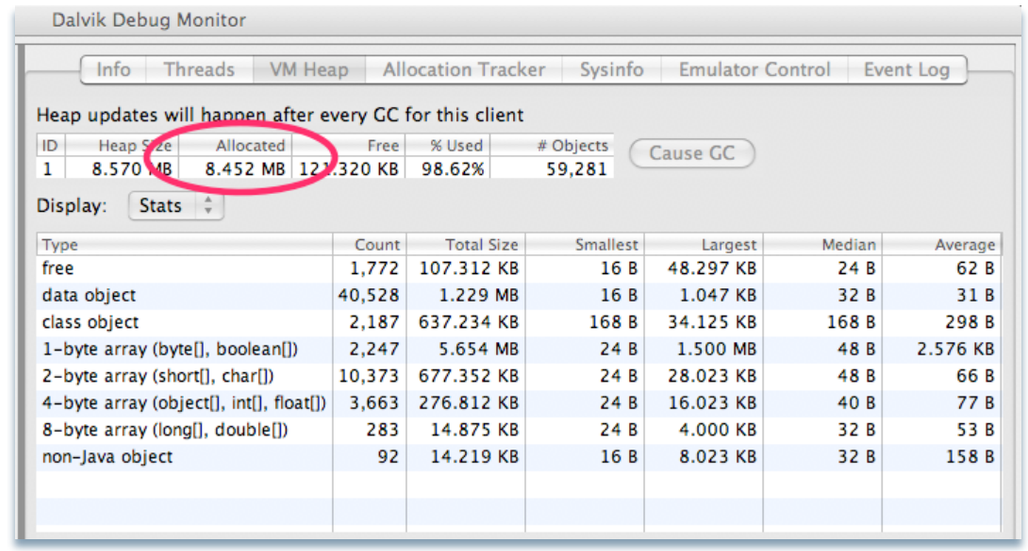
The Android SDK provides two main ways of profiling the memory usage of an app: the *Allocation Tracker* tab in DDMS, and heap dumps. The Allocation Tracker is useful when you want to get a sense of what kinds of allocation are happening over a

State of practice for debugging leaks ...



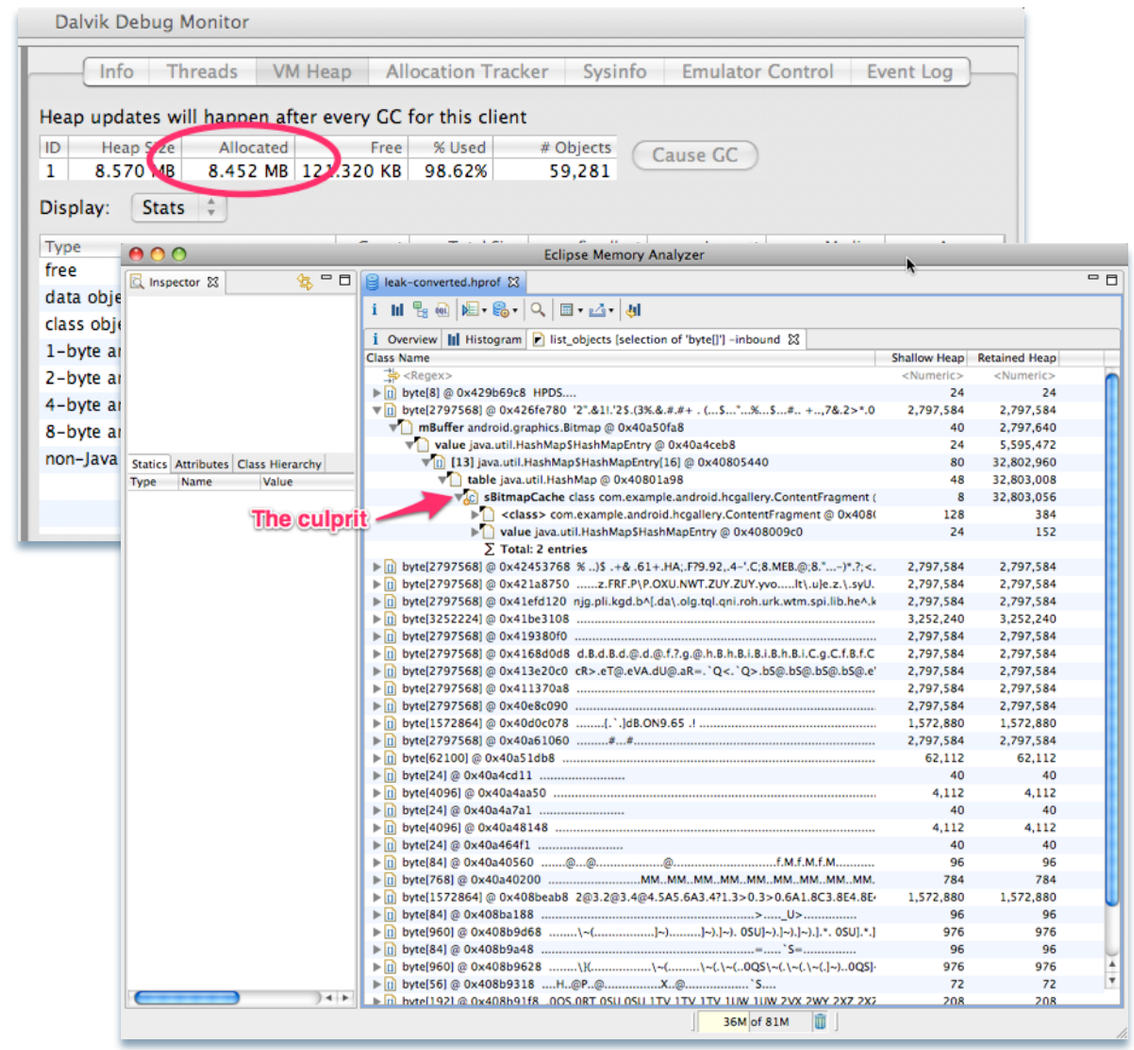
1. Run the app

State of practice for debugging leaks ...



