My research in software traceability is concerned with identifying and linking related information that is found in diverse artifacts, such as requirements specifications, design documents, code, test suites, archived email, developer wiki pages, and video records of online meetings. Traceability is essential to support various software development activities, such as determining whether requirements are fulfilled and adequately tested, assessing the quality of the design, identifying which parts of the system need to be modified to accommodate requirements changes, and understanding the rationale behind the design and implementation.

Capturing and maintaining traceability links in practice, however, is challenging. Numerous artifacts are produced throughout the course of the software development lifecycle. In addition, these heterogeneous artifacts are often generated by different software tools and platforms, and are owned by different organizational groups. These artifacts also change over time, and the captured links quickly become obsolete. Thus, tracing artifacts is generally a laborious and time-consuming task.

One way to address these challenges is by capturing traceability links in situ, while software engineers create or modify artifacts. This research project, referred to as Architecture-Centric Traceability for Stakeholders (ACTS), focuses traceability links to the high level architectural design, caters to varied stakeholder interests, and uses open hypermedia techniques and rules to automate the capture of links. With ACTS, it is possible to automatically link together different types of artifacts.

More recently, in collaboration with researchers from the University of California, Irvine, I have investigated the combination of ACTS with a machine learning technique known as topic modeling, to both guide the prospective capture of links and support the post-analysis of captured links. A probabilistic topic model known as Latent Dirichlet Allocation (LDA) was used to automatically discover semantic topics from the set of artifacts. We also built a visualization tool to show the topic distributions for each of the linked arti-
Dear Alumni and Friends of CSS,

In 2008, we doubled the publication rate of Bits and Bytes from once a year to twice a year. In 2009, we doubled each issue to eight pages. You now find in your hands the same eight pages, but now we have so much additional news that we’ve had to add two electronic supplements: an annual report (under “About Us” on the CSS web page) and a monthly “Nibbles” news email (if you’re not getting this, you can find the sign-up on the CSS web). And yet, the newsletter you see before you is still over-stuffed with what’s happening in CSS (but still has zero calories).

As always, CSS students nearing the end of their studies have all the fun, and you can read about recent internships, including a spotlight on Gustav Gennrich’s development of a novel trading platform for software licenses. Our faculty focus this issue is on Hazel Asuncion’s work on software traceability and its potential application to eScience and medical informatics. We also include brief listings of some recent faculty publications and talks in the CSS speaker series. Other news includes the first phase of our laboratory update plan, with a redesign of our Windows lab to become a “people-centric collaborative workspace”. We plan to move on to the second phase of this, with enhancements to our Linux, networking, and research labs this coming spring and summer.

New faculty, labs, and equipment are arriving just in time, as CSS enrollment continues its climb — up over 18% this year. And we don’t expect this increase to let up, with a new graduate certificate in the works, new courses for non-majors, and our Masters degree now ready to accept full-time and international students all three quarters during the academic year.

I hope you enjoy reading about all of this as much as we’ve enjoyed doing them.

Cordially,

Dr. Michael Stiber
Professor and Director

CSS Computer Lab Remodel

Having the right working environment can sometimes mean the difference between productivity and procrastination.

With that in mind, our CSS faculty and staff redesigned our Windows (UW1-310) lab to create a more open and welcoming atmosphere, facilitate better collaboration and creativity among our students, and update our hardware to better handle high-end software development, graphics rendering, and number crunching tasks.

Redesigns for the other CSS labs are currently in the advanced planning stages.

ACM T-Shirt Fundraiser

The UW Bothell ACM chapter will soon be selling t-shirts designed by their creative officer, Craig Nishina.

The design incorporates many characteristics that are unique to computer science and UW Bothell – distinguishing the wearer as a proud UW Bothell CSS student.

The t-shirts will be available during the Spring 2011 quarter.

For more information about the t-shirts, their availability, and pricing, please contact Dina Fix at dinam@uwb.edu.

2009-10 CSS Annual Report

Our 2009-10 annual report highlights our program’s amazing and exciting growth and change.

Learn about our increase in undergraduate enrollment, faculty research and new publications, student cooperative education projects, and our numerous events throughout the year that have helped further strengthen our ties with the local community.

To get your copy of our 2009-10 Annual Report, please visit www.uwb.edu/css/about

Launch of ‘Nibbles’ e-newsletter

‘Nibbles’ was introduced at the start of the year with a goal to bring CSS students, alumni, and everyone interested in our program monthly updates about past and upcoming CSS events and news.

