

**University of Colorado and the Computer Systems Group at the Vrije University in  
Amsterdam**

**Research Exchange Proposal**

**Evi Nemeth, February 2000**

**Overview**

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We propose an exchange between Dan Crawl, a graduate student in the Computer Science Department at the University of Colorado and the Computer Systems Group headed by Andy Tanenbaum at the Vrije University in Amsterdam.

Dan would work with Andy and Maarten van Steen on their Globe Research project for 9 months beginning January, 2000 in particular on the location service portion of Globe.

**Description of the Sending Institute**

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The Computer Science Department at the University of Colorado has about 25 faculty, 600 undergraduates, and 150 graduate students. The areas of strength in the department are numerical and parallel computing, artificial intelligence, and theory. The department is weaker in systems and has been actively trying to hire in the broad areas of software and systems for two years. We have so far been unsuccessful at hiring faculty in networks and distributed systems; the job market in the US for PhD faculty candidates is fierce right now. Candidates get "stolen" by companies like Microsoft, sometimes even before they graduate.

**Description of the Receiving Institute**

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The Computer Systems Group at the Vrije University is world reknown. The Globe project is addressing the very real problem of the web growing exponentially and not being designed with solid computer science expertise to scale accordingly. It is building on the web's universal interface and good usability features, but redesigning the underlying engine to support distributed shared objects that might be web pages or email messages or news articles.

The Vrije University also has strengths in artificial intelligence, theory, and is building a software engineering group.

## **Description of the Student**

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Dan Crawl first came to the Computer Science Department while in high school, at first to our programming contests and later to work in our system administration support group. Boulder high schools allow students to take University classes and count them for both high school and college. Dan choose to come to the University of Colorado in part because of the classes in the CS program that he had already taken. He was part of our 1998 programming team that won the ACM mountain regional contest (against 65 other teams) and participated in the ACM Internationals in Eindhoven.

He is a strong student, a good programmer and problem solver, and a finisher. He has a good feel for evaluating a problem, devising a solution and getting it done. He is in his first year of graduate school and wants to work in systems and networks.

## **Research Exchange Plan**

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Dan wants to do systems research for his Phd thesis, but the faculty in systems at Colorado lean to the architecture side (Dirk Grunwald), groupware (Skip Ellis) or modeling (Gary Nutt). No one is building systems that span the areas of systems and networks. Mike Schwartz was in this area, but left to help found @Home. The Computer Systems Group at VU is very strong in this area. and would in effect supplement the faculty at Colorado for Dan.

Dirk Grunwald whose primary research area is computer architecture, but who has also done work in performance analysis and distributed shared memory systems, would visit VU once during Dan's internship to exchange research ideas with the Computer Systems Group.

Evi Nemeth who is currently working in network traffic analysis will be in the Netherlands for the SANE conference in May and will also visit the group and check up on Dan's progress.

It is our hope that Dan can both be useful member of the team building the Globe system and also get ideas for his research that he can bring home and continue after the internship is over. If he is truly useful to the project then he could perhaps come back another summer or for a longer time when he is doing his dissertation research later in his degree program. (The first two years of graduate study at Colorado include taking classes and preliminary examinations; Dan took and passed

his theory prelim this fall).

His project will involve the Globe Location Service that keeps track of contact addresses of Globe Objects. These addresses specify the where and how to contact a distributed object. Since Globe is designed to handle up to billions of objects, this location mechanism is critical to the overall operation.

In a recently published paper entitled "Exploiting Location Awareness for Scalable Location-Independent Object IDs" a new design of the Location Service Structure is presented. It uses the (geographical) location of hosts to distribute the workload of the Location Service. However, this new scheme has yet to be prototyped. Even though these algorithms may look good on paper, their true reliability won't be known until they are actually implemented. Dan will implement this new algorithm as his student internship project.

Another paper, "Simple Crash Recovery in a Wide-Area Location Service", details a few simple algorithms to support crash recovery. These also have not been implemented and if time permits Dan will do them as well.

## **Deliverables**

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Since this is one of the first IRDP exchanges we would like to keep in close contact with both the student and his host. To that end, the student should submit a brief email report at the end of the first month and milestone reports at 3 month intervals thereafter. A final report is due a month after the exchange is over. These reports do not need to be long but should include status reports of the research project. The host should submit a status report midway through the exchange and also a final report after the exchange is completed. Also the host should report any problems or failures to meet expectations as they occur.

At Colorado there is a weekly graduate student seminar series, called BACTAC, where students present their work or practice their talks before presenting them at a conference. Dan would be required to do a talk on the Globe project and his part in it to this group on returning home. He would also be expected to give one or more talks in a similar series within the Computer Systems Group at the VU during his stay.

## **Futures**

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I see the possibility of a real strengthening of the opportunities for systems students at Colorado. It will never have an institute of the stature of the Computer Systems Group at VU, yet it will have really good students to help build systems like Globe. Every project that is building real software needs well trained software engineers and the IRDP presents a vehicle for supporting situations where both sides win. Collaboration can and surely will continue after the internship is over via the Internet. In addition, Dirk Grunwald's visit and presentation of his research interests in the systems area may create further opportunities for research collaboration.

### **Time Frame**

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Dan would like to come to VU in early January and stay until mid August, with a couple of weeks off in the middle to travel in Europe a bit or return home. He would enroll in an independent study course at Colorado so that his registration did not lapse. Unlike European Universities, where students automatically get credit for internships, that is not the case at Colorado but independent study courses can serve the same purpose. Any classes he could take at VU (taught in English) could be transferred and would apply to his degree. This time period comprises one semester at Colorado plus summer break and should be long enough for Dan to make real contributions to the Globe project while staying enrolled in school.

### **Budget**

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We have used NLnet 's estimates for some costs in the budget for Dan's costs because we are not familiar with the cost of living in Amsterdam.

round trip airfare	2 * euro 600.00	
housing	euro 350/month	for 9 months
food	euro 175/month	for 9 months
books, supplies	euro 425	
local transportation	euro 75/month	for 9 months
spending money	euro 110/month	for 9 months
conference talks, etc.	euro 1650	

This totals to about 1000 Euro's per month. If the budget turns out to be wrong (in either direction), it will be revisited at one of the 3 month reviews.

In addition Dirk Grunwald will be visiting Amsterdam once in the Spring for about a week.

round trip airfare	euro 600
hotel/food/	euro 1050 (150 * 7)