



DEPARTMENT OF COMPUTER SCIENCE

# LINKS

UNIVERSITY OF PITTSBURGH

FALL 2000

## Rami Melhem Elected New Department Chair

*Dr. Rami Melhem was elected to be the new Department Chair starting September 1, 2000. He takes over from Dr. Siegfried Treu, the previous Chair.*



It is with great excitement that I start my term as the Chair of the Computer Science Department. The rapid evolution of the information technology field poses great challenges and offers unique opportunities that are sure to make my job anything but a routine and boring day-to-day managerial job. Add to this the great success of the Computer Engineering program, the expectation that by the end of next year we will move to our future home in the new MPAC building, and the prospect of recruiting five new faculty members, and you can see why I am very optimistic about the future of our department. As any great institution with a futuristic vision

would do, the University of Pittsburgh is emphasizing the importance of information technology and computer education in all aspects of the university's life. It is natural for the Computer Science department to assume a major role in realizing the vision of the University. In fact, the support and commitment that our department is receiving from the University, in general, and FAS in particular, is a clear indication of the central and leadership role that we have been asked to assume within the university during this information and computer revolution age.

In the last few years, our faculty have worked hard to update our curricula and design new and exciting courses to reflect the fast changes in our discipline. We have designed new courses and seminars on robotics, interactive computer graphics, low power design and Internet middleware. We have streamlined our graduate program to allow for a more flexible and enriching course of study and to encourage early involvement in research. Starting this year, we are offering a combined BS+MS degree that will allow our best undergraduate students to complete the requirements of the two

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## John Ramirez Promoted to Senior Lecturer

*Dr. John Ramirez was promoted to Senior Lecturer in September 2000.*

This fall Dr. John Ramirez begins work in his new position as the Director of Undergraduate Programs. Dr. Ramirez is a graduate of Pitt's Computer Science Department (Ph.D. '95) and has been on the department's faculty since 1992. He has always been a strong advocate of undergraduate education and, in addition to his award winning teaching, has served on the department's Undergraduate Advising and Programs committees.



In his role as the Director of Undergraduate Programs in the Computer Science Department, Dr. Ramirez intends to see to it that undergraduate students are given the attention and services needed to facilitate a smooth transition into and through the department. To this end, he is continuing the traditional responsibilities of the Director of Undergraduate Programs by providing college preparatory services for students considering a career in computer science and academic advising for current computer science students. With the assistance of Matthew Wolfson, the

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# Janyce Wiebe Newly Hired Associate Professor

*Dr. Janyce Wiebe was hired as an Associate Professor in September of 2000. Her primary research interests are in Artificial Intelligence and Natural Language Processing.*

Janyce Wiebe joined the Computer Science department as associate professor this Fall, 2000. Her research interests are artificial intelligence, natural language processing (NLP), and computational linguistics. Wiebe moved to Pitt from the Computer Science Department and Computing Research Laboratory at New Mexico State University, where she was a tenured associate professor, and where she continues as an adjunct professor. She received her Ph.D. in Computer Science from SUNY Buffalo in 1990, and then spent three years as a postdoctoral fellow in the Computer Science department at the University of Toronto.

Wiebe's research focuses on two main problem areas in NLP: discourse processing, (interpreting sentences in the contexts in which they appear), and word-sense disambiguation (identifying the dictionary definition with which a word is used). Her research group uses statistical and machine learning techniques to develop, evaluate, and analyze NLP resources and automatic disambiguation systems. One of her main research projects investigates recognizing when opinions and evaluations are being presented, so a system can distinguish those from material presented as true. This would be a valuable ability for an information extraction or text mining system, enabling it to avoid material that is merely opinion. It would also be valuable for a search engine or question answering system. Imagine an engine that could find evaluations of products and services in free-form text, as well as retrieve texts exhibiting various points of view on an issue. Another project investigates understanding references to times in dialogs. Imagine an automated e-mail agent who schedules your meetings for you. When someone suggests meeting "at 6", the system must be able to figure out which "6" is being referred to (6AM on March 23? 6PM on February 2?) The system must sort through

the various times mentioned earlier to figure out which one was meant. Methodologically, Wiebe's group investigates methods for selecting and representing lexical features for input to machine learning algorithms, methods for formulating probability models that provide good characterizations of the relationships among linguistic features of a text, and methods for learning linguistic clues from text. In addition, they work on analyzing and improving interannotator agreement. To train and evaluate NLP systems, humans create the answer keys. It is important to use multiple judges, so that the answers do not reflect one person's idiosyncratic judgements. However, the problem of disagreement then arises.



