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**UNU-IIST**

International Institute for  
Software Technology

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# UNU-IIST Annual Report 2008

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Mike Reed, Chris George, Wendy Hoi Lok Wa

February 2009

## UNU-IIST and UNU-IIST Reports

UNU-IIST (United Nations University International Institute for Software Technology) is a Research and Training Centre of the United Nations University (UNU). It is based in Macao, and was founded in 1991. It started operations in July 1992. UNU-IIST is jointly funded by the government of Macao and the governments of the People's Republic of China and Portugal through a contribution to the UNU Endowment Fund. As well as providing two-thirds of the endowment fund, the Macao authorities also supply UNU-IIST with its office premises and furniture and subsidise fellow accommodation.

The mission of UNU-IIST is to assist developing countries in the application and development of software technology.

UNU-IIST contributes through its programmatic activities:

1. Advanced development projects, in which software techniques supported by tools are applied,
2. Research projects, in which new techniques for software development are investigated,
3. Curriculum development projects, in which courses of software technology for universities in developing countries are developed,
4. University development projects, which complement the curriculum development projects by aiming to strengthen all aspects of computer science teaching in universities in developing countries,
5. Schools and Courses, which typically teach advanced software development techniques,
6. Events, in which conferences and workshops are organised or supported by UNU-IIST, and
7. Dissemination, in which UNU-IIST regularly distributes to developing countries information on international progress of software technology.

Fellows, who are young scientists and engineers from developing countries, are invited to actively participate in all these projects. By doing the projects they are trained.

At present, the technical focus of UNU-IIST is on formal methods for software development. UNU-IIST is an internationally recognised center in the area of formal methods. However, no software technique is universally applicable. We are prepared to choose complementary techniques for our projects, if necessary.

UNU-IIST produces a report series. Reports are either Research **[R]**, Technical **[T]**, Compendia **[C]** or Administrative **[A]**. They are records of UNU-IIST activities and research and development achievements. Many of the reports are also published in conference proceedings and journals.

Please write to UNU-IIST at P.O. Box 3058, Macao or visit UNU-IIST's home page: <http://www.iist.unu.edu>, if you would like to know more about UNU-IIST and its report series.

G. M. Reed, Director



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## **Abstract**

This document covers UNU-IIST's activities in 2008. It describes the implementation of UNU-IIST's research, development, and training projects, its reports and its publications.



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## 1 Executive Summary

Within its target area of software technology, UNU-IIST seeks to balance the activities of research, training, and development. It focuses on the needs and opportunities of developing countries. It also balances the need for computing to be seen as a science, and for education in it to be rooted in fundamentals of that science, with the need to work with new and emerging technologies. Projects are chosen both to further the science and to meet the needs of software development in developing countries.

### 1.1 Projects

Major themes for projects in 2008 have included: (1) theories and tools for software technology, (2) electronic governance, and (3) open source software for environmental and health applications.

#### 1.1.1 Theories and tools for software technology

Projects in this area have been directly funded by UNU-IIST, the European Union, and the Macao Science and Technology Development Fund, with external funding exceeding 380,000 USD per year. Indirect funding via travel support and research collaboration of approximately 100,000 USD has been provided by our research partners in Europe, China, and India.

UNU-IIST now has three members on the Interlink committee set up by the European Commission to decide future areas for calls for EU-funded research. In addition, UNU-IIST now has a representative on the EU-funded project ATEST which combines the largest German automotive manufacturers (Daimler and VW) with academia in software technology. All UNU-IIST participation and travel costs are covered by the EU.

UNU-IIST is a partner with ARTIST2, a consortium of over 40 European institutions aimed at establishing collaboration between Europe and China on the development of embedded systems.

UNU-IIST jointly organised an annual workshop in India during January, 2008, with TATA Systems. These workshops bring in the world's best researchers in a given area each year and provide funding for an audience of young researchers from the developing world.

UNU-IIST sponsored the fifth ICTAC Colloquium (Theoretical Aspects of Computing) during September, 2008, in Istanbul. This colloquium was in conjunction with co-located workshops and tutorials. The proceedings of the colloquium was published as a volume in the Lecture Notes in Computer Science series by Springer. The ICTAC Colloquia were founded by UNU-IIST to promote cooperation on research and development between developing and industrial countries. Previous colloquia have been held in China, Vietnam, Tunisia, and Macau; the next

two colloquia are set for Malaysia and Brazil.

UNU-IIST academic staff in computer science have been invited speakers at seminars and conferences in China (3), Germany, Hungary, Italy, Malaysia, South Africa, and the UK. UNU-IIST has given courses in software technology in China, Iran, Malaysia, Nigeria, South Africa, Thailand, and Italy (within our joint PhD programme with the University of Pisa).

### 1.1.2 Electronic Governance

The Center for Electronic Governance was established in 2007 to provide organizational support to the growing number of activities executed by UNU-IIST in the area of Electronic Governance. During 2008, the Center executed nine projects, which led to the following outputs: (1) A set of concrete benchmarks to measure how the Center implements its five-year strategic plan, in terms of fellowships, events, projects, outputs and internal capacity; (2) The second edition of the ICEGOV conference, Cairo, Egypt, under patronage of the Government of Egypt, attracting 127 submissions from 46 countries; (3) 16 UNeGov.net workshops and schools in Nigeria, Cameroon, Kyrgyzstan, Afghanistan, Colombia, Ecuador and Mongolia in partnership with host governments, including two Leadership Schools for Cabinet Ministers and Members of Parliament of Kyrgyz Government in cooperation with UNDP Kyrgyzstan; (4) Translation of the UNeGov.net Foundation School into Arabic, Russian and Spanish; (5) Two senior government officials from India and Maldives invited to the Center as International Government Fellows (EduEGOV), carrying out research and program development in important areas to their governments; (6) The toolkit to help public organizations carry out Strategic IT Planning and Alignment, comprising methodology, software and templates, developed and applied to two agencies of Macao SAR Government; (7) Policy recommendations provided to Macao SAR Government on the alignment between Electronic Government and Public Administration Reform roadmaps; (8) The Messaging Gateway, part of lightweight software infrastructure for Electronic Government, improved and extended into a production-quality version; (9) The Wildlife Enforcement Monitoring System project successfully transferred from UNU Headquarters to the Center; and (10) Five papers and a volume of ICEGOV2008 proceedings published.

An official advisor to the national governments in Afghanistan, Colombia, Kyrgyzstan, Mongolia and Nigeria, and to local governments in Abuja and Macao, the Center comprises 11 staff from Argentina, Colombia, Cameroon, Italy, India, Kyrgyzstan, Maldives, Nigeria and Poland, including four women. It is supported by external funding of about 500,000 USD per year.

### 1.1.3 Open source software for environmental and health applications

Environmental modelling to support water management has a proven success record but is very expensive. The aim is to create a generic model of water resources together with a decision support system intended for use in developing countries that is cheap to instantiate while being effective in operation. The system will support such activities as development planning, the

exploration of ways to counteract environmental degradation, and the mitigation of events such as global warming or polluting accidents. The tools will as far as possible be free of charge and open source, and capable of using free data from the internet as well as local data. The WaterBase project is primarily in collaboration with UNU-INWEH, with initial funding provided by the UNU collaboration fund. The WaterBase website was established in December, 2007, with the modelling tool MWSWAT and considerable global data on land elevation, soil, landuse, and weather. The first training course on its use was given in India during March, 2008, and since then two decision support tools have been added. A Google *waterbase* group is running, and the tools have a substantial body of users. UNU-IIST now has a joint project on the development and training for the use of open source software in health management with UNU-IIGH, and has written the software for a module of their case-mix system. It is also a partner in a proposed UNU project on the Mekong Delta.

## 1.2 Training

UNU-IIST's main concern is the development of software technology in developing countries, and it concentrates on capacity building through postgraduate training. Training takes five forms: fellowships at UNU-IIST (9 fellows from 8 countries); joint PhD students with associated universities (2); postdoctoral fellows at UNU-IIST (6); fellowships for computer science lecturers at universities in developing countries to train in developed countries (4 fellows from 3 countries); and schools/courses/workshops in developing countries (14 in 13 countries).

## 1.3 Twinning relationships

### 1.3.1 Africa

UNU-IIST is planning to "twin" with the African Institute for Mathematical Sciences (AIMS), African Mathematical Institutes Network (AMI-Net), and the African University of Science and Technology in Abuja (AUST-Abuja). AMI-Net is a proposed network of mathematical sciences centres which are building capacity in research and teaching across Africa. AIMS (South Africa) and AUST-Abuja (Nigeria) are the first two institutions in this network. AUST-Abuja is devoted to mathematics and computer science. Both AIMS and AUST-Abuja bring students from all over Africa.

Neil Turok, Chair of mathematical physics at Cambridge and a winner of the 2008 TED Prize, is the driving force behind AMI-Net. The Director of UNU-IIST met with him in Cambridge, and agreed that UNU-IIST would become the source for education and research in computer science for AMI-Net. The Director has now been appointed to the Board of AUST-Abuja. Other members of the Board include Neil Turok, a former Minister of Finance and Foreign Affairs of Nigeria (now Chair of the Nelson Mandela Institution and Managing Director of the World Bank Group in Washington), and a former Director of The President's Office for the African

Development Bank. AMI-Net is receiving major funding from the Nelson Mandela Foundation, the World Bank, and African governments. UNU-IIST and AMI-Net have proposed an event in New York early in 2009. Participants expected would include Stephen Hawking and Neil Turok from Cambridge, Richard Branson, the actor Will Smith, the singer Bob Geldof, members of the TED organisation, and representatives from industry.

