# Fully-Funded PhD Scholarships
# at the University of California, Irvine

Founded only in 1965, the *University of California, Irvine* consistently ranks among the top research universities in the world.  Meanwhile, the California city of *Irvine* consistently ranks among the "best places to live" in North America and the surrounding Orange County beach cities are among the top tourist destinations in the United States.  One of only 62 members of the Association of American Universities, UC Irvine has produced three Nobel laureates and is known for combining academic achievement with an unsurpassed quality of life.  The university is about 5 miles from the Pacific Ocean, 45 miles from Los Angeles and 80 miles from San Diego.

The research group of Professor Michael Franz is welcoming applications for additional researchers to join our team.  We have several fully funded Ph.D. positions available.  We work on a wide range of "Systems" research topics at the intersection of compilers, virtual machines, and security.  **Full scholarships** are available, covering tuition, fees and a monthly living stipend.  Furthermore, the group has ample research funding, enabling members to utilize state-of-the art computing equipment and travel to research conferences all over the world.

Our research group is well known for inventing trace tree compilation, the technology that is behind the *TraceMonkey* JIT for JavaScript in Firefox.  Its co-inventor, former UCI Ph.D. student Andreas Gal, is now the CTO of Mozilla.  More recently, we also transitioned the "compartmental garbage collector" invented in our lab into Firefox, which not only makes JavaScript in Firefox a lot safer (invalidating most heap spraying attacks) but surprisingly also faster.

Over the past few years, our research has moved further into security, because that is where some of the most interesting "Systems" problems are these days.  One of our current projects involves compiler-generated software diversity as a defense mechanism against software attacks, inspired by biodiversity in nature.  Imagine an "App Store" containing a diversification engine (a "multicompiler") that automatically generates a unique version of every program for every user.  All the different versions of the same program behave in exactly the same way from the perspective of the end-user, but they implement their functionality in subtly different ways.  As a result, any specific attack will succeed only on a small fraction of targets.  An attacker would require a large number of different attacks and would have no way of knowing a priori which specific attack will succeed on which specific target.  Equally importantly, this approach makes it much more difficult for an attacker to generate attack vectors by way of reverse engineering of security patches.  We have built such a multicompiler which is now available as a prototype and which runs on Amazon's EC2 service, making it almost infinitely scalable.  We can diversify large software distributions such as the Chromium and Firefox web browsers, or a complete Linux distribution.

This project has received quite some attention, with coverage even in the popular press ranging from as far as *The Economist* (http://www.economist.com/news/science-and-technology/21602664-organisms-stop-infections-spreading-being-diverse-so-can-computer-apps-divided) to *Wired Magazine* (http://www.wired.com/2014/12/software-clones-genetic-variation-technology/).

Our research has been appearing in some of the most competitive publication venues. For example, we just had two papers accepted at the 2015 Network and Distributed System Security Symposium (NDSS) which by some measure is the 4th ranked publication venue across ALL of computer science (see http://www.cs.cornell.edu/andru/csconf.html). These two papers (which will be presented in February 2015) provide a very good idea of the flavor of research that we do in our group.

> V. Mohan, P. Larsen, S. Brunthaler, K. Hamlen, and M. Franz: "Opaque Control-Flow Integrity;" to appear at 2015 Network and Distributed System Security Symposium, http://www.ics.uci.edu/~perl/ndss15_opaque_cfi.pdf

> S. Crane, A. Homescu, S. Brunthaler, P. Larsen, and M. Franz: "Thwarting Cache Side-Channel Attacks Through Dynamic Software Diversity;" to appear at 2015 Network and Distributed System Security Symposium, http://www.ics.uci.edu/~perl/ndss15_sidechannels.pdf

Please address your inquiries to Prof. Michael Franz (franz@uci.edu). Note that while the university has a fixed deadline for applying for the Ph.D. degree (which has already passed), it is possible to accept exceptional candidates that are sponsored by an individual professor outside of these deadlines. Preference will be given to candidates responding by January 15, 2015.

*Picture: Aerial View of the UC Irvine campus*