Wiebe's group uses statistical techniques to analyze patterns of agreement to identify systematic disagreements that result from relative bias among the judges, and then uses an unsupervised machine learning algorithm to produce corrected tags representing consensus opinions of the judges. Much of this work is performed jointly with Rebecca Bruce, who was Wiebe's Ph.D. student at New Mexico State.

In addition to her research activities, Wiebe has served in a number of professional capacities, including Program Committee Chair for a major international conference (NAACL-2000), Vice President of the ACM Special Intelligence (SIGART), Chair of the Organizing and Program Committees for the SIGART/AAAI Doctoral Consor-

tia, Local Arrangements Chair for a major conference (ACL-94), and elected member of the Executive Board of the North American Chapter of the Association for Computational Linguistics. Wiebe very much enjoys teaching, both undergraduate and graduate classes. Her teaching interests include artificial intelligence and natural language processing. In addition, one of her favorite courses is a computer organization and programming class, in which the students build and program small autonomous robots. For six years she was Faculty Advisor to the Faculty Adviser to the NMSU local student chapter of the ACM, a group whose activities included programming competitions, tutoring, and student-lead seminar series. Recently, the students won their regional ACM Programming Competition, sending them to the international competition.

## **Bruce Childers, New Assistant Professor**

*Dr. Bruce Childers was hired as an Assistant Professor in January of 2000. He received his Ph.D. from the University of Virginia.*

In recent years, there has been tremendous growth in the popularity of personal electronics, including cellular phones, personal digital assistants, MP3 players, and digital cameras. In the future these devices will be connected to themselves and other devices through wireless ad hoc networks. Some of these devices will be relatively simple, nothing more than sensors and actuators with a network connection. Other devices, such as set-top boxes, will be more complex, and have the ability to collect, process, and serve data and interact with one another and users. These more complex devices called information appliances (IAs), will be very small and portable, cooperate and share services, consume negligible energy, and have wireless network and server capabilities. A major challenge to achieving this vision is reducing energy consumption, and package size.

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**John Ramirez Promoted to  
Senior Lecturer  
(continued from page 1)**

Undergraduate Programs administrator, Dr. Ramirez authorizes the transfer of computer science credits from other accredited colleges and universities and certifies students for graduation. Dr. Ramirez is also reviving the student chapter of the Association of Computing Machinery (ACM), giving undergraduate students the opportunity to be involved in a national computing organization.

For more information on undergraduate education in the Computer Science Department, visit the Department's undergraduate web site at [www.cse.pitt.edu](http://www.cse.pitt.edu) or email Matthew Wolfson at [wolfson@cs.pitt.edu](mailto:wolfson@cs.pitt.edu). If you need to contact Dr. Ramirez, his office hours are posted on his web site at [www.cse.pitt.edu](http://www.cse.pitt.edu) and his email address is [ramirez@cs.pitt.edu](mailto:ramirez@cs.pitt.edu).

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**DARPA Grant  
Awarded to  
Daniel Mosse and  
Rami Melhem**

*Drs. Daniel Mosse and Rami Melhem were awarded a research grant by DARPA for development of power management techniques in real-time systems.*

Why do we have to be concerned with power while computing? Can we not just assume that there is enough power for computing everywhere? What are the benefits of power-aware computing? Who benefits? Who should actually care?

In Tokyo, Hong-Kong, and New York, as well as in Pittsburgh and throughout the world, cell phones and other *on-the-move* electronic gadgets are in very high demand. Current trends show that the majority of our population wants handheld devices and want them to be smaller, faster, cooler, better, flashier, and cheaper. It is this ubiquitous nature of mobile computing,