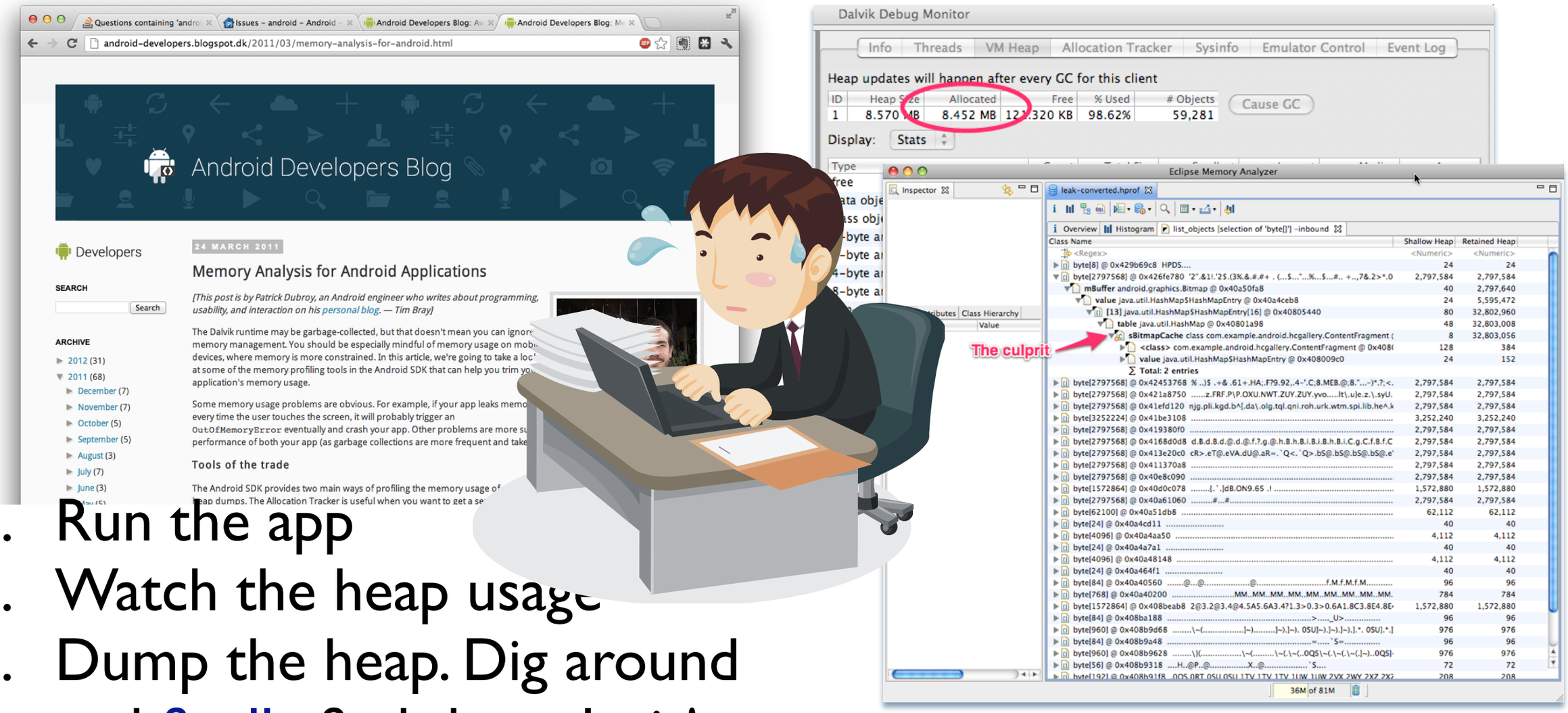
1. Run the app
2. Watch the heap usage

State of practice for debugging leaks ...



1. Run the app
2. Watch the heap usage
3. Dump the heap. Dig around and finally find the culprit!

State of practice for debugging leaks ...



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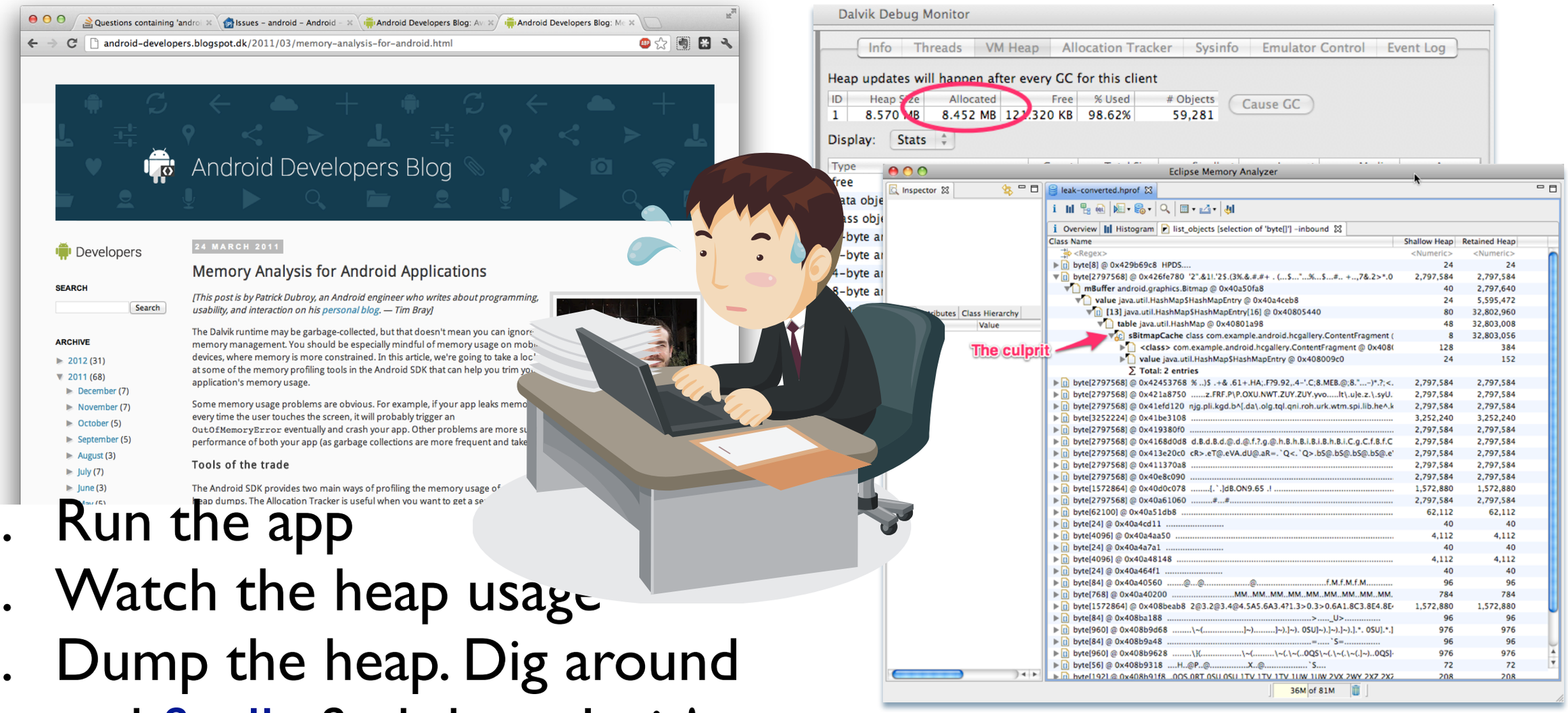