### **1.3.2 Universiti Kebangsaan Malaysia**

This university in Kuala Lumpur has been recently been funded to build a major research center in Malaysia to offer MSc and PhD education in computer science to students in Malaysia and Southeast Asia. The university already has some 400 undergraduates in computer science, but they have little experience with world class research. They have visited us and we have visited them. They very much want UNU-IIST to help develop their programmes. We have a MOU to express this relationship, and are planning a formal joint PhD programme.

### **1.3.3 Guizhou Academy of Sciences, Guizhou University, and Guizhou Normal University**

This is a consortium of institutions in Western China with whom we already have an MOU for collaboration. We have given several courses there, organized a major international conference there funded by the Chinese Ministry of Trade to bring in academics from both developing and developed countries to China, and also had research collaboration. In the past we have discussed setting up a UNU-IIST center in the region for education and research; this is definitely in the developing area of China. In May, the Director visited there to meet with vice-rectors and the vice-governor of the province to discuss this matter seriously. We are now preparing a proposal for funding.

### **1.3.4 Algeria, Iran, and Oxford**

UNU-IIST has been requested by the Department of Computer Science at University Mentouri, Constantine, Algeria to redesign their MSc course, offer help in teaching and supervisions, and help build a PhD programme.

UNU-IIST gave a course at Kashan University of Iran in February of 2008. UNU-IIST have now been approached to set up joint MSc programmes at a new campus being built in the Free Zone in the Persian Gulf area.

Oxford has started a DPhil programme in e-government and invited UNU-IIST to collaborate both in research and in recruitment of students from developing countries.

## 1.4 Annual UNU conference in Macau

Finally, to increase our and UNU's local and global visibility, we plan a major international conference each year in Macau. The focus would change each year, and be organized by different UNU institutes. We would hope to obtain around 200,000 USD of funding each year. We have a "verbal" commitment from the Macao Chief Executive to support such a conference.

## 2 Status of implementation of project activities

### 2.1 Formal Methods for Object and Component Systems

**Staff responsible** Zhiming Liu and Volker Stolz

**Project abstract** The objective of research on Formal Methods for Object-Oriented and Component-Based Systems is to develop a *Component-Based Model Driven Software Design Method*, called the rCOS (Refinement of Component and Object Systems) method, to deal with the challenges due to the complexity of software development projects. Software complexity is handled by a theory of modelling that supports separation of concerns by factoring a model of a software component into models of different views of the *data functionality*, the *interaction protocol* with the environment, and the *reactive behaviour* of the component. The method includes a specification notation with a formally defined semantics and a calculus of refinement so that formal techniques can be applied for verification and refinement. The project is also to develop tool support for model construction, correctness preserving model transformations that automate important model refinement rules, and verification of properties of models. The ambition of the project is to achieve this aim by *developing* and *teaching* a coherent and comprehensive methodology that begins with design for verification and validation and integrates verification into development. Therefore, the project includes *theoretical research*, *tool development*, *experiments on software development* and *technology* and *knowledge transfer* via UNU-IIST schools and training courses in developing countries. The research of the project is positioned within the Worldwide Collaborative Research on the Grand Challenge: "Verified Software: Theories, Tools and Experiments", and in particular it fits very well in the mission of UNU-IIST to help developing countries strengthen their education and research in computer science and their ability to produce computer software.

**Main achievements** The achievements are in the following three areas.

**Research Capacity Building** It took a 4-year effort in building research capacity. This year with external funding from the Macao Science and Technology Fund, we have built a team of an ideal size with one research assistant (recently promoted from a postdoctoral fellow), three postdoctoral fellows (two women), one project staff, one PhD student and two or three fellows. This is a substantial contribution to the

capacity increase of the institute in research and training and improves the scientific environment for collaboration with researchers at different levels.

**Research Progress and Results** The team has worked hard and enjoyed collaborations with external partners. In the last 12 months, focus of the project has been on the three strands of *theory*, *application experiments* and *definition of the engineering process*. In collaboration with former fellows, external collaborators and colleagues in other groups, the project group has produced **19 publications and presentations, including four journal publications**. We provide a brief summary of the publications below.

**Theory** The theoretical research focuses on *the application of rCOS in security modelling and testing*, *object-oriented refinement and design patterns*, *black-box composition and refinement of software components*, and *defining a component-based model driven software engineering process*. In particular, we investigated the following problems:

1. We studied the relation and difference between algebraic laws of object-oriented programs in the rCOS reference semantic model and a copy-semantics, and the result is presented in the conference paper [1]. This gives us the idea in future research on a smooth link between a semantic model with object references and a semantics without them. The former semantics is often used for specifications of models in later development phases and the latter for specifications of model at earlier design phases.
2. A major piece of work on rCOS refinement is the formulation of refinement rules and their completeness in a graph transformation setting. This is important for the development of tool support to object-oriented design. This paper is published in the Journal of Formal Aspects of Computing [2].
3. For the purpose of automation of design patterns as correctness preserving model transformations, we formalised and proved design patterns and refactoring rules and the work is presented in the conference paper [3].
4. For component-based design, we have defined the specification of *component publication*, that is taken as the black-box specification of components. We started to study the calculation, composition operators and refinement of component black-boxes, and their limitations. The initial results of this work are accepted for a presentation at UTP 2008 as a work in progress paper [4].
5. In another major piece of work, we studied how rCOS is used to identify modelling, design, implementation and analysis activities and formulate software artifacts in a component-based mode driven development process. With the case study of a trading system, we illustrated how tool support can be provided to the activities of modelling, model transformation and verification. This work is published in its short version as a book chapter in [5]. A substantially extended version is accepted for publication in the *Journal of Science of Computer Programming* [6].
6. We started to investigate extensions and applications of rCOS to problems of access control [7] and testing [8]. The work on access control is based on a

combination of rCOS and the techniques developed in [9, 10]. We have also looked at techniques of run time monitoring with temporal logic assertions [11].

**Tools** This year we have put a lot of effort into the tool development. We have defined the machine readable syntax and its parser for rCOS (though it is yet to be finalised), a UML profile for rCOS and the translation of some UML models in the profile to the rCOS syntax. An algorithm of the *expert design pattern* is implemented to support OO functional decomposition among classes. Further work includes translation of rCOS sequence diagrams and state machines into CSP. These are presented in the journal paper [6], the presentation [12] at the VDM/Overture Workshop '08 associated with the FM 2008 conference, and the FM tool presentation [13]. The tool is built using the Eclipse platform and made available on the project web page (<http://rcos.iist.unu.edu>).

We further developed the tool for automatic prototype generation from models of requirements and this has resulted in a journal publication in [14]. Within the QVT framework, we have looked into integrating refinement into software development tools [15]. The tool development also gave team members and students valuable insight into software project and source code management techniques for a project of non-trivial size and complexity.

**Experiments** We have experimented the method with a trading system, that is the benchmark used in CoCoME (<http://cocome.org>) in [6, 5], and a library system [14]. We have also applied model checking techniques to real-time properties [16].

A member of the team, Dr. Volker Stolz, has also served as editor of workshop proceedings [17, 18]. Together with Jeff Sanders and Mike Reed, we have started to look into future directions, such as Ensemble Engineering [19].

**Technology and Knowledge Transfer** With the research results, the tool and the case studies, we have developed a course on *rCOS: A Method of Component-Base Model Driven Design*. The course was taught first at a UNU-IIST course in Guiyang (China) in Spring 2008, and then at the University of Pisa as a course for the joint PhD Program between UNU-IIST and Pisa University. The theoretical foundation of rCOS was also early developed into a course on *Relational Method of Program Design and Analysis*. The course has been taught in UNU-IIST schools in Brazil, China and Iran.

**External Seminars** Zhiming Liu gave a seminar on the rCOS Method at the Institute of Software, the Chinese Academy of Sciences, E-Y. Kang gave a seminar there too on tool supported real time system verification techniques with combination on abstraction/deduction and model checking.

**Training activities** In 2008, Liu Jicong finished his fellowship and completed his Master Degree based on his work at UNU-IIST. He has now got a job in industry. Dr. Yang Kehua completed his fellowship and returned back to Hunan University (China) and he is to teach a course based on the material he studied at UNU-IIST. Sun Haoyu has got a job in industry after he finished his fellowship in June. Chen Xin, a former fellow from Nanjing University, has just received his PhD based on the work he did

on the project during his fellowship and he is now appointed as lecturer at Nanjing University.

**Impact** The impact of the research, training and teaching developed from this project has been growing. There are 14 former fellows, and their supervisors have close contacts with us in the areas related to this project. 9 of them (this is over 50 percent of the former fellows of this group) have co-authored papers with us this. There are another four groups in developing countries, including a group in Guiyang (China), two groups in Xi'an (China), a group in Vietnam (led by Dang Van Hung, a former research fellow), and a PhD student at Peking University, working directly on problems in the rCOS method.

**Status and plans** We will continue this project in improving the theory and make major investigations into tool development. We will carry on the investigation into further applications and extensions of rCOS to real-time, fault-tolerance, and web-based computing.

**Sources of funding** UNU-IIST and the HQSoftD grant from Macao Science and Technology Development Fund (75 000 USD, started in 2006), and HTTS grant from Macao Science and Technology Development Fund (USD 350,000 for three years started in August 2007).

**Collaborations** The project enjoys the collaboration with the University of Macau, Macau University of Science and Technology, Prof. Anders Ravn's group at Aalborg University (Denmark), the Institute of Software of the Chinese Academy of Sciences, Nanjing University (China), East China Normal University (China), the National Key Lab for Parallel and Distributed Computing (China), and Dang Van Hung at Vietnam National University.