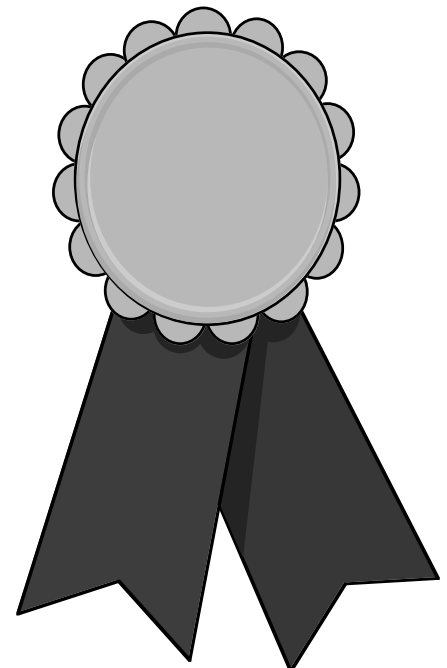
and the demand for longer battery life, that has brought power management to the forefront of research. Hardware and software giants, such as Intel, Microsoft and Toshiba, have introduced standards such as the ACPI (Advanced Configuration and Power Interface) for power management of laptop computers. This management allows several modes of operation, turning off some parts of the computer (e.g., the disk) or reducing the voltage of some devices (e.g., reducing CPU speed and dimming screen brightness); these modes allow us to reduce power usage and consequently extend battery life and reduce battery size/weight. Handheld devices such as Personal Digital Assistants (their actual denomination is "PDA", and *not* "Palms") and cellular telephones will have even more stringent battery requirements, due to their smaller size and greater functional capability. Battery management is, therefore, one of the most important issues since it determines, to a large extent, their appeal to the public (lifetime, quality of service (QoS), battery size, device weight, etc).

Earlier this summer, Computer Science professors Rami Melhem and Daniel Mossé were awarded a grant by DARPA for development of Power Management Techniques in Real-Time Systems. The project will develop unique management techniques for increasing the capabilities of handheld devices, including extending battery life or reducing energy consumption. This will enable system developers to enhance the number of applications and/or the quality of the results of the applications running in the device.

For example, cell phones with web interfaces will allow for loading and/or displaying animations; such animations could be presented either with high quality if it is the only application being executed, or with low quality while audio conversations are active in

the background. Other examples include audio transmission, reception, and playback, web-page loading, video transmission and display, among others. Professors' Mossé and Melhem will modify the services of the operating systems so that they become power aware on a continuous basis, and not only when the computer is not being used (much the same way turning off or dimming video monitors work to conserve energy). These techniques will be especially important in systems that have time as an essential component of their functions. For example, in video display, the quality of the video is closely tied to the rate at which the video is displayed. The operating system services developed in this project will alter the power consumption of the machines on a continuous and adaptive basis.

Some early results have shown that making small changes in the part of the operating system that schedules the applications allows up to 90% savings on energy consumption; this means that a cell phone or a GPS would last ten times longer with these new power management techniques, continuing the quest for *faster, smaller, better*.



# Thomas Dwyer

*The following note by Margot Critchfield appeared in the September 14, 2000 issue of University Times, and is reproduced here with their permission.*

Dr. Thomas Dwyer, retired professor of computer science, died July 7 at age 76. A memorial service was held at First Unitarian Church at Ellsworth and Morewood avenues.

Dwyer earned a BS in mathematics and physics at the University of Dayton. He taught for many years at Cathedral Latin High School in Cleveland, while earning his MS and Ph.D. in mathematics at Case Institute of Technology (now Case Western Reserve University).

He taught mathematics, physics, computing, numerical analysis, logical design and electronics at the University of Dayton and helped to establish the computer science department there.

He was self-taught in photography, electronics, radio, electronic organ building, audio systems, and piano playing. He was also a private pilot, holding single and twin-engine licenses, instrument and amphibious ratings, as well as an instructor's rating.

Dwyer joined the Pitt faculty as an associate professor in January 1968. But just before that he had an adventure that seems uncharacteristic to those who knew his cautious, precise approach to flying. He agreed to fly an aircraft with another pilot to Equitos at the headwaters of the Amazon River. For this they needed a custom-built extra gas tank to fly across the Gulf of Mexico. They also needed to test the valve feeding the gas ahead of time, but they didn't. They ran out of gas over the Gulf of Mexico, but they were very, very lucky. They managed to land, and then were picked up by a freighter and not only rescued, but had the aircraft retrieved by the freighter's loading cranes.

At Pitt, Dwyer became a pioneer in the use of computers in pre-college edu-

cation. His first efforts extended the University's timeshared computing system to terminals in several Pittsburgh area high schools. Most people in the late 1960s thought computers in education would be an extension of programmed learning machines, a kind of interaction where short responses from the student would be positively or negatively rewarded, molding the student's behavior or ideas. Dwyer had a different vision. He believed very strongly that students and teachers should "take charge of the machine." At this time the only way to take charge of the computer was to program it yourself. Dwyer believed that people should program the computer, not the reverse.