1. Run the app
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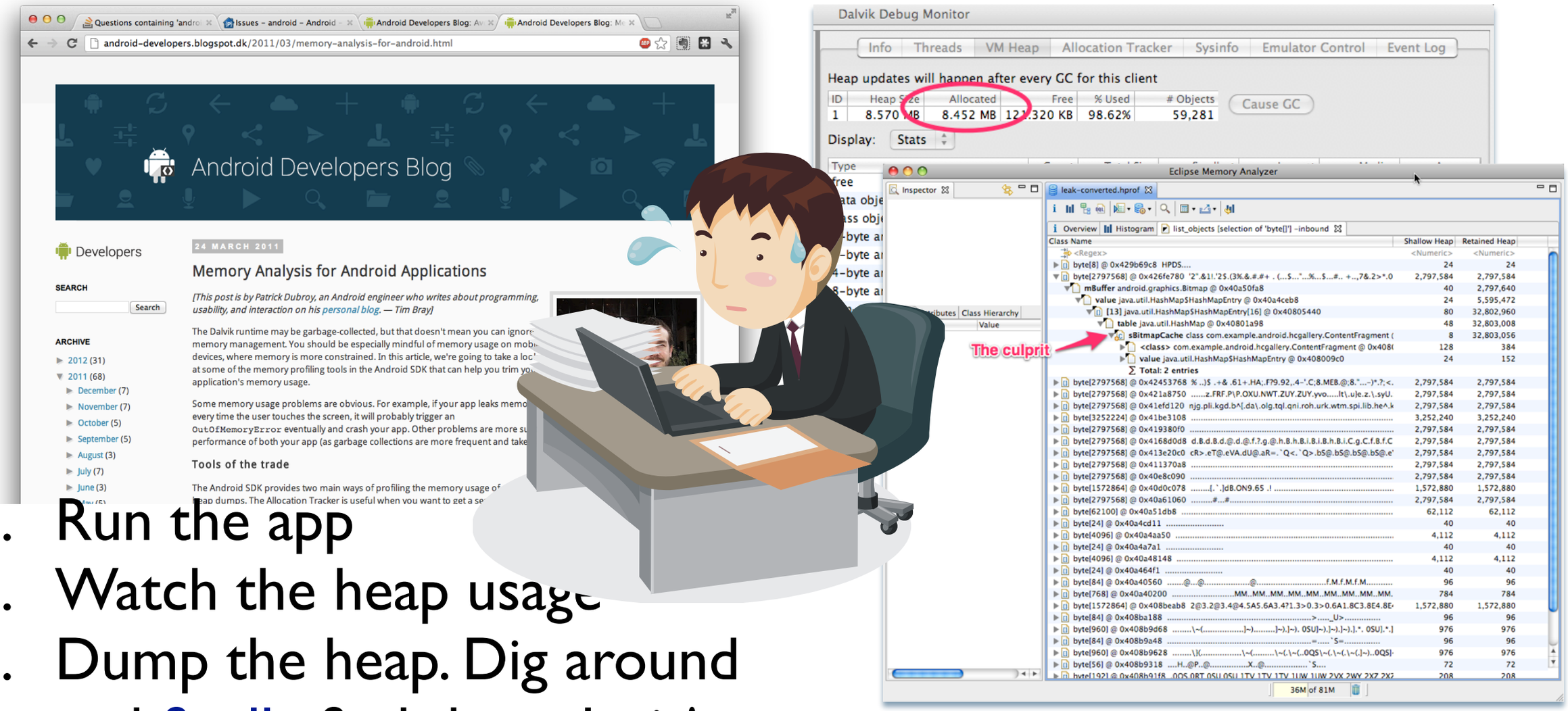
4. Commit a bugfix

GitHub

State of practice for debugging leaks ...



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3. Dump the heap. Dig around and finally find the culprit!
4. Commit a bugfix
5. Bugfix is picked up by our tool **Fixr**

Idea

GitHub

Fixr

A **Fixr**-enabled IDE responds ...