**Assessment** The project has progressed very well. We are very pleased with the results achieved, and the impact in relation the mission of UNU-IIST. These results have now been recognized in the community of formal aspects, both for object-oriented and component-based approach, and have become attractive to our collaborators. Also, the framework is now a topic of research projects in a number of universities (Beijing University, Nanjing University and East China Normal University) in China, funded by the Chinese NSF. Several other universities and institutes (in Beijing, Guizhou, Hunan, Nanchang, and Xi'an) start to study the results of our research. In Europe too, our research is gaining attention and it is now studied, used and even taught in classes in universities, such as Graz University of Technology (Austria), University of Aalborg (Denmark), and Pisa University (Italy).

## 2.2 Center for Electronic Governance at UNU-IIST

**Staff responsible** Tomasz Janowski

**Project abstract** The UNU-IIST Center for Electronic Governance (UNU-IIST-EGOV) was established in January 2007 to contribute to the mission of UNU-IIST through relevant, high-impact activities focusing on Electronic Governance - technology-enabled transformation of public organizations and their relationships with citizens, businesses, civil society,

and with one another. Strategically, the establishment of the Center aims at supporting the acquisition and execution of relevant projects and programs, enhancing local and international visibility, and increasing opportunities for partnership and funding.

The mission of the Center is to support governments in developing countries in strategic use of technology to transform the workings of public organizations in order to increase their capacity for creating public value. To fulfill its mission, the Center is engaged in applied and policy research, capacity building and various forms of development - strategy development, software development, institutional development and development of communities of practice. The Center works in partnership with governments and universities from developing and transition countries, other centers of excellence, and international and UN organizations. Across its activities, the Center works to: (1) produce concrete benefits to governments in developing countries; (2) connect institutions in developing countries across sectoral (public, private and voluntary), functional and national borders in sharing experiences and engaging in cooperative initiatives; (3) work closely with institutional partners to access complementary capabilities and resources; and (4) continuously develop its internal capacity and capabilities.

The Center currently comprises a team of 10 staff: 5 senior staff, 3 junior staff and 2 fellows; this number is expected to grow due to the current project portfolio and increasing number of international requests for assistance. It is presently engaged in all its activity areas, strategically relying on existing institutional partnerships, notably with the host government in Macao, as well as developing new ones.

More information about the Center can be found at its portal <http://www.egov.iist.unu.edu>.

**Achievements, status and plans** The Center has recorded a number of achievements in 2008, in the areas of: strategic direction and internal workings, projects, organization of events and conferences, research and development, fellowships, networking and strategic partnerships, visitors and international outreach. These achievements are briefly described below.

1. *Strategy* - To realize the five-year strategic plan for the Center, approved by the UNU-IIST Board in May 2007, a set of concrete benchmarks were defined to measure the progress in terms of: fellowships, events, projects, outputs and internal capacity. Along with the benchmarks, the impact created by the Center through its various activities was assessed in four main areas: (1) Impact upon governments in developing countries by raising their awareness and human/organizations capacity to plan, implement and evaluate Electronic Governance initiatives - UNeGov.net; (2) Impact upon national agencies responsible for coordinating Electronic Governance development by raising their capacity for policy, strategy and program development through research - EDUeGov; (3) Impact on the global research and practice community for Electronic Governance by connecting together practitioners, researchers and developers working in the area - ICEGOV; and (4) Impact on the host government through building tools, providing guidance, and developing capacity of different agencies in implementing the Public Administration Roadmap through Electronic Government - e-Macao.

2. *Projects* - A total of nine projects were executed by the Center, as described by different sections of this report: (1) UNeGov.net - Community of Practice for Electronic Governance - Section 2.3, (2) Information Technology Governance for Public Administrations - Section 2.4, (3) Software for Electronic Government - Section 2.5, (4) Knowledge Management for Electronic Government - Section 2.6, (5) Semantic Interoperability for Electronic Government - Section 2.7, (6) Developing Open Courseware - Section 2.8, (7) WEMS - Wildlife Enforcement Monitoring System - Section 2.9, (8) Capacity Building for Software Technology and Electronic Governance, internal collaboration within UNU-IIST - Section 2.10, and (9) Development of Computer Science Departments in Developing Countries, the UNU-IIST project currently executed by the Center - Section 2.11.
3. *Events* - Responding to increasing demand, there has been again a considerable increase in the number of workshops, schools and other e-government-related events organized in 2008. Through UNeGov.net, the Center organized five workshops and eleven schools in: Afghanistan, Cameroon, Colombia, Ecuador, Kyrgyzstan, Mongolia and Nigeria, all in partnership with host governments. In the case of Kyrgyzstan, a new Leadership School was delivered to Cabinet Ministers and Deputy Ministers of the Kyrgyz Government. In the case of Colombia, following last year's events at the national level, a series of schools were delivered to provincial-level governments in collaboration the central coordinating agency and the association of municipalities. In the case of Mongolia, following last year's Foundation School, a new Implementation School was prepared and delivered to respond to concrete needs of Mongolian Government.
4. *Conferences* - The Center organized in 2008 the second edition of the International Conference on Theory and Practice of Electronic Governance, 1 - 4 December 2008, Cairo, Egypt, [www.icegov.org](http://www.icegov.org) (ICEGOV2008). Co-organized with the German University in Cairo and taking place under official patronage of the Ministry of State for Administrative Development, Government of Egypt, the conference brought together practitioners, developers and researchers from government, academia, industry and non-governmental organizations to share the latest findings in the theory and practice of Electronic Governance. It attracted 127 submissions from 46 countries - 80 from academia, 21 from government, 15 from industry and 11 from non-governmental and international organizations. The program included: 3 invited talks, 15 invited sessions, 10 tutorials, 6 workshops, 9 panel discussions, 12 regular paper sessions and 1 poster session, by leading international experts and practitioners in the field. Conference proceedings were published by ACM Press in the International Conference Proceedings Series.
5. *Research and Development* - A number of development outputs were produced during 2008 such as: Strategic IT Planning Framework including software, processes and training materials (Section 2.4); Strategic Alignment Toolkit and Software, and Macao IT Strategy for 2010 - 2020 produced with its help 2.4; production-quality version of the Message Gateway and two communication-intensive applications built upon it (Section 2.5); semantic interoperability middleware and its integration with the Message Gateway (Section 2.7); and software to collect, manage and visualize

electronic eco-messages for the WEMS Project (Section 2.9). A number of development outputs are yet to turn into publications. The publications in 2008 include six papers in conference proceedings [20, 21, 22, 23, 24, 25], one article in a magazine [26] and the book of ICEGOV2008 proceedings [27].

6. *Fellowships* - Two international government fellows were invited by the Center in 2008: Radha Chauhan, Principal Consultant at the National eGovernance Plan, Government of India to work on the policy framework for sustainable Electronic Governance in India; and Mohamed Shareef, Deputy Director, National Centre for Information Technology, Republic of Maldives to work on the readiness assessment framework as a basis for strategic IT planning for the Maldives. Both Government Fellows carried our research and project development in their chosen areas, and are expected to continue their work and return back to the Center.
7. *Partnerships* - A number of partnership agreements have been developed and formalized in 2008, with Memoranda of Understanding formulated and signed with: the Ministry of Communications and IT, Islamic Republic of Afghanistan; National IT Center, Kyrgyz Republic; Ministry of Communication, Government of Colombia; Universidad Externado de Colombia, Colombia; Federal Capital Territory Administration, Abuja, Nigeria; and Global IT Technology Program, Information and Communications University, South Korea. Center for Technology in Government, University at Albany, State University of New York, remains a strong partner of the Center, German University in Cairo co-organize with the Center the ICEGOV2008 conference, and 2008 noted concrete collaboration with UNU-MERIT (a module contributed by the Center to the UNU-MERIT school on Design and Evaluation of Innovation Policy in Developing Countries in Amman, Jordan) and with UNDESA (organization in Macao of the 1st Executive Meeting of Electronic/Mobil Government Repository for Asia-Pacific, an initiative by UN Department of Economic and Social Affairs, where the Center plays the role of global research partner).
8. *it Visitors* - The Center hosted four visitors during 2008: Philipp Schmidt, University of the Western Cape, South Africa and UNU-MERIT, 29 April 2008; Francisco Camargo, Director for Coordination and Management, Agenda Conectividad, Ministry of Communication, Colombia, 12-19 September 2008 invited as Senior International Government Fellow and e-Macao Visitor; Dr. Ebot Ebot Enaw, Director, National Agency for IT Development, Government of Cameroon, 15-26 September 2008 invited as Senior International Government Fellow; and Ms. Seema Hafeez, Economic Affairs Officer, UN Department for Economic and Social Affairs, New York, 8-12 December 2008 invited as e-Macao Visitor.
9. *Outreach* - The staff of the Center gave 15 invited presentations, including keynote and invited talks, at various events during 2008: Hawaii International Conference on System Sciences, Hawaii, United States, January 2008; African E-Gov Forum, Kampala, Uganda, March 2008; Center for Technology in Government, University at Albany, State University of New York, March 2008; UNU Headquarters, Tokyo, Japan, March 2008; Capacity-Building Workshop on Back Office Management for e/m-Government in Asia-Pacific Region, Shanghai, China, May 2008; Training Programme on Design and Evaluation of Innovation Policy in Developing Countries, Amman, Jordan, June

2008; Seoul Conference on Innovation Strategy Collaboration and Networking across Boundaries, Seoul, South Korea, September 2008; Asia e-Government Forum 2008, Seoul, South Korea, October 2008; 3rd Conference on Global e-Governance, Waseda University, Tokyo, Japan, November 2008; EU-China Information Society Project Annual Conference 2008, Beijing, China, November 2008; Inter-University Institute of Macao, November 2008; Strategic UNU Workshop on Innovative Capacity Development through E-learning with a Special Focus on Africa, Bonn, Germany, November 2008; 2nd Workshop on Formal Languages and Analysis of Contract-Oriented Software, Malta, November 2008; e-Government Workshop at Japan Advanced Institute for Science and Technology, Kanazawa, Japan, December 2008; and Japan Electronic Industries Technical Association, Tokyo, Japan, December 2008.

