



## **Backgrounder**

### **The ORION Discovery Award**

#### **2007 Winner: Eucalyptus**

Last October, at the Society of Arts and Technology, in Montreal, members of the research community and other visitors saw and, in effect, strolled along a life-size 3D recreation of both sides of a five-block stretch of Saint-Laurent Boulevard.

The continuous image was projected onto a 360° screen with a 30-foot diameter. The detail was absolutely perfect, down to the texture of the bricks and paint on the buildings.

The projection was astonishing in itself and even more remarkable because the data was being sent from the Carleton Immersive Media Studio (CIMS) and the research team behind the ground-breaking Eucalyptus: User Controlled LightPath Enabled Participatory Design Studio, at Ottawa's Carleton University.

Architecture and industrial design are examples of advanced professions requiring collaboration of a diverse team around powerful visualization and modeling tools.

Carleton University's Immersive Media Studio (CIMS) partnered with teams from Communications Research Centre (CRC) and National Resource Council (NRC) to develop a project that participated in the burgeoning research and development initiative around the next generation network and the instruments and middleware.

The project has been successful in providing a new and innovative way to manipulate, share and visualize large and heterogeneous data sets, by integrating various technologies such as video-conferencing devices and applications, 3D modeling and animation software such as Autodesk's Maya, and visualization tools such as IBM's DCV - Deep Computing Visualization into a user-friendly "dashboard" that allows collaborators to control these tools and instruments with the support of Service Oriented Architecture and Web Services.

By enabling geographically remote participants to work together on tasks that require high performance manipulation and visualization of massive, disparate, geographically distributed file and data sets, Eucalyptus has the potential to enable faster, more effective, and less expensive engineering system design, development, user training, maintenance and business processes.

"Think of the auto industry," Michael Jemtrud, CIMS's director, said to one reporter. "It has designers here and engineers there, in Detroit, L.A. and Tokyo. It would be huge to be able to connect them with models of this level of sophistication, to help them overcome time delays, travel barriers and make more informed collaborative decisions."

In other words, such high-level collaboration had, till now, been impossible because of the limitations of standard high-speed Internet lines and the lack of a way of integrating all the tools



that would enable engineers and others to do substantial, hands-on work together from different sites in real time.

Other uses for CIMS's new technology could include the full-scale reconstruction of shorelines and cities devastated by catastrophic weather and real-time collaboration of multiple engineering teams to design next-generation jets and satellites.

Already showcased at international demonstrations and events in the research and education community, Eucalyptus sets the stage for the next phase of research with further development of the collaborative tools. The team is looking at adapting the technology to enhance of performance environments for music and dance, and bring performers together via technically mediated devices and platforms.

Eucalyptus's primary partners are the National Research Council, the Communications Research Centre, Carleton's Systems Engineering Department and CANARIE, Canada's advanced Internet development organization.

For more information on Eucalyptus, visit their Web site at: [www.cims.carleton.ca](http://www.cims.carleton.ca).

### **The ORION Discovery Award of Merit**

#### **2007 Winner: Black Holes and Cosmic Evolution**

The Black Holes and Cosmic Evolution Project, led by a team of Ontario and US researchers using some of Canada's top supercomputers, successfully addressed one of the world's computational Grand Challenges, and effectively confirmed that black holes have indeed had a role in the evolution of galaxies.

The research required one of the world's largest computer-based simulations of its kind, spanning six billions years of cosmic history and 684 million light years of the Universe.

It involved high performance computing facilities at SHARCNET and HPCVL in Ontario and WestGrid in Alberta, interconnected over Canada's advanced, ultra-high speed Canadian research networks, including ORION, Netera, BCnet and CANARIE.

Over the last decade or so, high-precision surveys indicated that galaxies tend to evolve in a hierarchical way. Dwarf galaxies merge to form galaxies, galaxies merge to form galaxy clusters, and so on. The big anomaly was that large galaxies stop forming stars much sooner than smaller ones, which indicated that something was missing from the prevailing astrophysical model.

A wide range of clues suggested that the role played by the enormous black holes that reside at the centres of galaxies was the missing factor. Remarkably, black holes release a significant amount of energy into their environs, because of the hot accretion disks that form around them, and it was thought that this could dramatically affect the evolution of the gas within a galaxy.

Last year, to test this hypothesis, project lead Prof. Robert Thacker, adjunct faculty member in



the Department of Physics, Engineering Physics and Astronomy at Queen's University in Kingston, partnered with Prof. Hugh Couchman, Scientific Director of SHARCNET, and Dr. Evan Scannapieco, of the Kavli Institute for Theoretical Physics, at the University of California, Santa Barbara, to conduct what was then the world's largest computer simulation of its kind.