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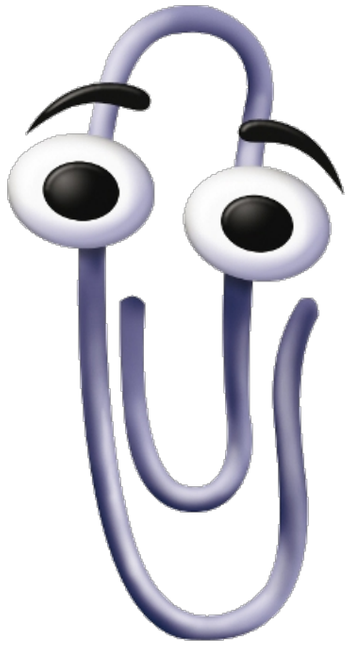

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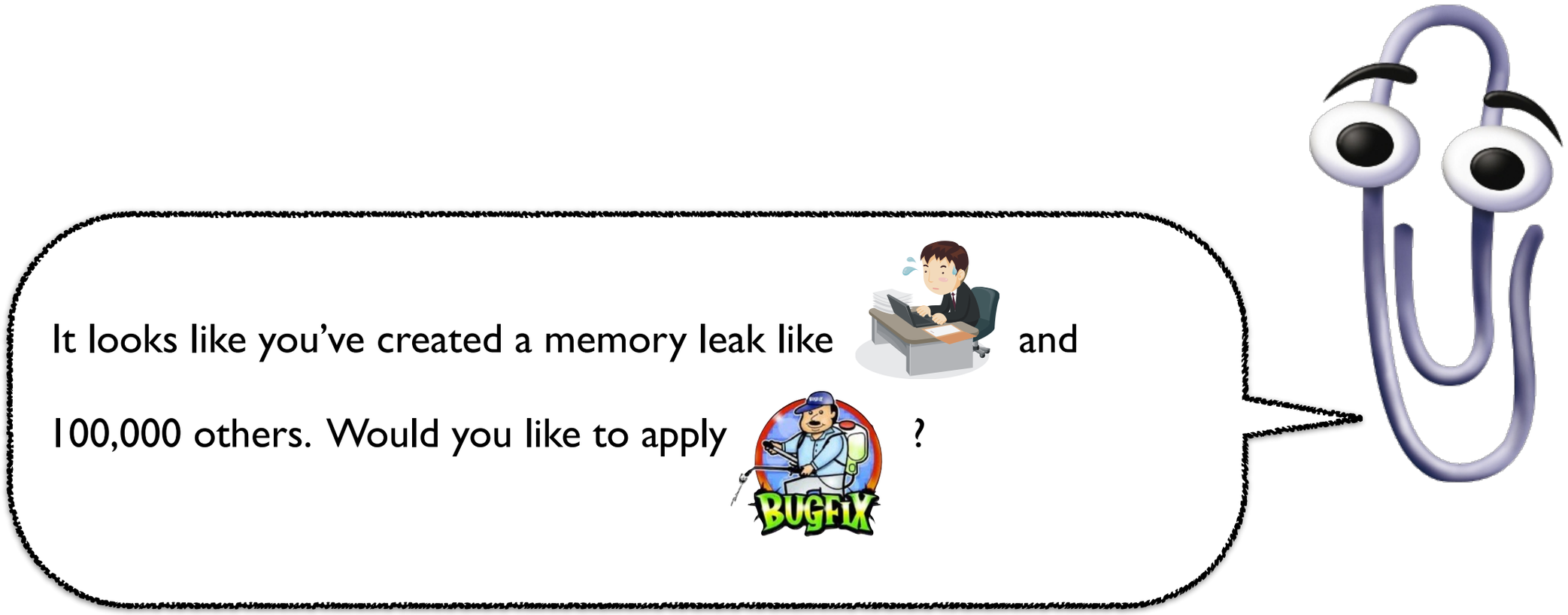

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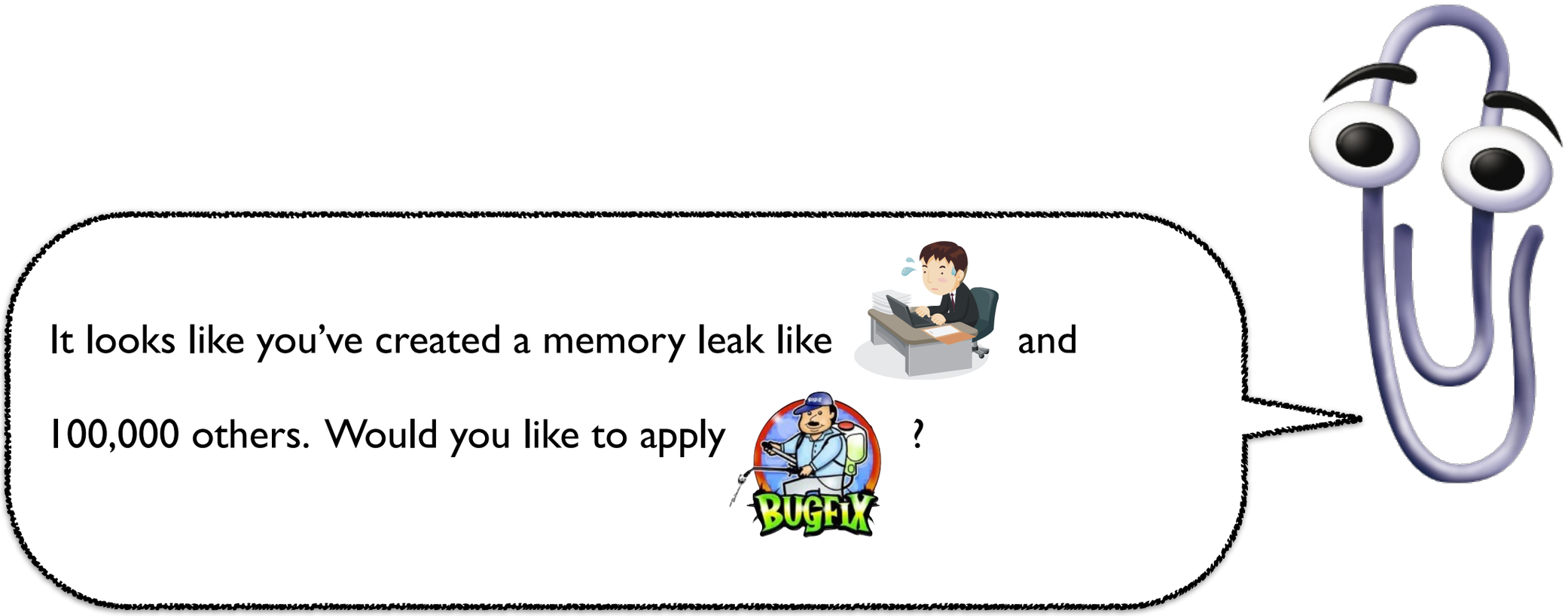


the bugfix is "transferred"