The Center completed its first set of project contributions to the e-Macao Program in the first months of 2008. It also continued developing its internal capacity and capabilities to cope with the increasing international demand for assistance and collaboration, and the resulting likely increase in project activities and events.

**Sources of funding** The Center and its activities are funded by several sources including: Government of Macao SAR, Macao Foundation, UNU-IIST, Microsoft Corporation, UN Development Program, UN Asia Pacific Center for ICT for Development, International Fund for Animal Welfare, UNU Joint Activities Fund, and various in-kind contributions by its partners. The largest contribution received by the Center is from the Government of Macao SAR through Macao Foundation - between 1,125,000USD and 1,350,000USD for the period from 2007 to 2009 - for its contribution to the e-Macao Program.

**Collaborations** The Center includes several partners including government, academic and international organizations. Chief among government organizations is Macao SAR Government and many of its agencies - SAFF, DSC, IFT, DSF, DSRT, etc. Other government organizations collaborating with the Center include: Afghanistan - Ministry of Communication and IT; Cameroon - National Agency for IT Development; Colombia - Program Government Online, Ministry of Communication; Kyrgyzstan - National IT Center and e-Government Department at Prime Minister's Office; Maldives - National Centre for Information Technology; Mongolia - Information and Communication Technology Authority; Nepal - National IT Center and High-Level Commission for IT; Nigeria - National IT Development Agency, Federal Government of Nigeria, and Federal Capital Territory Administration, Local Government of Abuja city; and South Korea - Korea Agency for Digital Opportunity and Promotion. Academic organizations collaborating with the Center include: Cameroon - University of Yaounde I; Colombia - Universidad Externado de Colombia; Egypt - German University in Cairo; India - Kalinga Institute for Industrial Technology; South Korea - Information and Communications University; UK - University of Oxford; USA - Center for Technology in Government, University at Albany, State University of New York. International organizations collaborating with the Center include: UN Department for Economic and Social Affairs, Division for Public Administration and Development Management; UN Development Program, Kyrgyzstan; UNU-MERIT; Canada School for Public Service; Microsoft Corporation.

**Assessment** Through its projects and events, and despite the modest funding basis, the Center has already achieved significant impact upon: (1) Governments in developing countries, in terms of awareness and human/organizations capacity to plan, implement and evaluate Electronic Governance initiatives - UNeGov.net; (2) National agencies responsible for coordinating Electronic Governance development, in terms of their capacity for policy, strategy and program development through research - EDUeGov; (3) Global research and practice community for Electronic Governance, by connecting together practitioners, researchers and developers working in the area - ICEGOV; and (4) The host government, through building tools, providing guidance, and developing capacity of the agencies of Macao SAR Government in implementing the Public Administration Roadmap through Electronic Government - e-Macao. The Center is now an official advisor on Electronic Governance development to the national governments in Afghanistan, Colombia, Kyrgyzstan, Mongolia and Nigeria, and to the local governments in Abuja and Macao. The achievements recorded so far confirm in concrete terms that the Center fulfills its objectives, its design is successful, and its operations are sustainable in the long run.

### 2.3 Community Building for Electronic Governance - UNeGov.net

**Staff responsible** Elsa Estevez

**Project abstract** The UNeGov.net initiative - Building a Community of Practice for Electronic Governance, aims to build and support a global Community of Practice comprising researchers and practitioners interested in technology-enabled transformation of public organizations and their relationships with citizens, businesses, civil society and with one another.

The initiative maintains an activity framework comprising: (1) A community portal to document all activities of the community, coordinate its work and maintain a repository of resources for Electronic Governance; (2) A series of network-building workshops to bring together government, academia, industry and civil society to discuss local challenges to Electronic Governance and agree on collaborative initiatives to overcome them; (3) A series of schools and courses to build awareness and capacity of the government towards planning, implementing and evaluating Electronic Governance initiatives; (4) Innovative research and development projects that promote Electronic Governance as a major tool and vehicle for carrying out Public Administration Reform; and (5) A series of International Conferences on the Theory and Practice of Electronic Governance.

Within this framework, community actions are carried out in the scope of various thematic areas, such as: business process re-engineering, free and open-source software, government enterprise architectures, human capacity development, innovation patterns in government, international cooperation, organizational change, public benefits management, public-private partnerships, public services for rural areas, readiness assessment, security and privacy, software infrastructure, stakeholder management, standards and interoperability, strategic planning, technology adoption, etc.

More information about UNeGov.net can be found at <http://www.unegov.net> and at

the Center's project page at [http://www.egov.iist.unu.edu/cegov/projects/unegov\\_net](http://www.egov.iist.unu.edu/cegov/projects/unegov_net).

**Achievements, status and plans** During 2008, the UNeGov.net initiative was present in: Africa - one workshop and two schools organized in Nigeria and Cameroon; Asia - three workshops and five schools organized in Afghanistan, Kyrgyzstan and Mongolia; and South America - one workshop and four schools organized in Colombia and Ecuador. The community currently comprises 630 members from 52 countries.

Continuing a program of International Government Fellows established in 2007, two government officials from Maldives and India visited the Center for two months as Fellows. They conducted research and project development in the areas strategically important for the development of Electronic Governance in their countries: a framework for readiness assessment in support of Electronic Government planning for Maldives, and a model for policy interventions in support of sustainable development of Electronic Governance for India. The results were published in the proceedings of ICEGOV2008 [21, 20].

During 2008, UNeGov.net organized 16 workshops and schools:

1. *10th UNeGov.net School on Electronic Governance - Foundation, Abuja, Nigeria, 7 - 8 March 2008* - The school was co-organized by the National IT Development Agency, Federal Government of Nigeria; Federal Capital Territory Administration, Abuja, Nigeria; and UNU-IIST-EGOV. Around 30 people attended the school, mostly government officials from various ministries and academics from Nigeria.
2. *12th UNeGov.net Workshop on Electronic Governance - Network-Building, Yaounde, Cameroon, 12 March 2008* - The workshop was co-organized by the National Agency for IT Development, Government of Cameroon; University of Yaounde I; and UNU-IIST-EGOV. It was attended by about 100 participants from government, academia and industry in Cameroon, and comprised several presentations by local speakers.
3. *11th UNeGov.net School on Electronic Governance - Foundation, Yaounde, Cameroon, 13 - 15 March 2008* - The school was co-organized by the National Agency for IT Development, Government of Cameroon; University of Yaounde I; and UNU-IIST-EGOV. Around 70 participants attended the school, mostly government officials from various ministries and academics from different universities in Cameroon.
4. *12th UNeGov.net School on Electronic Governance - Foundation, Bishkek, Kyrgyzstan, 19, 22 - 23 May 2008* - The school was co-organized by the National IT Center, Kyrgyz Republic; e-Government Department in Prime Minister's Office, Kyrgyz Republic; UNDP Kyrgyzstan; and UNU-IIST-EGOV. Around 60 government IT managers from various ministries of Kyrgyz Government attended the school.
5. *13th UNeGov.net School on Electronic Governance - Leadership, Bishkek, Kyrgyzstan, 20 May 2008* - The school was co-organized by the National IT Center, Kyrgyz Republic; e-Government Department in Prime Minister's Office, Kyrgyz Republic; UNDP, Kyrgyzstan; and UNU-IIST-EGOV. The school was attended by 10 Cabinet Ministers, Members of Parliament and around 50 government officials including heads of government agencies from Kyrgyzstan.

6. *14th UNeGov.net School on Electronic Governance - Leadership, Bishkek, Kyrgyzstan, 21 May 2008* - The school was co-organized by the National IT Center, Kyrgyz Republic; e-Government Department in Prime Minister's Office, Kyrgyz Republic; UNDP, Kyrgyzstan; and UNU-IIST-EGOV. The school was attended by 10 Deputy Cabinet Ministers and around 70 government officials including heads of government agencies and staff of the Presidential Administration.
7. *13th UNeGov.net Workshop on Electronic Governance - Network-Building, Bishkek, Kyrgyzstan, 24 May 2008* - The workshop was co-organized by the National IT Center, Kyrgyz Republic; e-Government Department at Prime Minister's Office, Kyrgyz Republic; UNDP, Kyrgyzstan; and UNU-IIST-EGOV. The workshop was attended by around 100 participants from government, academia, industry, and non-governmental and international organizations in Kyrgyzstan. It produced a joint declaration drawing a vision for further development of Electronic Governance in Kyrgyzstan.
8. *14th UNeGov.net Workshop on Electronic Governance - Network-Building, Kabul, Afghanistan, 30 June 2008* - The workshop was co-organized by the Ministry of Communications and IT, Islamic Republic of Afghanistan (MCIT); ICT Institute, MCIT; and UNU-IIST-EGOV. The workshop was attended by around 80 participants from government, academia, industry, and non-governmental and international organizations in Afghanistan, and comprised several presentations by local speakers.
9. *15th UNeGov.net School on Electronic Governance - Foundation, Kabul, Afghanistan, 1 - 3 July 2008* - The school was co-organized by the Ministry of Communications and IT, Islamic Republic of Afghanistan (MCIT); ICT Institute, MCIT; and UNU-IIST-EGOV. The school was attended by around 80 participants from government, academia, industry and non-government organizations in Afghanistan.
10. *16th UNeGov.net School on Electronic Governance - Implementation, Bogota, Colombia, 28 - 30 August 2008* - The school was co-organized by the Observatory for Society, Government and Information Technology, Externado University of Colombia; Program Government Online, Ministry of Communication, Colombia; and UNU-IIST-EGOV.
11. *17th UNeGov.net School on Electronic Governance - Foundations, Santa Marta, Colombia, 1 - 3 September 2008* - The school was co-organized by the Observatory for Society, Government and Information Technology, Externado University of Colombia; Program Government Online, Ministry of Communication, Colombia; and UNU-IIST-EGOV.
12. *18th UNeGov.net School on Electronic Governance - Foundations, Cucuta, Colombia, 4 - 6 September 2008* - The school was co-organized by the Observatory for Society, Government and Information Technology, Externado University of Colombia; Program Government Online, Ministry of Communication, Colombia; and UNU-IIST-EGOV.
13. *15th UNeGov.net Workshop on Electronic Governance - Network-Building, Loja, Ecuador, 8 September 2008* - The workshop was co-organized by the Under-Secretary for Information Technology, Government of the Republic of Ecuador; Universidad Tecnica Particular de Loja; and UNU-IIST-EGOV.