The simulation was able to confirm for the international scientific community that black holes have a strong impact on the evolution of the largest galaxies in the universe, and that black holes in the largest galaxies and galaxy clusters emit enough energy to perturb the intra-cluster gas.

The three scientists made movies of the simulation remotely, which were particularly useful in understanding the impact of heating from black holes. The most important data are now archived at Queen's and still being analyzed.

Prof. Thacker, who credits significant upgrades in connectivity between institutions thanks to ORION and CA\*net 4 and other network infrastructure to the success of the research, notes that the massive simulation project could only go ahead once a high-speed connection over ORION and CANet 4 was established between SHARCNET and WestGrid.

The visualization was largely performed on the facilities at Simon Fraser University on the WestGrid visualization server.

Prof. Thacker was recently named Canada Research Chair (CRC) in Astronomy and Astrophysics at Saint Mary's University in Halifax, where he will develop new physical models and computational techniques to unravel the complex interplay between the formation and death of individual stars within the global evolution of a single galaxy.

For more information, visit [www.astro.queensu.ca/~thacker/new/rob.html](http://www.astro.queensu.ca/~thacker/new/rob.html).

### **The ORION Learning Award**

#### **2007 Winner: Institute for Knowledge Innovation and Technology**

The Institute for Knowledge Innovation and Technology (IKIT), based at the Ontario Institute for Studies in Education at the University of Toronto, continues to have a growing impact on the world of education.

Founded at the University of Toronto in 2001, IKIT grew out of a 25-year history of theoretical research, research-based innovation, and technology development. With funding support from the Social Sciences and Humanities Research Council's Initiative of the New Economy, IKIT has helped to build communities that advance beyond best practices in education, knowledge work and knowledge creation.

To unite these communities, IKIT hosts international virtual meetings, an annual Summer Institute, and the Knowledge Society Network, with more than 400 active members in more than a dozen different disciplines and 20 countries. The innovations these communities pursue are grounded in the concept of knowledge building, the collective advancement of knowledge as a



social product, an idea that is now prevalent in science and industry but is only beginning to take hold in education.

The results of these innovations show up in the work of students. These range from pre-kindergarteners producing theories to explain puzzling observations, to elementary school students presenting their research at meetings of adult professionals and analyzing and reporting on their own knowledge building activities, to university students producing prize-winning medical illustrations through collaborative knowledge building effort.

IKIT has brought a number of awards and innovations to Ontario, including an award for the first collaborative networked learning environment and a World Cultural Council award for worldwide effort to advance educational opportunity.

IKIT promotes knowledge building via professional development activities, publications and, above all, demonstrations with real students in real classrooms.

Since April 1, 2003, IKIT has hosted 56 Virtual Meetings, attended by 370 different participants from 17 countries and 109 different institutions. These are idea-centered meetings. For instance, educators in Ontario, Barcelona and Hong Kong plan a joint knowledge building experiment in which students develop theories, movies, and advance understanding of global warming and potential solutions.

The results have been remarkable. In 2002, for example, a group of elementary students presented the keynote event—the results of their IKIT-inspired research-- to a conference of the U.S. National Academy of Education. Their articulate grasp of knowledge building astonished the audience of adult scholars and educators.

IKIT's primary technological development is Knowledge Forum, the founding knowledge building environment, an extension of the first collaborative learning environment, CSILE (Computer-Supported Intentional Learning Environment). The technology has been constantly evolving since 1983 and can be used in education, kindergarten through post-graduate levels, health care, business, community organizations—any group committed to collaborative knowledge work.

It differs from other collaborative environments by having features that empower rather than control the users and encourage them to rise above conventional learning. Knowledge Forum is now in use around the world and increasingly being imitated.

Knowledge Forum also supports the Knowledge Society Network, which spans the Americas, Asia, and Europe, and enables the Toronto IKIT team to remain the "hub of innovation" for educational work in the area of knowledge creation, with the support of a Knowledge Innovation and Technology lab made possible through funding from the Canadian Foundation for Innovation.

The awards and endorsements that IKIT has received from many countries and all levels of education speak to the impact of its leadership and innovation being felt around the world.

For more information, visit <http://ikit.org> and [www.knowledgeforum.com](http://www.knowledgeforum.com).