Program synthesis for network updates

Program synthesis for network updates

Program synthesis

Program synthesis for network updates

Program synthesis

Network Updates

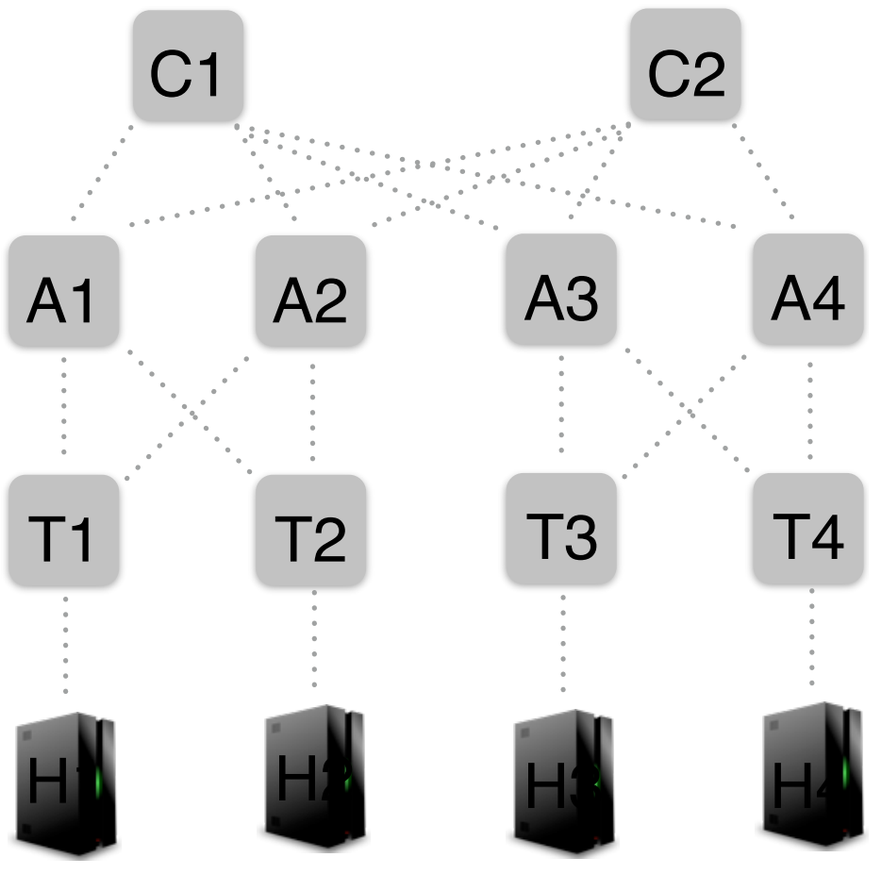
Program synthesis for network updates

Program synthesis

Network Updates

Work to appear at PLDI 2015
First author: Jed McClurg
(second-year PhD student)

Order Update Example



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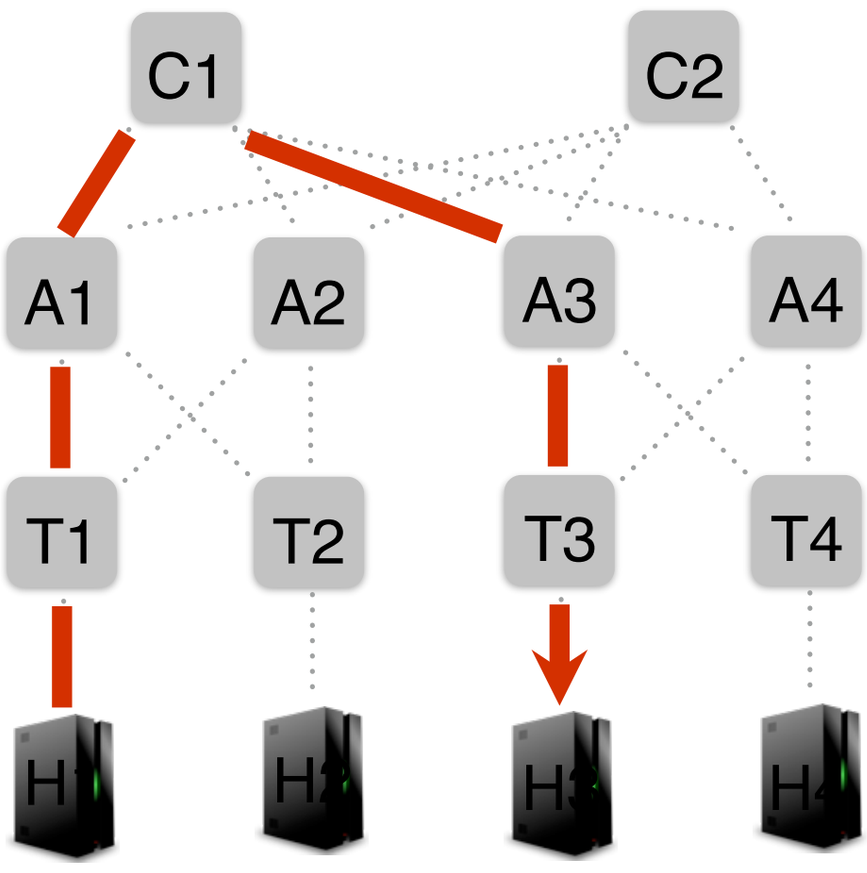