If you would like to sign-up to receive your monthly ‘Nibbles’, please visit www.uwb.edu/css/nibbles.
Revolutionizing THE Software Industry

Coupling his entrepreneurial spirit and computer science know-how, CSS student, Gustav Gennrich, developed the Software Trading Lounge – an innovative online market place for consumers to resell their software licenses.

What was your project about?

The Software Trading Lounge (STL) provides a solution for the software industry whereby users, publishers, and developers benefit from the resale of software licenses. The STL is a digital and non-digital distribution and digital rights management web application for auctioning and trading away software license rights. The STL develops new incentives within the software industry that protects the interests of the publishers and developers while also conveniently, quickly, and cost effectively allowing end-users to resell or trade a software license through an attractive and intuitive web interface.

Current business models (and potential competition), such as the trade-in programs through GameStop, Best Buy, and Amazon, fail to allow the user to dictate the value of used software licenses through typical economic portals where supply and demand as well as market factors control the valuation of said licenses. Ultimately, this takes power away from the consumer. In addition, these programs prevent the publishers and developers from partaking in any of the proceeds from products they have created plus, in some cases, they violate End-User License Agreements (EULA) by failing to renegotiate licensing terms. In some states, courts have ruled that the First Sale Doctrine does not apply to software licenses. My system works with publishers and developers and provides new incentives, such as a coupon system, to end-users that reduce the entry level cost for new software while also providing an outlet that allows users to dictate the pricing of used software licenses.

Enabling users to resell software through an auction house can increase revenue and profitability in the long run; the STL and publishers and developers will take a small percentage of proceeds from each auction or trade; publishers and developers will have the opportunity to capture new customers and increase market share by lowering the entry cost for games through coupons which will be given to 3rd party sellers who successfully auction off a video game license. Earning revenue from used games sales will also extend and increase the revenue curve that most typical video games experience over their lifespans. Furthermore, by supporting publishers and developers, they will be inclined to support our system through advertising which will help provide additional revenue for the STL.

How did you become interested in this project?

I became interested in this project after reading articles relating to used game sales and observing restrictions imposed by the Steam® client by Valve Software. Games that are purchased and downloaded through Steam® are locked to your account permanently. There is no solution to transfer or resell unwanted video game licenses. Furthermore, many video game publishers scowl at used video game sales business models because they cut into their revenue streams. These two issues led me to believe that there was a serious market need to solve these problems.

What were some barriers you faced and how did you overcome them?

Originally I wanted to modify the Steam® client in order to allow trading and reselling video game licenses. However, Valve was not interested in this idea and without access to the source code this path was unfeasible. The alternative was to develop a solution that directly competed with Steam® and GameStop.

Another major hurdle I had to overcome was learning a new application framework, namely ASP.NET, and a new language, C#. This ultimately led to learning while developing which is challenging.

What were some CSS classes you found helpful for this project?

CSS 342, 343, 360, and 370 helped lay the foundation for my project particularly since I did an independent internship. CSS 342 and 343, the core programming courses, helped me on the coding aspect of the project, whereas CSS 360 and 370 helped me on the analysis, design and software development methodology aspects.

When can we expect to see STL available to consumers?

Since my internship project was done independently I retain all of the intellectual property rights. However, I plan on working for a company within the software industry before starting my own company as I believe the experience and exposure gained from working under someone else is instrumental in creating a successful startup.

In the interim, however, I plan on fixing the remaining issues I have documented, addressing the items in the backlog, and polishing up the business proposal.

When the time is right, I will pitch my business idea to venture capitalists. If there is enough interest to fund the project then I expect a release could be made within one year of that date.
A capstone project required for all Bachelor of Science students, the Cooperative Education senior project is structured in a way that allows the student to choose the option that best fits his/her educational goals. The following are short synopses of what just a few recent and upcoming graduates have done for their cooperative education experience.

AUTUMN 2010

**NAEEM UDDIN**
High5 Software

“SME Web-Connect”
Naeeem worked at High5 Software on Web-Connect which provided a secure portal for technicians to access the service management product database from any internet-enabled web browser.

**MATT PENNEBAKER**
ArenaNet

“Iterative MMO Game Design/Combat and Activities in Guild Wars 2”
Matthew worked on a core design team, and used the knowledge of the tools received there to implement a mini-game that significantly altered the gameplay mechanics with the space of the mini-game.