## **The ORION Learning Award of Merit**

### **2007 Winner: Learning Connections**

The Learning Connections Project, winner of the 2007 ORION Learning Award of Merit, brings together a dedicated group of partners and champion teachers who are learning how to make full use of the Knowledge Age's endless resources and new, interactive technologies to raise the literacy and numeracy levels for Ontario students.

The project, which reaches out to nine school districts throughout Ontario, has helped transform teacher practice with the goal of raising student achievement in literacy and numeracy by using videoconferencing, web streaming, and other collaborative technologies and interactive resources.

It points to powerful results in supporting curriculum and professional learning that engages teachers and students, and helps Ontario keep at the leading edge of education, teaching and learning leadership and innovation.

Supported by the Ontario Ministry of Education's Literacy and Numeracy Secretariat and administered through the Advanced Broadband Enabled Learning (ABEL) program at York University, Learning Connections is breaking new ground as an experimental professional development program.

The program is nearing the end of its second implementation year, and with positive results it models the emerging innovations in technology use and teacher training that may eventually be applied across the province.

The program has two human components. One is the Learning Connections team, which began its initial planning in the spring of 2005. The other is the "embedded" teachers in each district. They are also called district champions.

The teachers are said to be embedded, because they are. That is, while they do attend summer conferences, the bulk of their professional development is occurring at their individual schools, as they implement this still-evolving program in their classrooms. But they are not alone.

The Learning Connections team and its bilingual web-portal are the hub of a community of learning. The portal provides the teachers with a wealth of interactive resources. Videoconferencing and various collaborative technologies enable them and the team to jointly develop and evolve course content and learning activities in the light of fresh classroom experience.

The Learning Connection team members are:

- Brian McLean, program manager and facilitator.



- Tania Sterling, literacy program developer and facilitator.
- Sharman Howes, numeracy program developer and facilitator.
- Rita Conley, directrice et facilitatrice pour les francophones au portail liens d'apprentissage (three of the nine districts are francophone).
- Judy Speirs, executive officer, Literacy and Numeracy Secretariat, with special responsibility for Learning Connections.
- Rudy Candela, Grade 4-5 teacher, district champion for the Limestone District School Board and anglophone district champions representative.
- Obadiah George, innovation technology manager, research and innovation, York University.
- Pierre Cazabon, enseigneur en 5<sup>e</sup> / 6<sup>e</sup> année à l'école Renaissance et représentant les champions francophones à l'communauté « liens d'apprentissage ».

The community members can also, of course, communicate one-on-one for mentoring and other purposes. The portal's resources include self-guided literacy and numeracy study programs; work spaces and forums, in which teachers can explore such topics as how to encourage mathematical thinking at the junior level; and synchronous and asynchronous webcasts on boys' literacy, reading comprehension, developing critical inquiry, developing data literacy, place value in mathematics, mind mapping and many other subjects.

However, this is not one-way traffic from the hub to the schools. At the very beginning, the district champions were asked to create communications and implementation plans based on their own and their districts' needs.

In a sense, then, they are implementing their own plans, but ones that are constantly being modified in light of their own, their students' and the community's learning and experience.

The most recent evaluation of the project is very positive, and it has also been noted that the embedded teachers are acting as true champions, in that they have begun to interest other teachers in what they are doing, which was also a goal of the initial plan.

For more information, visit [www. learningconnections.on.ca](http://www.learningconnections.on.ca).



## **The ORION Leadership Award**

### **2007 Winner: Dr. Nicolas D. Georganas**

Technological change is now such a constant factor in our lives, we are rarely, if ever, surprised by the new marvels that regularly come our way, and we probably never even think about the people who, over the last four decades, have been making it all happen.

One such person is Dr. Nicolas Georganas, one of Canada's most accomplished information technology and networking research pioneers and world authority on interactive multimedia communications.

The winner of the 2007 ORION Leadership Award, Dr. Georganas, Associate Vice-President of Research (External) at the University of Ottawa, has made substantial and enduring technical contributions in computer, cellular and multimedia networking.

Widely regarded as one of the "fathers" of high technology in Canada, he helped train and mentor the community researchers that has made Ontario a global leader in information technology.

As a working researcher, he is currently involved in at least six highly relevant projects. His many honours include the Order of Ontario and the Queen's Golden Jubilee Medal. He was recently invested as an Officer of the Order of Canada.

Born in Greece in 1943, he received his undergraduate electrical engineering degree in Athens, then earned two doctorates, one in Germany, the other at the University of Ottawa, which has been his home ever since.

In the early 1970s, he was one of the first Canadians to make major contributions to the foundations of information networks. Initially, this involved work on the optimal design and the flow and congestion control of such networks. The result was several well-published algorithms, which are still pertinent and useful in today's high-speed networks and are often cited in the literature.