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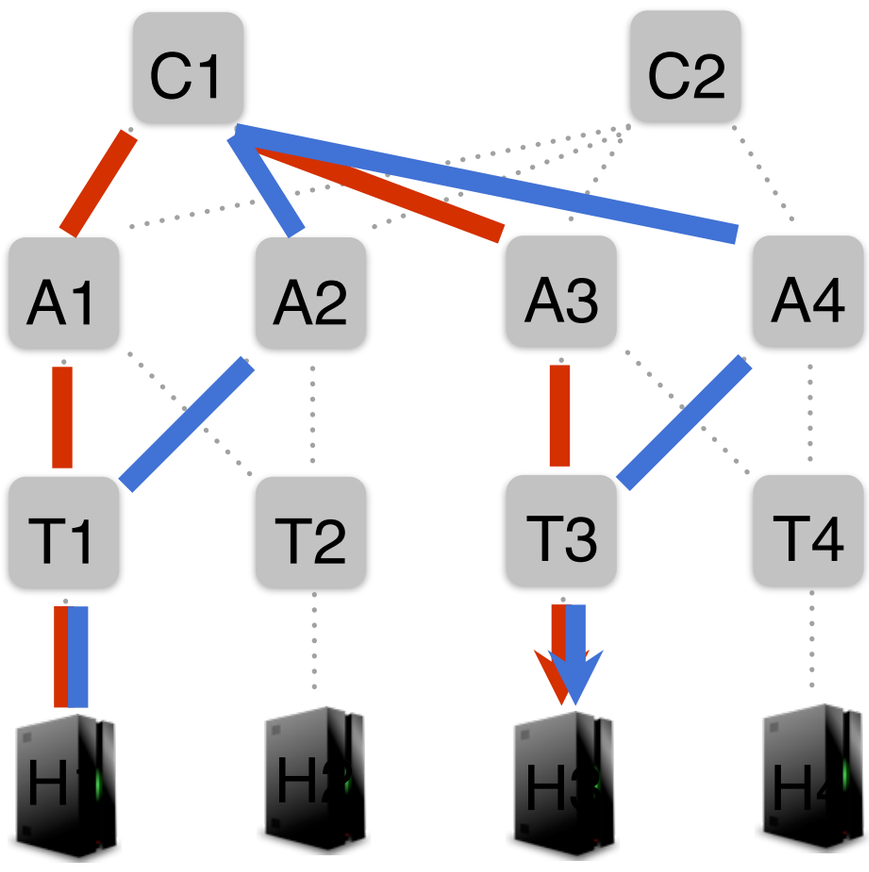

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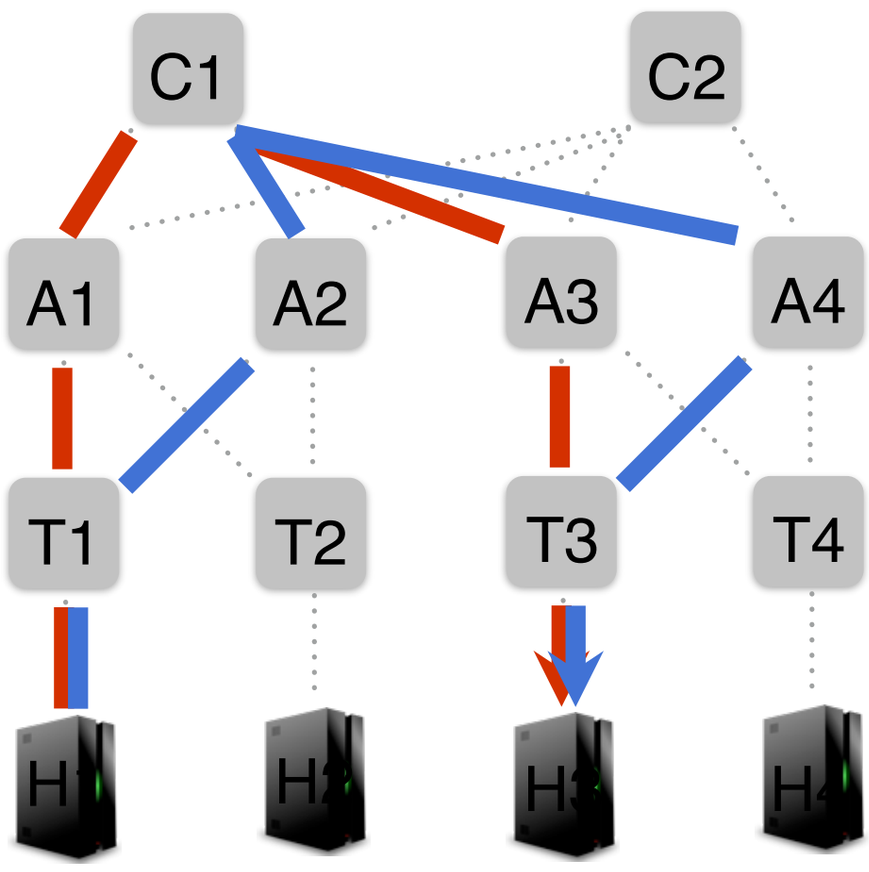