With grants from the National Science Foundation, Dwyer carried out Project Solo, Project Soloworks, and Project Solo/Net/works dedicated to the idea that using computer technology should be as exhilarating as making one's first solo flight in an airplane. Dwyer chose the computer language BASIC as the best one to get people, even nonmathematicians, to program. He also chose to use standard computing technology (which was changing rapidly), rather than try to create a customized machine for education.

To document his research, Dwyer had two 16mm films and a multi-slide film show made, collaborating closely with local film makers Bernie Wodzinski, Phil Curry, and Tara Alexander.

Dwyer used computer terminals as personal computers before PCs were invented and used multimedia to express ideas when it was just thought of as an entertainment medium. He was also among the first to use networked microcomputers for educational purposes.

Dwyer was a co-author of many books on microcomputers and BASIC programming.

Today, as we struggle to keep ahead of ever more complex and powerful software and computers, the simple joys of programming a physics calcu-

lation, a game, or simulated chemistry experiment seem hard to imagine as very exciting. But the idea of empowering teachers and students is perennial. The idea of putting people in charge just takes on a different form.

Dwyer will be remembered as a gentle, caring man who used his intelligence for enjoyment and to help others.

He is survived by his brothers Paul and Gerard, both of Cleveland.

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## Progress on MPAC Building

In the last several weeks, the MPAC building (future home of the Department of Computer Science) has progressed from a really big hole in the ground, to a really big hole in the ground with substantial concrete and steel in place. The picture below was taken in October. Completion of the building is projected for October 2001.



With several University of Pittsburgh construction projects currently in progress, much of Oakland has become a maze of orange cones, temporary fencing, and construction vehicles. Going out to lunch has become an exercise in *dynamic planning*.

## Rami Melhem Elected New Department Chair (continued from page 1)

ments of the two degrees in five, rather than six, years. We have also established a new undergraduate program in Scientific Computing with the Mathematics department and we are currently working with the Electrical Engineering department to build on the success of the undergraduate computer engineering program and establish a new graduate program in Computer Engineering.

The research productivity of our faculty has also increased, as did our research funding. The annual research expenditure of the department is close to two million dollars, and our goal is to increase the research funding by at least 50% over the next two years. Every graduate student in the department is supported by an assistantship and we have more externally funded research assistantship than we have Ph.D. students. Although our graduate students can compete for a number of internally funded fellowships, the availability of permanent fellowships is becoming crucial for recruiting top Ph.D. students in Computer Science. We are closely working with the institutional development office to identify potential corporate, foundations or individuals that can provide endowments for the creation of fellowships to attract some of the best graduate students in the field.

We all know that graduates with BS, MS or Ph.D. degrees in Computer Science or Engineering do not look for jobs, but rather have jobs look for them. Recruiters are eager to hire our students even before they finish their degrees, and as a result, fewer and fewer students chose to go to graduate school. Although I can understand the need that the computer and information industry has for our students, I have to warn them that a decrease in the number of graduate students will lead to a decrease in the number of professors. This, in turn, will lead to smaller pool of graduates to recruit from. This "chicken and egg" problem can only be solved by a

long-term partnership between universities and industry. One of my main goals as a chair is to build lasting relationships with industrial partners to enrich our educational mission at both the undergraduate and the graduate levels. I will form a *council of industrial partners* that will lay the foundations for a successful partnership to benefit both our department and our partners.

In order to increase the ties among faculty, graduate students, undergraduate students, prospective students, alumni and industrial partners, we are establishing an annual Computer Science day. This year, this event will take place on December 2. It will include seminars, panel discussions, research expositions, alumni meetings, recruitment and placement sessions and many other activities. I would like to extend an invitation to attend this event to any person who considers himself or herself a member of the extended Computer Science Department family. More information about the activities and schedule for the CS day will be posted on our departmental web page.

Finally, being a Pitt CS graduate myself (I received my Ph.D. from Pitt in 1983), I would like to strengthen the ties between the department and its alumni. This newsletter is one vehicle for keeping the communication lines open, but we in the department are always open to suggestions for increasing the bandwidth of these communication lines, and having them set to full duplex mode.

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## Accolades Faculty

**Bruce Buchanan** gave the Presidential Address at the annual meeting of the *American Association for Artificial Intelligence*. He also delivered the keynote address at the annual *International Conference on Knowledge Discovery and Data Mining*.