Dr. Georganas turned his attention to local area networks (LANs). One of his endeavours in this field resulted in a breakthrough algorithm for the exact numerical analysis of queuing networks.

It was that field's premier discovery of the decade, and his book on the subject was published by MIT Press in 1989. Subsequently, Dr. Georganas' work on the modeling of "fractal" data traffic and its implications in designing switches for high-speed networks earned him the Institute of Electrical and Electronic Engineer's (IEEE's) coveted Prize Paper Award in 1995.

He also did substantial work on wireless traffic and was among the early major global contributors to the optimal dynamic and hybrid channel allocation assignment in wireless mobile cellular networks.



He founded a multimedia lab at the University of Ottawa, the first of its kind in Canada, with a radically diverse team of engineers, psychologists, economists and people from other disciplines.

To date, Dr. Georganas has received \$55 million in research grants and contracts. The money has been used to fund both his own and many other people's research and help build institutions that bring together government, academia and private industry.

Dr. Georganas was instrumental in establishing the Ottawa Centre for Research and Innovation's research programs, and was principal investigator at the National Capital Institute of Telecommunications (NCIT) from 2003-2005, which he helped to create.

While at NCIT, Dr. Georganas worked in a field called collaborative virtual environments and co-founded the DISCOVER laboratory, (Distributed and Collaborative Virtual Environments Research Laboratory).

Dr. Georganas can point to a long list of awards, citations and achievements, including recognition as a Fellow of the Academy of Sciences (Royal Society of Canada). He's also received the Pioneer in Computing in Canada Award from the IBM Centre of Advanced Studies and earlier this year, he received the very first Canada Computer Medal from the Institute of Electrical and Electronic Engineering.

For more information, visit [www.discover.uottawa.ca](http://www.discover.uottawa.ca).

### **The ORION Leadership Award of Merit**

#### **2007 Winner: Dr. Ronald M. Baecker**

Dr. Ronald M. Baecker, University of Toronto Professor of Computer Science, widely recognized as one of the world's pioneers of computer animation and leading authority in the field of human-computer interaction, is the 2007 ORION Leadership Award of Merit winner.

From his early research at MIT, where he pioneered the use of computers to enable artists to interactively create animated films, Dr. Baecker's 40-year research career spans applications to education, medicine, and design.

Founder of the world-renowned Knowledge Media Design Institute (KMDI), Dr. Baecker has accumulated a long list of international awards and citations, making him one of Ontario's most accomplished and celebrated innovators.

A professor in three faculties at the University of Toronto (Computer Science, Electrical and Computer Engineering, and Management), he is also Bell Universities Laboratories Chair in Human-Computer Interaction; and founder and chief scientist at the UofT's KMDI.

He is also principal investigator of the Natural Science and Engineering Research Council's Canada-wide Network for Effective Collaboration Technologies through Advanced Research



(NECTAR); and an affiliate scientist with the Kunin-Lunenfeld Applied Research Unit at Baycrest.

ACM SIGGRAPH (Association for Computing Machinery's Special Interest Group on Graphics), the industry's premier professional association, named him one of 60 pioneers of computer graphics. In 2005, he had the rare distinction of also being elected to the CHI (Computers and Human Interaction) Academy by ACM SIGCHI.

In the late 1960s, his PhD work helped launch the field of computer animation and in the 1970s, his interest in user-centered design led Dr. Baecker to the development of the field now called human-computer interaction, pioneering the use of new, friendlier input techniques and improved user interface design.

His instructional movie, *Sorting out Sorting*, was a landmark contribution to software visualization and is still used by computer science instructors all over the world. In that decade, he also pioneered the use of digital typography, to make computer programs more readable and accessible.

Around that time, he was among the developers of the idea of telepresence for computer-supported collaborative work. He was also among the first to see that the dissemination of "knowledge" and its encapsulation as "media" would have a profound effect on how information is represented and communicated.

As an entrepreneur, Dr. Baecker has founded, managed and successfully sold two software companies.

His current interests include ePresence, his vigorous new webcasting, conferencing, and rich media archiving system. Distributed as open-source technology by the UofT, it is used by 25 Canadian universities and medical schools and a growing number in other countries.

His most recent interest finds Dr. Baecker pioneering in yet another new field: the creation of computer-based cognitive tools as prosthetics for memory and language, to help victims of amnesia, Alzheimer's disease and other maladies and their caregivers.

For more information, visit <http://kmdi.utoronto.ca/rmb> and <http://epresence.tv>.

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