14. *19th UNeGov.net School on Electronic Governance - Foundation, Loja, Ecuador, 9 - 11 September 2008* - The school was co-organized by the Under-Secretary for Information Technology, Government of the Republic of Ecuador; Universidad Tecnica Particular de Loja; and UNU-IIST-EGOV.
15. *20th UNeGov.net School on Electronic Governance - Implementation, Ulaanbaatar, Mongolia, 11 - 13 November 2008* - The school was co-organized by the ICT Authority, Government of Mongolia, and UNU-IIST-EGOV.
16. *16th UNeGov.net Workshop on Electronic Governance - Network-Building, Ulaanbaatar, Mongolia, 14 November 2008* - The workshop was co-organized by the ICT Authority, Government of Mongolia, and UNU-IIST-EGOV.

As a result of the interest raised by the schools and based on collaborations established with local co-organizers, the slides of the courses taught in the “UNeGov.net School on Electronic Governance - Foundation” were translated to: Russian by UNDP Kyrgyzstan, Spanish by the Observatory for Society, Government and Information Technology, Externado University of Colombia, and Arabic by the ICT Institute, Ministry of Communications and IT, Islamic Republic of Afghanistan.

Besides workshops and schools, the major event organized by the Center in 2008 was ICEGOV2008 - 2nd International Conference on Theory and Practice of Electronic Governance, Cairo, Egypt, 1-4 December 2008, [www.icegov.org](http://www.icegov.org). Taking place under the official patronage of the Ministry of State for Administrative Development, Government of Egypt, ICEGOV2008 is co-organized by UNU-IIST-EGOV and the German University in Cairo. Like last year, the conference brings together practitioners, developers and researchers from government, academia, industry and non-governmental organizations to share the latest findings in the theory and practice of Electronic Governance. By design, the conference creates ample opportunities for close interactions between these three categories of participants, so that each could benefit from the interaction with others.

In the tradition established by ICEGOV2007, ICEGOV2008 provided a rich networking and capacity building program comprising: (1) Three invited talks to present government, academia and non-government perspectives on Electronic Governance by distinguished experts and practitioners in the area; (2) 15 Invited Sessions by the institutions - governments, universities, companies and international organizations - to present their work related to Electronic Governance; (3) Six half-day “horizontal” tutorials covering a range of cross-cutting topics related to Electronic Governance - Theory, Technology, Information, Organization, Value and Policy; (4) Six half-day workshops with presentations of accepted papers and case studies on the same topics as horizontal tutorials; (5) Four “vertical” tutorials covering applications of Electronic Governance to various application domains - Education, Health, Environment, Transfer; (6) Nine discussions panels on: Post-Conflict Countries, Implementation Frameworks, Interoperability Frameworks, Rural Communities, Environmental Governance, Citizen Journalism, Dispute Resolution, Electronic Governance in Europe and Progress Assessment; (7) 12 sessions to present accepted papers and case studies; and (8) One poster session.

Regular paper sessions comprised presentations of the papers and case studies accepted for the conference. A total of 127 submissions were received from 46 countries: Afghanistan,

Algeria, Argentina, Australia, Austria, Bangladesh, Benin, Cameroon, Canada, China, Colombia, Czech Republic, Ethiopia, Germany, Ghana, Greece, Hong Kong, India, Iran, Italy, Japan, Kenya, Macao, Malaysia, Maldives, Mongolia, Morocco, Nepal, Netherlands, Nigeria, Oman, Pakistan, Palestine, Senegal, Singapore, South Africa, South Korea, Spain, Sri Lanka, Switzerland, Thailand, Taiwan, Turkey, UK, USA and Uzbekistan. Among 127 submissions, 80 papers originated from academia, 21 from government, 15 from industry, and 11 from non-governmental and international organizations. After the review process (3 reviews per paper - 2 academic and 1 non-academic) involving 72 experts and practitioners in the ICEGOV2008 Program Committee, 32 submissions were accepted as papers (8 pages), 35 as case studies (6 pages) and 16 as posters (2 pages). The proceedings of ICEGOV2008 were published by ACM Press in the International Conference Proceedings Series [27].

In addition to the events organized by UNeGov.net, 15 contributions were provided to the events organized by partner organizations:

1. *What Constitutes Excellence in Electronic Government Research? Or Defining Our Domain Ten Years Later, Hawaii, United States, 07 January 2008* - Co-organization of the Global Electronic Government Research and Practice Symposium at the 41st Hawaii International Conference on System Sciences (HICSS-41), along with the contributed panel presentation and discussion.
2. *Government-Academia Partnership to Advance Electronic Governance Research and Practice in Africa , Kampala, Uganda, 05 March 2008* - Invited talk at the “African E-Gov Forum 2008 - Utilizing ICT for More Efficient, Effective and Inclusive Governance”, organized by the Commonwealth Telecommunication Organization and the Ministry of Information and Communication Technology, Republic of Uganda.
3. *Electronic Governance at United Nations University and Programmable Messaging for Electronic Government, Albany, United States, 20 March 2008* - Two presentations and a discussion at the Center for Technology in Government, University at Albany, State University of New York.
4. *Electronic Governance and UN University - Connecting Research, Practice and Development, Tokyo, Japan, 24 March 2008* - Seminar presentation at UNU.
5. *Contributing to Global e-/m-Government Repository: UNU's Perspectives, Shanghai, China, 27 May 2008* - Presentation and panel discussion at the Capacity-Building Workshop on Back Office Management for e/m-Government in Asia-Pacific Region, organized by the United Nations Department of Economic and Social Affairs (UN-DESA) and the Regional Cooperation Office for City Informatization (RCOCI).
6. *Public Sector Innovation through Electronic Government, Amman, Jordan, 11 - 12 June 2008* - A half-day course taught as part of the Training Programme on Design and Evaluation of Innovation Policy in Developing Countries, organized by The Royal Scientific Society (RSS) of Jordan, the Jordan Innovation Centre for Engineers and Industrial Enterprises at RSS and the United Nations University - Maastricht Economic and Social Research and Training Center on Innovation and Technology (UNU-MERIT).

7. *Developing Electronic Governance Government-Academia Partnership Models, 26 September 2008* - Keynote lecture at the 1st Seoul Conference on Innovation Strategy Collaboration and Networking across Boundaries, Seoul, South Korea, organized by the Seoul National University.
8. *Building a Foundation for Sustainable Electronic Governance - Experience, Lessons, Framework, 24 October 2008* - Invited talk at the Asia e-Government Forum 2008, Seoul, South Korea, hosted by the Ministry of Public Administration and Security and the National Information Society Agency. Also moderated a panel discussion on Delivering Seamless e-Government Services at the conference.
9. *Building a Foundation for Sustainable Electronic Governance - Experience, Lessons, Framework, 6-7 November 2008* - Invited talk at the 3rd Conference on Global e-Governance, Waseda University, Tokyo, Japan. Also moderated a concluding session.
10. *Government, Citizens and Their Relationships in 2020 - Scenarios for the EU and the Developing World, 11-12 November 2008* - Invited talk at the EU-China Information Society Project Annual Conference 2008, Beijing, China, November 2008. Also co-moderated the workshop on Integrating Informatization and Industrialization.
11. *Electronic Governance at United Nations University - Theme, Implementation, Institution, 17 November 2008* - Invited talk at the Inter-University Institute of Macao.
12. *UNeGov.net - From Community Building To Capacity Development, 25 November 2008* - Presentation at the Strategic UNU Workshop on Innovative Capacity Development through E-learning with a Special Focus on Africa, Bonn, Germany.
13. *Increasing Trust in Public Service Delivery - Contract-Based Software Infrastructure for Electronic Government, 27-28 November 2008* - Invited talk at the 2nd Workshop on Formal Languages and Analysis of Contract-Oriented Software, Malta.
14. *Electronic Governance at United Nations University - Theme, Implementation, Institution, 18 December 2008* - Invited talk at e-Government Workshop, Japan Advanced Institute for Science and Technology, Kanazawa, Japan.
15. *Government, Citizens and Their Relationships in 2020 - Knowledge Society and UN Millennium Development Goals, 19 December 2008* - Invited talk at JEITA - Japan Electronic Industries Technical Association, Tokyo, Japan.

Finally, six UNeGov.net thematic areas were developed during 2008 through various projects: human capacity development, semantic interoperability, software infrastructure development, information technology governance for public administrations, e-readiness assessment and sustainability of Electronic Governance.