**Panos Chrysanthis** returned from sabbatical at CMU. His activities during the year included delivering a tutorial at ICDE 2000, giving a guest lecture at the University of Ioannina (Greece), and serving on the program committees of several major conferences.

**Taieb Znati** was promoted to full professor.

**John Ramirez** and **Kirk Pruhs** received an *Innovation in Teaching Award* from the University of Pittsburgh Advisory Council on Instructional Excellence.

**Don Chiarulli** and **Martha Pollack** also received an *Innovation in Teaching Award* from the University of Pittsburgh Advisory Council on Instructional Excellence.

**Kirk Pruhs** was appointed to the editorial board of *Journal of Scheduling*. He was also a program committee member for the *2001 ACM/SIAM Symposium on Discrete Algorithms (SODA)*, and editor of a special issue of *Journal of Algorithms* devoted to selected papers from the conference.

## Focus on Graduates

**Michael Wagner** received his BS in Computer Science in April of 2000.

If you were a student (or faculty member) in the department during the last four years you probably know Michael Wagner: he was the really smart guy sitting near the front of the class! Michael wanted to be a programmer since he was in the fifth grade, and after four years at Pitt as a student in the Honors College and a CS major, he has accomplished that goal.

While he was here, he took a broad range of Computer Science courses, ranging from Programming Languages, to Operating Systems, to Artificial Intelligence, to Graduate Multimedia Software  
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## Bruce Childers

### New Assistant Professor

(continued from page 2)

Our work addresses the problems of low-power IA's through research in device cooperation, computer architecture and compiler optimization, and power-management for real time systems.

For device cooperation, our focus is how IAs can interact and share services in wireless networks. Device cooperation lets an IA migrate its services to other devices with larger power budgets to extend battery life and conserve total network energy. As an example, consider a wireless and battery-powered video conferencing appliance. When this IA is brought into a local wireless network, device cooperation lets it off-load image processing and serving to another host with greater energy reserves. This off loading extends the video appliance's mission length and helps balance network energy consumption. We are also studying how the quality of an IA's services can be adjusted to help save device and network energy.

At their core, IAs have a processor that does the majority of computational work. This processor consumes considerable energy, and as performance demands increase, more advanced architectures, executing at faster clock rates, will be employed that consume even more energy. In order to substantially lower processor energy, system software and the underlying hardware must closely collaborate. One of our projects concentrates on ways to increase the synergy of the compiler and processor architecture. Part of this includes developing compiler optimizations and micro-architecture features that adjust the memory hierarchy to better match an application's execution behavior. For example, we have designed a micro-architecture feature to reorder an application's memory access stream with compiler assistance to reduce the power consumption of the memory bus.

We are also researching compiler optimizations for memory data layout and allocation. By reducing an application's memory activity and intelligently placing and allocating data, the amount of energy consumed by memory can be decreased.

In addition to power-aware memories, we are studying ways to trade application parallelism for lower execution rates. By taking advantage of an application's parallelism, a desired level of performance can be achieved at a lower rate of execution and energy consumption. This work involves designing schemes to scale clock frequency and supply voltage based on an application's instruction-level parallelism to maintain a given level of performance. Preliminary results for our techniques are very encouraging, with energy reductions of more than 50% for many applications. Our work also investigates ways to adjust hardware parallelism and manage functional devices (e.g., register files, functional units, and caches) to conserve power lost to static leakage. We are also investigating similar techniques for thread-level parallelism and multiprocessor systems.

Another area where we are using compiler technology is in real-time scheduling for variable voltage/frequency systems. We are developing compiler optimizations to insert power adaptation points that sample current operating conditions and either slow down or speed up the clock speed to ensure that hard deadlines can be met while executing at the lowest energy settings.

As the capabilities of IAs continue to increase, there is an ever greater need for more computing power with extended battery life. Reducing energy consumption has become a major priority for many system manufacturers. Through research in device cooperation, compiler optimization, computer architecture, and real-time systems, we are developing novel techniques for power-aware IAs that will enable new classes of applications and devices previously not possible.

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### Focus On Graduates

(continued from page 5)

Engineering . Michael states that he mostly worked hard, but admits to "slacking off" a couple of semesters. Nonetheless, he graduated *magna cum laude*. While not taking classes or studying, he enjoyed being with the many friends he made in the department. An especially enriching experience was helping students as a CS401 Teaching Assistant.