**JOSEPH LARSON**
Advanced BusinessLink

“Extending a Product into New Environments”
Joseph created an application which enabled end users to access functionality hosted on mid-range systems from mobile device such as the iPhone. Creating the application involved technical research, software architecture, user interface design, project management and significant programming.

WINTER 2011

**THOMAS BARON**
“Semi-Automatic Sprite Animation Pipeline”
Continuing his CSS 498 (Independent Study) development project, Thomas worked on a solution to semi-automatically create a sprite animation for 2D games from photographs, allowing players to quickly and easily place themselves into games, such as Sammy Goes to UWB.

**CLAYTON JOHNSON**
Caribbean Cardroom LLC

“Intelligent Casino Informational Systems”
Clayton worked on Intelligent Casino Informational Systems (ICIS), a vertical market software for Caribbean Cardroom LLC’s poker room. His project entailed creating a working software that would provide easy-to-use player tracking services in order to reduce staff effort and provide statistical information about client for business analytics.

**VOLHA KAUGHARENIA**
Trupanion

“Development of Windows Application for Database Log Analysis.”
Volha worked with Trupanion (a pet insurance company) to further develop and enrich their Log Application which logs errors that emerge on their SQL server, website, and other applications that are used throughout the company in test and production environments.

**PAUL LIAM**
The Boeing Company

“Thinking Lean: Interning with Boeing IT Finance Systems”
Paul interned at the Boeing Company as a Functional Analyst, which made him a liaison between business customers and his IT team. This critical position had him assisting his team with handling system change requests, performing critical analyses of existing IT systems, and making assessments for future development.
Dmitry interned at ChemPoint.com to develop an application that allowed their IT administrators to remotely control the company’s servers via an internal network accessed through a web browser. It was important that the administrators would be able to run performance monitor and retrieve usage and performance data through this application.

Max and David created QuickApps, a website that enables businesses to develop a custom iPhone/Android application to help them advertise their services. QuickApps allows a business to provide their users with company and contact information, an RSS feed for coupons and news, and a link to their website. Max and David developed the back- and front-end primarily using Ruby on Rails.
Full-Time Enrollment & New Graduate Certificate Program for Masters Degree

Our new MSCSS program has received an incredible response from the local community and, as a result, we have further expanded it to better serve our students.

The MSCSS can now be taken on a full-time basis, enabling students to complete their degree in just over a year (five quarters).

As an additional development, the Masters Preparation Sequence (MPS) is being transitioned into a Graduate Certificate in Software Design & Development*. Through this 18 credit (six credits per quarter) career accelerating graduate certificate program, students will learn graduate-level object-oriented and system programming concepts, software design methodologies, and testing practices that today’s top jobs demand.

Approval for this graduate certificate is still pending, but we plan to have it available before the July 1st application deadline for the Autumn 2011 quarter.

Center for Serious Play Teams Up With Prof. Sung & Students

Prof. Kelvin Sung and his team of CSS 498 (Independent Study) students have created some remarkably interesting games over the past year that not only entertain but also teach players.

They introduced their first interactive campus tour game last February for the University of Washington Bothell called ‘Sammy Tours UWB’ (http://depts.washington.edu/itts/CampusTour), which guided new students around the campus through a series of mini-games.

His group also developed a Zune-based augmented reality game that took participants on a tour of the UW Bothell Library with a ‘Who did it?’ mystery theme (you can experience this game by visiting UW Bothell’s UW1 Welcome Desk and checking out a Zune).

Creative games, such as these, facilitate learning from a completely different perspective. They incorporate the “engaging nature of [gaming] to accomplish a task,” says Sung.

The most recent development has been UW Bothell’s Center for Serious Play (CSP) teaming up with CSS to create a new version of a campus tour game.

Sung’s student team of 6 developers, and 3 artists from CSP led by producer Scott Berfield, have taken the mini-game concept from the original ‘Sammy Tours UWB’ game and improved upon it by incorporating more popular genres of game play, such as item matching (similar to Bejewelled) and tower defense (similar to Plants vs. Zombie).

These mini-games are hosted on a website (http://depts.washington.edu/csscts/ctc/) that features various prominent locations of the UW Bothell campus. Students can login using their Facebook account to play the mini-games and battle for the ‘Conqueror of the Campus’ title!