Property: at all times, maintain H1-H3 connectivity and either traverse A2 or A3

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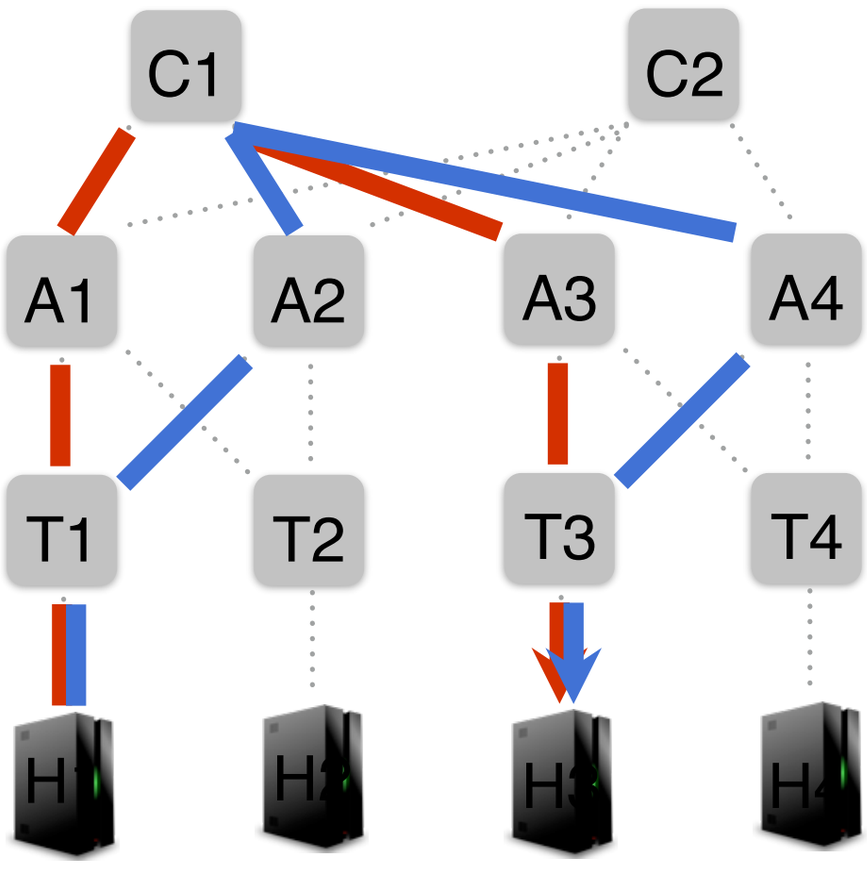
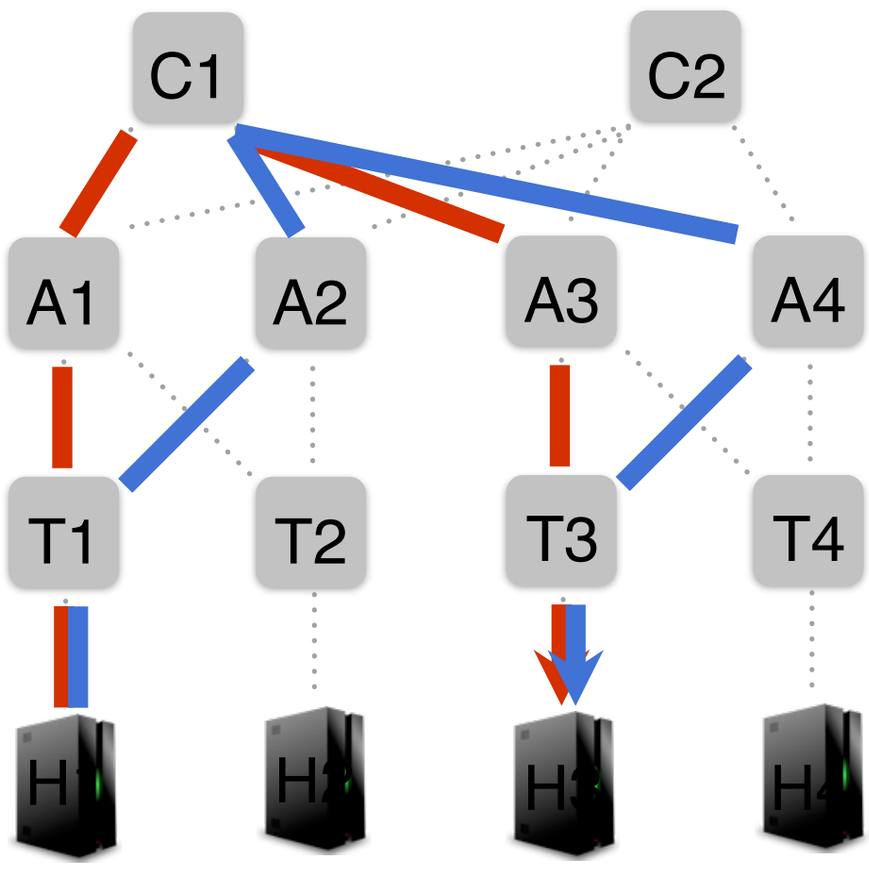


A2-A4-C1 (not good)

A2-A4-T1-C1 ?

Property: at all times, maintain H1-H3 connectivity and either traverse A2 or A3

Order Update Example



A2-A4-C1 (not good)

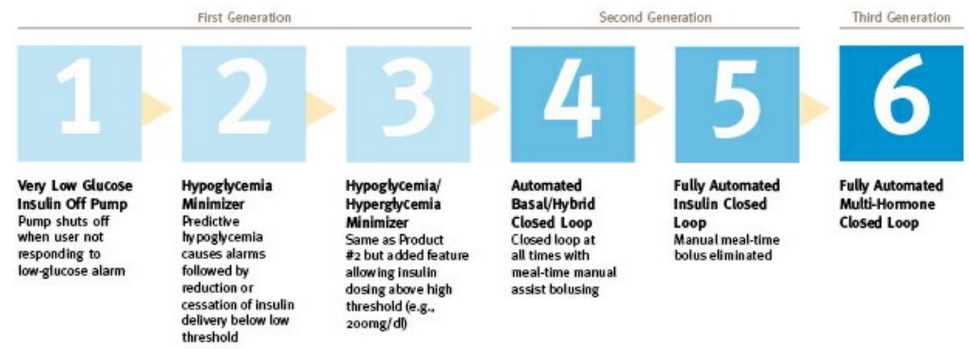
A2-A4-T1-C1 ?