**Sources of funding** UNU-IIST plus individual partners contributions. Generally, UNU-IIST-EGOV covers the costs of international travel for its staff, while the host covers the remaining costs, perhaps through contributions from international organizations, e.g. logistics and translation for UNeGov.net schools in Bishkek covered by UNDP Kyrgyzstan. Individual partners are listed in the collaborations section below.

**Collaborations** Federal Capital Territory Administration, Abuja, Nigeria; National IT Development Agency, Federal Government of Nigeria; National Agency for IT Development,

Government of Cameroon; University of Yaounde I; National Information Technology Center, Kyrgyz Republic; e-Government Department at Prime Minister's Office, Kyrgyz Republic; United Nations Development Program, Kyrgyzstan; Ministry of Communications and IT, Islamic Republic of Afghanistan (MCIT); ICT Institute, MCIT; Observatory for Society, Government and Information Technology, Externado University of Colombia; Agenda for Connectivity, Government of Colombia; and Information and Communication Authority, Government of Mongolia.

**Collaborations** Government organizations collaborating with the Center on this project are: Afghanistan - Ministry of Communication and IT; Cameroon - National Agency for IT Development; Colombia - Program Government Online, Ministry of Communication; Kyrgyzstan - National IT Center and e-Government Department at Prime Minister's Office; Mongolia - Information and Communication Technology Authority; Nigeria - National IT Development Agency, Federal Government of Nigeria, and Federal Capital Territory Administration, Local Government of Abuja city. Academic organizations include: Cameroon - University of Yaounde I; Colombia - Universidad Externado de Colombia; Egypt - German University in Cairo; Korea - Information and Communications University. International organizations include: UN Department for Economic and Social Affairs, Division for Public Administration and Development Management; UN Development Program, Kyrgyzstan; UNU-MERIT.

**Assessment** Since its establishment in December 2005, the project has organized 39 events - 3 conferences, 15 workshops and 20 schools, in 15 countries, attended by over 2500 civil servants and academics from developing countries, many of them holding senior positions and decision making authority in their organizations. Through UNeGov.net events, the Center is consistently promoting the principle of applying technology as a tool, not an aim, to transform public organizations and their relationships with citizens, businesses, civil society and one another in order to create public value, realize specific development goals, and strengthen the value of government as a public asset. The events also highlighted the need to carry out various forms of applied research (comparative, policy, technical) to underpin the development of government programs in this area. The project has achieved its objectives during 2008 in terms of: the number of workshops and schools organized; the level and diversity of participation at such events; the number of new project partners including governments, universities and international organizations; and the geographical area covered.

## 2.4 Information Technology Governance for Public Administration

**Staff responsible** Adegboyega Ojo

**Project abstract** Strategic Information Technology Planning is essential for government institutions to effectively support their socio-economic and developmental objectives with Information Technology (IT). The alignment of IT strategies with public sector reform initiatives is equally required to transform and improve the internal workings of governments, how they deliver public services, and how they meet the needs of various stakehold-

ers. Developing and aligning IT strategies at various levels of governments (central, state, provincial and local) as well as across ministries, departments and agencies, is imperative for coherence of purpose and optimal use of public resources. However, the requisite capabilities for developing well-researched IT strategies which can concretely support Public Administration Reform through Electronic Government, are not readily available within public administrations in general. This is particularly problematic in low-income countries where scarce public resources must be used to address huge public needs.

By exploiting the experience and outcomes of the IT Master Plan development carried out for Macao Institute for Tourism Studies (education sector), Financial Affairs Bureau (financial sector) and Bureau of Telecommunication Regulation (communication sector), and international best practice frameworks for IT Governance and Strategic IT Planning, this project aims to develop a methodology and a set of toolkits to support strategic IT planning in public organizations in general. Specific objectives of the project include: (1) Developing a Strategic IT Planning Framework comprising an IT Planning Process and an IT Planning Toolkit to support the execution of the planning process both organizationally and technically; (2) Carrying out a number of strategic IT planning exercises with selected government agencies in Macao as part of the ongoing e-Macao Program; (3) Developing training manuals and training government officials in the application of the developed process and toolkit; and (4) Disseminating the IT Planning Framework to developing countries through the UNeGov.net initiative.

More information about this project can be found at <http://www.egov.iist.unu.edu/projects/planning>.

**Achievements, status and plans** The following results were achieved by the project in 2008:

- Strategic IT Planning - A strategic IT planning process for government organizations, with supporting toolkit and templates, has been developed and validated through IT strategy exercises in three pilot government agencies in Macao. An open-source software for managing and analyzing IT strategies across the whole of government has been developed. Policy recommendations on the practice of IT planning in the agencies of Macao SAR Government have been developed, based upon the developed processes and tools, and submitted to the government. Finally, a government-wide IT Strategy for Macao SAR has been developed.
- Alignment of Electronic Government and Public Administration Reform Programs - A generic procedure for determining the degree of alignment between Electronic Government and Public Administration Reform Programs has been developed. A procedure for aligning these two programs across major organizational and governance perspectives has been developed. The alignment procedure has been applied and validated through the Alignment Project of the e-Macao Program and already packaged into a toolkit. The strategic alignment tool is subject to ongoing development.
- Framework for Electronic Government Standards - A framework for establishing baseline Electronic Government standards, based on the Reference Model for Open Distributed Processing (RM-ODP) and established international good practices has been

developed. The framework was applied and validated through the Standards Project of the e-Macao Program.

All project deliverables have been completed. Over 50 personnel from various agencies of Macao SAR Government have been trained on the subject of IT Strategy Development and Strategic IT Alignment. They have also been trained on how to effectively use the developed IT Strategy Toolkit. Dissemination activities on the project will continue till June 2009. However, dissemination of project results to developing countries will continue beyond mid-2009.

**Sources of funding** The project is funded by the Government of Macao SAR through Macao Foundation, part of the e-Macao Program portfolio, and UNU-IIST.

**Collaborations** Twelve agencies of Macao SAR Government collaborate with UNU-IIST-EGOV on this project: DSAJ - Legal Services Bureau; DSC - Macao Post Office; DSF - Financial Services Bureau; DSFSM - Public Security Forces Affairs Bureau; DSRT - Bureau for Telecommunication Regulations; DSSOPT - Lands, Public Works and Transport Bureau; DST - Government Tourism Office; FSS - Social Security Fund; IACM - Civic and Municipal Affairs Bureau; IFT - Macao Institute for Tourism Studies; SAFFP - Public Administration and Civil Service Bureau; and SS - Health Services Bureau.

**Assessment** The project has achieved its objectives. Capacity of government agencies have been developed in the area of strategic IT planning. Concrete government-wide and agency-specific IT strategies are available for implementation. The project is technically completed.

## 2.5 Software for Electronic Government

**Staff responsible** Elsa Estevez

**Project abstract** This project aims to rigorously develop a production-quality software infrastructure comprising components, frameworks and services, to support the rapid development, deployment and execution of Electronic Public Services. Developed using open standards and open-source technologies, the infrastructure comprises five major elements: (1) Front Office Framework, (2) Back Office Framework, (3) Workflow Service, (4) Messaging Service and (5) Infrastructure Management Service.

Due to the complexity and size of the project, a staged development has been adopted, beginning with the development of the Messaging Service through the so-called Message Gateway in 2007. The Gateway enables the exchange of information and documents among government agencies, and in general facilitates collaboration between them, including the provision of organizational and semantic support to such collaborations.

More information about this project can be found at <http://www.egov.iist.unu.edu/projects/infrastructure>.

**Achievements, status and plans** The project achieved a number of results in 2008. First, the implementation of the Message Gateway was completed. In addition to basic communication services, the Gateway implements a set of enhanced messaging services: logging, validation, transformation, encryption and decryption of messages, as well as three semantic services provisioned by the SIM (Semantic Interoperability Middleware) project - validation, mediation and discovery. Second, two sets of Application Programming Interfaces (APIs) were identified and implemented to invoke the services of the Gateway from legacy applications. Third, two web-based client applications were developed to facilitate the use of the Gateway - one to manage the resources used by the Gateway and another to invoke its messaging services. Fourth, two software applications were built to demonstrate the applicability of the Gateway - one to make appointments with agencies and another to manage customers queuing for services.

The deliverables produced by the project in 2008 were: (1) production-quality source and binary code of the Gateway including five enhanced and three semantic services; (2) quality assurance report for the Gateway; (3) two set of APIs to invoke the services of the Gateway from the applications developed in Delphi and from the command line; (4) new release of the encryption/decryption extension using certificates issued by Macao Post Office; (5) technical report on enhanced services and new APIs for the Gateway; (6) source and binary code for the e-Appointment service developed using the Gateway; (7) development report for the e-Appointment Service; (8) user manual for the e-Appointment Service; (9) source and binary code for the e-Queuing Service built using the Gateway; (10) development report for the e-Queuing Service; and (11) user manual for the e-Queuing Service.

The results of the project were disseminated through e-Macao Technical Committee Meetings, project website and UNeGov.net events.

**Sources of funding** The project is funded by the Government of Macao SAR through Macao Foundation, part of the e-Macao Program portfolio, and UNU-IIST.

**Collaborations** Two agencies of Macao SAR Government collaborate with UNU-IIST-EGOV on this project: DSC - Macao Post Office, and SAFFP - Public Administration and Civil Service Bureau.

**Assessment** The project achieved its objectives for 2008. A major infrastructure component (Gateway), two web-based client applications, and two infrastructure services were delivered, all with technical, user and quality assurance (Gateway) documentation.

## 2.6 Knowledge Management for Electronic Government

**Staff responsible** Zamira Dzhusupova

**Project abstract** Knowledge Management (KM) is a critical tool for innovation and transformation of public administrations, aimed at building trust in government. It enables the use of relevant knowledge assets for decision making, strategic planning and public service

delivery in government. The main goals of KM for Electronic Government is organizing and making various knowledge resources related to e-Government available to public managers, and providing them with appropriate tools to utilize such knowledge.