Impressed with these games, the Pacific Science Center (PSC) has invit-

* Pending approval by UW Graduate School.

facts, enabling a software engineer to quickly identify incorrectly linked artifacts.

How will your research benefit people in the eScience and healthcare informatics?

The identification of related information scattered across distributed and heterogeneous environments is a fundamental task in many contexts. Thus, my research in software traceability has the potential to benefit other fields like eScience and medical informatics.

eScience is a growing area of scientific research that relies on computational resources to collect data, run experiments, and perform scientific analyses. Due to advances in high-performance computing, it is now possible to collect and process petabytes of scientific data. With this capability comes the challenge of tracking how results are produced, since input data may come from different instruments and may be processed by numerous off-the-shelf scientific tools or custom scripts. Determining how a given dataset is derived (i.e., its data provenance) is essential to supporting the repeatability of experiments or analyses. While there are provenance systems that automatically capture the processing of data within one tool, these systems fall short in capturing data processing across heterogeneous tools, which is often done in eScience. Currently, I am investigating how my software traceability research can be efficiently applied to the task of data provenance capture across different tools and among collaborating researchers.

Medical informatics is another field where tracing related information is of growing importance. Particularly with the passage of the Health Insurance Portability and Accountability Act (HIPAA) where patients are entitled access to their medical records, it is now becoming necessary to link together information artifacts that are not only stored in different formats but are also distributed across different medical service providers who use their own medical systems. In this field, connecting patient records that are under different authority domains is a key requirement and is possible with traceability techniques.

How did you become interested in software traceability and the computing profession in general?

The personal computer was increasing in popularity when I was growing up and I was fascinated by computers in general.

My research focus was shaped by my experience as a software engineer who was assigned to a new project. It was difficult for me as a project newcomer to locate the information I needed to perform my tasks, and I found it necessary to always ask the other team members for pointers. When I pursued my graduate studies, I wanted to look for ways to facilitate efficient access to related information and that is how I came to study software traceability.

How are you adjusting to the Pacific Northwest after California?

I’m adjusting very well. The surrounding area here, especially around Bothell, is lovely, with so much greenery compared to Southern California! Of course, it is a bit colder here, but I’m getting used to the weather as well.
PUBLICATIONS

Computing Students Learning Computing Informally

Teaching Introductory Programming With Popular Board Games

Game-Themed Programming Assignment Modules: A Pathway For Gradual Integration of Gaming Context Into Existing Introductory Programming Courses

Serious Game Development As An Interactive User-Centered Agile Software Project

Simple And Efficient Projective Clustering

Software Licenses In Context: The Challenge Of Heterogeneously-Licensed Systems

WORKSHOPS

‘Game-Themed CS Education: Empowering the Faculty’ and ‘Video Game Design Workshop’
K. Sung, “Game-Themed CS Education: Empowering the Faculty”, and “Video Game Design Workshop”, Invited 2-day visit, Department of Computer Science, Iowa State University, Ames, Iowa, November 2010.

Open Source and Freeware Tools for 3D Game Development Courses

Video Game Design Workshop
K. Sung, “Video Game Design Workshop”, Invited two-day Workshop, Faculty of Physics, Universidad Autonoma de Nuevo Leon (UANL), Monterrey, Mexico, October 2010.

COLUMN

Recent Videogame Console Technologies

GAME RELEASES

Sammy’s First Day at UWB

Conquer The Campus
HELP SUPPORT
Our Mission

Whether you donate $5 or $500, every gift helps keep the Computing & Software Systems program a unique and rewarding experience for students and an important resource for computing education in this region.

Support from people like you enables us to grow our activities even in the face of state budget cuts. Become part of our mission by donating whatever you can.

You can direct your giving to CSS by visiting www.uwb.edu/css and clicking on the “Make a Gift” link.

Thank you for your generous support.

‘CHANGES’ CONT.
ed Sung to build a similar orientation game for its visitors. He has received support from the Microsoft Windows Phone 7 Team with a donation of 35 cell phones. Visitors will be able to play the orientation game on these phones while they explore PSC. Sung is investigating the potential of working with CSP on this project.

Prof. Sung’s long-term goal is to continue working with local non-profits and businesses to develop game-like applications to address relevant practical problems and needs.

STAY CONNECTED!

GET IN THE LOOP AND KNOW WHAT’S GOING ON WITHIN OUR CSS PROGRAM!

Visit www.uwb.edu/css for links to our Facebook, Twitter, YouTube, and e-newsletter.