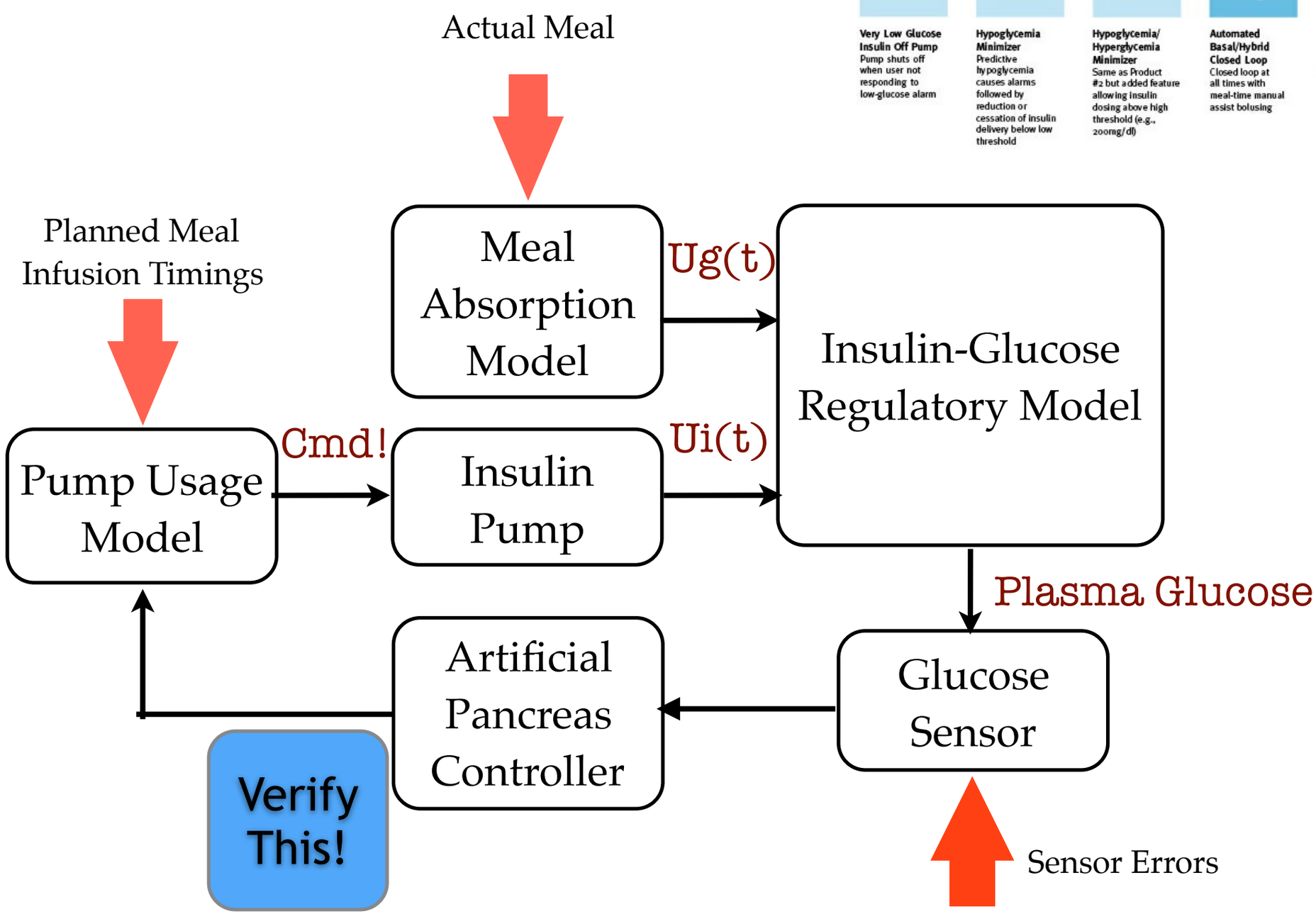
A2-A4-T1-wait-C1

Property: at all times, maintain H1-H3 connectivity and either traverse A2 or A3

Artificial Pancreas Verification Project

Collaboration with UC Denver Medical School and UT El Paso.





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PLV research at CU has *world-wide collaborations*!

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SRI International

TOYOTA
TOYOTA TECHNICAL CENTER

CRAY
THE SUPERCOMPUTER COMPANY

The PLV group has *fun* together!

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Group meetings at the Boulder Tea House twice a semester

The PLV group has *fun* together!

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Travel to conferences (POPL 2012)

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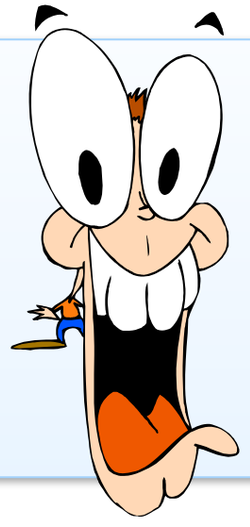
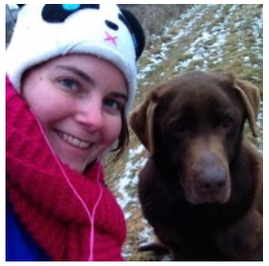


Our mentoring: Guide you to research that excites you!

Our group


Shawn


Jed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Post-Doc


Vris


Amin

BS


Evan


Kyle


Max

PhD


Sam


Aleks


Hadi


Aditya


Fabio


Sriram


You?


You?

Faculty


Pavol


Evan


Dirk

Some of our other research projects

- False alarm triage analysis
- Modular invariant checking
- Analysis of dynamic languages
- Mobile app malware detection
- Incremental verification-validation
- Analysis of medical devices
- Health care process analysis
- Cyber-physical systems verification
- Program synthesis
- Synthesis for software-defined networking

- **And soon projects created by you!**