This project aims at developing a KM platform for managing knowledge on e-Government capabilities, creating a knowledge base to store the information on Electronic Government readiness, and providing a mechanism for the agencies to update such information incrementally online. The project also aims at defining exploitation scenarios for different stakeholders to use the knowledge base, and developing APIs for other government applications to access the knowledge base according to such scenarios.

More information about this project can be found at <http://www.egov.iist.unu.edu/projects/knowledgemanagement>.

**Achievements, status and plans** The project carried out research, development, capacity building and dissemination activities in 2008 as follows: (1) Study of conceptual frameworks for KM system in the e-Government domain; (2) Review of international best practices on KM for e-Government, including the initiatives from UN, World Bank, OECD and EU, and national KM practices from USA, UK, Australia, South Korea and Singapore; (3) Analysis of the lessons learnt, experiences and challenges in KM for e-Government by different countries; (4) Development of the requirements and models for KM systems to capture e-Government capabilities; (5) Creation of the Knowledge Base (KB) on the basis of the e-readiness assessment; (6) Development of a web-based application implementing a KM system for e-Government, including modules for knowledge capture, update, analysis, reporting, questionnaire and administration; (7) Describing the functionality of the KM system; (8) Developing guidelines for users; (9) Defining exploitation scenarios on using the KB; (10) Presenting the findings at the workshop on UN Global Electronic/Mobile Government Repository; (11) Including project results in the training course on e-Government for Transformation, presented at the Strategy School for Macao SAR Government in 2009; (12) Disseminating project results through e-Macao Technical Committee Meetings and the project website. APIs for client applications, including knowledge capture from other sources and knowledge retrieval from other government applications, are under development and will be deployed in the first quarter of 2009.

The deliverables produced through the activities above are: (1) The report on Knowledge Management System findings and description of technical solution, its functionality and exploitation scenarios; (2) Software prototype for web-based KM system, including modules for knowledge update, analysis, reporting, questionnaire and administration; (3) Knowledge Base, a repository of e-readiness data deployed on the KM platform to capture e-Government capabilities; (4) User Manual, a guide for users to update information in the Knowledge Base, use analytical, reporting and system administration tools, and apply questionnaires.

**Sources of funding** The project is funded by the Government of Macao SAR through Macao Foundation, part of the e-Macao Program portfolio, and UNU-IIST.

**Collaborations** UNDESA - UN Department of Economic and Social Affairs, and SAF - Public Administration and Civil Service Bureau.

**Assessment** The project started in the second half of 2008.

## 2.7 Semantic Interoperability for Electronic Government

**Staff responsible** Adegboyega Ojo

**Project abstract** Interoperability remains one of the most critical factors in enabling communication and collaboration within government and between government and its major stakeholders - citizens, businesses, intermediaries and suppliers. Beyond achieving physical connectivity between heterogeneous ICT systems in government (technical interoperability), full interoperability must enable the execution of cross-agency processes to deliver seamless services (organizational interoperability), while ensuring that different systems involved in such processes share the semantics of information exchanged (semantic interoperability). In addition, full interoperability must support the widest possible access to information and capabilities available through the government ICT eco-system, particularly with respect to citizens and businesses.

The Semantic Interoperability for Electronic Government Project (SIEG) aims to provide a better understanding of the semantic interoperability problems in the government context, and to offer a generic approach and a concrete solution to address such problems. The project established a set of generic semantic interoperability requirements for Electronic Government (independent of any specific national or international context) and presented a reference architecture (Semantic Interoperability Framework - SIF) to guide collaborating organizations in developing the necessary capabilities to address these requirements. In addition, SIEG developed a concrete technical solution (Semantic Interoperability Middleware - SIM) to resolve semantic conflicts arising in the delivery of seamless Electronic Public Services. SIM offers three basic services to higher-level applications: validation, mediation and discovery. For the purpose of dissemination, the project developed two training modules aiming to provide public managers with the basic understanding of semantic interoperability, and the ability to use SIM for service delivery or data sharing in the context of any public administration.

More information about the project can be found at <http://www.egov.iist.unu.edu/projects/interoperability>.

**Achievements, status and plans** The project has produced the following results, documented as project deliverables:

- State-of-the-art Survey Report - A detailed study of the state of practice and state-of-the-art in semantic interoperability, particularly for Electronic Government, documented in a report.
- Semantic Interoperability Requirements - A set of generic semantic interoperability requirements for Electronic Government, spanning interoperability scenarios within a single and between two or more administrations involving government agencies, government customers, intermediaries and suppliers. The requirements draw upon various national and transnational experiences captured in the Survey.

- Semantic Interoperability Framework (SIF) - A pair of reference architectures, one addressing policy and governance, and another addressing organizational and technical requirements for semantic interoperability in the government domain.
- Semantic Interoperability Middleware (SIM)- A generic, platform-independent semantic gateway that resolves semantic differences in the information exchanged between major actors in the government domain - agencies, citizens, businesses, suppliers, intermediaries, etc. The gateway relies on the information and semantic resources - dictionaries, thesauri, taxonomies, mapping tables, ontologies, etc. provided through a Central Registry (Clearinghouse) or maintained locally by individual agencies. The SIM provides three services to deliver semantic support to any message exchange infrastructure, service delivery, or government capability in general: semantic validation of messages, semantic mediation of messages, and semantic discovery of resources. The implementation of SIM was provided on Java and .NET platforms, with respective APIs provided to develop client applications able to access these services.
- Online Demo Application - Three example applications, all based on the delivery of social welfare services, have been developed to demonstrate the applicability of the three semantic services offered by SIM. These applications are accessible online.
- Integration of SIM and G-EEG - The SIM was successfully integrated with the Government-Enterprise Ecosystem Gateway (G-EEG), a programmable messaging gateway developed by the Center to address technical and organizational requirements for government-to-government information exchange. The SIM-to-G-EEG integration was implemented through the extension facility natively supported by G-EEG.
- Semantic Interoperability Courseware - Two training modules were developed: the first introduces public managers to the interoperability problem domain, with emphasis on semantic interoperability for Electronic Government, the second explains SIM as a solution to technical and organizational interoperability, and how to customize the framework to specific contexts. This course is packaged as Open Courseware, to be accessible through the UNU Open Courseware portal.

**Sources of funding** The project is funded by Microsoft Corporation (50,000 USD for 2007 and partly 2008) and UNU-IIST.

**Collaborations** Microsoft

**Assessment** All projects deliverables have been successfully completed. Possible continuation of the project is being investigated.

## 2.8 Developing OpenCourseware for the United Nations University

**Staff responsible** Rilwan Basanya

**Project abstract** The UNU OpenCourseWare (UNU-OCW) Project promotes the development, use and distribution of OpenCourseWare (OCW) and related free and open educational resources throughout UNU and in developing countries. It also carries out research

and development on advanced software tools for OCW. This project is carried out in the context of the ongoing UNU OpenCourseware Project involving other Research and Training Centers and Programmes (RTC/Ps) of the university, and aligned with the overall objectives of the OpenCourseware Consortium (OCWC) where UNU is a member.

The objectives of the project are: (1) Setting up a UNU-OCW portal; (2) Developing courses to be hosted on the portal and made available under the Creative Commons License for use and adaptation by educators and learners; (3) Increasing the awareness of OCW and its benefits to RTC/Ps beyond the initial participants of the project; (4) Creating a network of UNU staff willing and capable of adding new courses to the UNU-OCW portal; (5) Institutionalizing the development of courses by RTC/Ps; (6) Increasing the number of project partners; (7) Supporting UNU's e-learning activities; (8) Strengthening course development as part of twinning and collaboration within UNU and with non-UNU partners; and (9) Laying the groundwork for UNU-OCW sustainability.

More information about this project can be found at <http://www.egov.iist.unu.edu/index.php?cegov/projects/open-courseware>.

**Achievements, status and plans** In early 2008, Phase I of the project was completed with the successful launch of the UNU OpenCourseWare portal at <http://ocw.unu.edu>. The portal currently hosts 14 courses published on a variety of topics covering a range of expertise present within UNU. These include six courses on Software Technology and Electronic Governance published by UNU-IIST-EGOV: (1) Introduction to Electronic Government; (2) Strategic Planning for Electronic Government; (3) Structures and Processes for Implementing and Operating Electronic Government; (4) Workflow and Business Process Management for Electronic Government; (5) Building a Community of Practice for Electronic Government; and (6) Ontology, Semantic Web and Electronic Government. Other project partners contributed the remaining eight courses. All courses published by UNU-IIST-EGOV were adopted by the Online Training Center of the United Nations Public Administration Network (UNPAN), an internet-based network maintained by the UN Department of Economic and Social Affairs that links regional and national institutions devoted to public administration to promote the sharing of knowledge, experiences and best practices. The courses are available on the UNPAN portal at <http://www.unpan.org/ELearning/OnlineTrainingCentre/tabid/88/language/en-US/Default.aspx>.

Review and enhancement to existing courses, and publication of new Software Technology and Electronic Governance courses are expected to be achieved as part of Phase II, to last until 2009. Other activities of Phase II of the project include: (i) Linking OCW to Adaptation and Training by identifying partners to offer additional training programmes based on UNU course materials; (ii) Design of an evaluation framework to monitor the use and production of UNU-OCW; (iii) Creating a "starter-kit" to make it easier for RTC/Ps to join the project; and (iv) Review of the current practices in light of the efforts towards OCW standardization within the Open Courseware Consortium, and developing institutional best practices.