After graduation, Michael took a few months off, during which he "took the path of absolute nothingness". When he was ready to find a job, there were many opportunities waiting. He decided to accept a offer from Futuristics Labs to work in their R&D center in the Pittsburgh area.

Michael states that "I made the right decisions at the right time in my life, and I owe much of the credit to all the great people at the Pitt CS Dept. Thanks!" Michael plans to return to academia one day. Perhaps, with luck, he may choose the CS graduate program here at Pitt.

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## Focus On Graduates (continued from page 6)

*Debbie Keil graduated with a Master's Degree in August 2000 from our Department of Computer Science.*

Debbie's research with Dr. Bruce Buchanan and Dr. John Aronis investigated the use of genetic algorithms to learn patterns that can characterize large bodies of text. The results are very promising and should provide opportunities for further research in Machine Learning and Artificial Intelligence.

Debbie received her Bachelor's Degree in Computer Science and Mathematics from the University of Pittsburgh in August 1986. She developed a strong interest in compiler design through a compiler course offered by Dr. Mary Lou Soffa. This resulted in her accepting a position with Tartan Inc. developing Tartan's Ada compilers.

In 1996, Texas Instruments Inc. (TI) acquired Tartan, and Debbie expanded her software knowledge to focus on architecting and developing TI's real-time analysis framework. Debbie co-architected TI's Real-Time Data Exchange (RTDX™) technology which enables data to be exchanged between TI's Digital Signal Processors (DSPs) and a host computer in real time without stopping the processor. She has published in the **EE Times** and the **TI Technical Journal**, and she has several patents pending for her work on RTDX. Debbie leads the software engineering team that develops TI's real-time analysis solutions. For these contributions, Debbie was appointed to TI's prestigious Technical Ladder—an honor bestowed upon the top 20% of TI's engineers world-wide.

Debbie says hello and thanks to all of the Pitt professors who were instrumental in educating her during her academic years. Debbie can be contacted via email at [d-keil@ti.com](mailto:d-keil@ti.com).

*Rastislav Bodik received his Ph.D. in December 1999. He worked with Dr. Gupta and Dr. Soffa while he was here.*

To his own surprise, Ras Bodik has already survived two semesters as an Assistant Professor at the University of Wisconsin-Madison.

Although he misses Pittsburgh's history and ethnicity, he is enjoying a competitive yet very friendly and supportive department.

Building on what he was taught at Pitt, it took him only one semester to win the prestigious departmental Carolyn Rosner Excellent Educator Award. Officially awarded for "exceptional efforts to improve undergraduate and graduate education," the award was actually earned through making compiler and architecture students vigorously argue with each other in class.

Thanks to the success of the class, Ras is now learning how to manage a large research group. His students investigate how to use program analysis tricks in designing hardware predictors, how to use dynamic optimization for optimization of distributed applications, and how to understand and debug million-lines-long programs. And even though his students haven't yet published a paper, Ras sleeps well (albeit short) because he is not falling a bit behind his junior colleagues from Berkeley and CMU.

*Gordon Dorworth is a 1980 graduate of the University of Pittsburgh.*

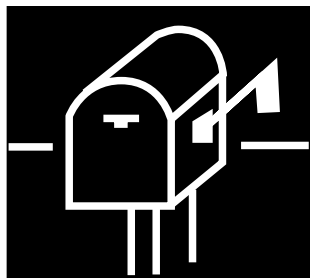
Most of our graduates do well after they leave Pitt, and some do very well. Gordon Dorworth has done *very* well, indeed. A 1980 graduate of our department, Mr. Dorworth is now the President and CEO of Stampede Technologies Inc. Stampede recently landed a multi-million dollar deal with IBM to put its TurboGold client-to-server accelerator software on desktops and laptops of IBM employee's worldwide.

TurboGold uses patented compression, streaming, and caching techniques to accelerate the transfer of Lotus Notes databases. Performance gains better than two to one are typical, and higher gains are possible.

Dorworth stated "We can't begin to tell you how delighted we are to have received this order from IBM, and in a small but important way, help contribute to their success."

The CS faculty is also delighted to contribute to Gordon's success in a (perhaps) small but important way.

If you are in a position to consider making a contribution to support the programs of the Department of Computer Science, please contact the Department Chair, Dr. Rami Melhem, Department of Computer Science, University of Pittsburgh, Pittsburgh PA 15260, or email him at [melhem@cs.pitt.edu](mailto:melhem@cs.pitt.edu).



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