**Sources of funding** The project is funded by the contribution from the UNU Joint Activities Fund - 18,000USD (covering 2007), and UNU-IIST.

**Collaborations** Phase I of the project was carried out in collaboration with other RTC/Ps: UNU Online Learning (part of the UNU Center), UNU-MERIT and UNU-INWEH. We expect collaboration with other RTC/Ps in Phase II scheduled for 2008-2009.

**Assessment** The project has achieved its objectives.

## 2.9 Wildlife Enforcement Monitoring System - WEMS

**Staff responsible** Remi Chandran

**Project abstract** Wildlife Enforcement Monitoring System (WEMS) project promotes an environmental governance model for monitoring enforcement and compliance with the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) through a joint effort carried out by United Nations bodies, national governments, industries, civil society and research institutions.

This is planned to be achieved by building a common data collection and reporting mechanism at a national level. Currently, the reporting process regarding the compliance to the CITES convention is incomplete, one of the prime reason being insufficient sharing and submission of information from the parties to the convention. The project plans to address this by bringing together various national institutions to a common information sharing platform, and thereby building a Government to Government (G2G) Information Technology infrastructure for the states to manage knowledge on the trends and threat assessment concerning wildlife crime. The project also brings together various agencies (Customs, Police, Forests) within national governments to enhance collection and information sharing on environmental crime. The project is developed in line with the Bali Strategic Plan for Technology Support and Capacity Development, formulated by the United Nations Environment Programme.

The project plans to produce various outputs: (1) The web-based database system to collect and analyze electronic Eco-Messages; (2) The wildlife trafficking atlas, produced annually, to visualize the regions and trends of seizure; (3) Data clock – electronic calendar recording the months of seizure; (4) WEMS-IMAP - the GIS-based map used for sharing information between different agencies; and (5) Tracking Routes - simulation models describing the tracking of transboundary trafficking.

For detailed description, please visit <http://www.egov.iist.unu.edu/cegov/projects/wems>.

**Achievements, status and plans** The results produced by the project in 2008 include: (1) A paper on WEMS presented during the Yale-UNITAR conference on Environmental Governance and Democracy, Yale Law School, New Haven, United States, May 2008 [22]; (2) Software for collecting, analyzing and visualizing data about cases of wildlife crime; (3) Endorsement by the Government of India for implementing WEMS at the national level. A decision on the matter was conveyed during a meeting between the officials from the Ministry of Environment and Forests (MOEF) and UNU-IIST-EGOV in March 2008. Subsequently, the project has been approved by the cabinet of the Government of India and is now awaiting the national-level implementation process.

WEMS was also presented at the ASEAN Programme Coordinating unit (PCU) meeting in October 2008 and to the United States Department of Interior, in the presence of officials from the US State Department, US Law Enforcement, World Bank and ESRI, in December 2008.

The main objective for the next stage of WEMS is the implementation of the project in India, in collaboration with the Wildlife Institute of India and the Ministry of Environment and Forests, with UNU-IIST-EGOV providing training on IT strategy and implementation.

**Sources of funding** The project is funded by the International Fund for Animal Welfare (30,000USD, covering 2007 and partly 2008), ESRI (in kind contribution), and UNU-IIST.

**Collaborations** The collaborators of WEMS include: (1) Ministry of Environment and Forests, Government of India; (2) Environmental System Research Institute (ESRI), United States; and (3) International Fund for Animal Welfare (IFAW), United States. New collaboration opportunities are explored.

**Assessment** The project fulfilled its objectives for 2008.

## 2.10 Capacity Building for Software Technology and Electronic Governance

**Staff responsible** Tomasz Janowski and Antonio Cerone

**Project abstract** This project aims to build human capacity for developing countries in the area of Software Technology and Electronic Governance. This aim will be realized by conducting activities in three areas: (1) Building and maintaining a software infrastructure for e-learning, including online repository of learning materials; (2) Development of OpenCourseware - OCW and Open Educational Resources - OER to be deployed on this infrastructure; and (3) Development of a fellowship program for government officials and academics from developing countries involved in Electronic Governance initiatives. Specifically, the project will extend the completed project on Research in the UN, a prototype project to build an online repository of UN-originating research materials, as a basis for developing the first activity area. In collaboration with others RTC/Ps, the project will also aim to produce a set of OpenCourseWare to be published on the developed e-learning infrastructure. Using the contents and infrastructure developed through the first two activity areas, the project will help develop required Electronic Governance skills among invited government officials and partner organizations.

**Achievements, status and plans** The activities carried out in 2008 include:

- Visiting the Open University, Milton Keynes, UK. The aim of the visit is to explore ways to put into practice the existing collaboration, to establish the terms and modalities in using and customizing Open University's tools and e-learning resources, and to benefit from its experience in distance learning.
- Hosting a visiting academic expert in e-learning technologies from the Open University, Milton Keynes, UK.

- Presenting project results in the conferences on e-learning and human-computer interactions.

Other activities planned for 2008 include: (1) Revision of the available courses for possible delivery over the e-learning platform; (2) Identifying an appropriate open licensing framework, e.g. Creative Commons, and packaging the revised courses as OpenCourseWare; (3) Establishing procedures, guidelines and tools for developing further courses; (4) Deploying courses on the developed e-learning platform; (5) Provision of customized training programs to government fellows at UNU-IIST once the platform and the contents have been produced; (6) Definition of the supervision activities for distance fellowship to be implemented on the platform; (7) Design of an off-shore government fellowship program which utilizes the e-learning platform to train government fellows in particular.

**Sources of funding** The project is funded by Macao Foundation and UNU-IIST.

**Collaborations** This project is a collaboration between the UNU-IIST Center for Electronic Governance and the “Research in the UN” project team. Other RTC/Ps are expected to contribute to the development of OpenCourseWare. More external members are expected to join the project as it progresses.

**Assessment** The project started in 2008.

## 2.11 Development of Computer Science Departments in Developing Countries

**Staff responsible** Adegboyega Ojo

**Project abstract** This project aims to strengthen all aspects of Computer Science teaching in universities in developing countries. Under the project, UNU-IIST arranges for Computer Science lecturers or professors from universities in developing countries to visit partner universities in industrialized countries for one semester as Fellows. During such visits, Fellows work to update their curricula and develop new courses. At the end of fellowships, they are expected to return to their home departments and use the knowledge gained, together with the course materials, as a basis for improving or updating existing courses or introducing new courses into the teaching curricula of their university. Host institutions provide Fellows with free-of-charge access to their facilities, and also waive tuition fees. Besides supporting Fellows, UNU-IIST provides recommended textbooks for the courses studied, which become the property of the Fellows’ departments after the fellowships.

**Achievements, status and plans** In 2008, 4 lecturers from 3 universities in 3 developing countries have been trained under the project. See Appendix A for the list of the UDP Fellows in 2008.

**Sources of funding** UNU-IIST and partner institutions in industrialized countries.

**Partner Institutions in Developing Countries** To date, 35 institutions in developing countries have benefited from this project. They are:

- Mongolian Technical University, Ulaanbaatar, Mongolia
- National University of Mongolia, Ulaanbaatar, Mongolia
- University of Natural Sciences, Ho Chi Minh City, Vietnam
- Hanoi University of Telecommunication and Transport, Vietnam
- University of Technology, Ho Chi Minh City, Vietnam
- University of Natural Sciences, Vietnam National University, Hanoi, Vietnam
- Hanoi University of Technology, Hanoi, Vietnam
- Posts and Telecommunications Institute of Technology, Ha Tay, Vietnam
- University of Dschang, Cameroon
- University of Yaounde I, Yaounde, Cameroon
- University of Buea, Buea, Cameroon
- University of Lagos, Lagos, Nigeria
- University of Ibadan, Ibadan, Nigeria
- Chittagong University, Bangladesh
- Obafemi Awolowo University, Ile-Ife, Nigeria
- Kathmandu University, Nepal
- Gui Zhou University, Gui Yang, China
- Wuhan University of Technology, Wuhan, China
- Xian University of Post and Telecommunications, Xian, China
- Nanjing University, Nanjing, China
- East China Normal University, China
- Northwest University, Xian, China
- National University of Laos, Laos
- Nong Lam University, HoChiMinh City, Vietnam
- Technological University of Tajikistan, Dushanbe, Tajikistan
- University Of Agriculture, Abeokuta, Nigeria
- University of Zimbabwe, Harare, Zimbabwe
- University of Catamarca, Argentina
- University of Science and Technology, Chittagong, Bangladesh
- Quaid-i-Azam University, Islamabad, Pakistan
- South-West China University, ChongQing, China
- Thai Nguyen University, Thai Nguyen, Vietnam
- Universidad San Pablo, Arequipa, Peru
- Hanoi University of Transport and Communication, Hanoi, Vietnam
- Hue University of Sciences, Hue City, Vietnam

- San Pablo Catholic University, Arequipa, Peru
- Federal University of Technology, Akure, Nigeria

**Partner Institutions in Industrialized Countries** 11 institutions have been involved in training lecturers from developing countries as part of this project. They are:

- Queens University, Belfast, UK
- University of Leicester, UK
- University of Oxford, UK
- University of Queensland, Brisbane, Australia
- University of Toronto, Canada
- University of York, UK
- University of Calgary, Calgary, Canada
- Swinburne University of Technology, Australia
- South Bank University, London, UK
- National University of Singapore, Singapore
- Kwangju Institute of Science and Technology, South Korea
- Eindhoven University of Technology, Netherlands
- De Montfort University, Leicester, UK
- Ball State University, USA
- Bond University, Australia

The National University of Singapore and Ball State University hosted the Fellows in 2008.

**Assessment** Two UDP fellows have successfully completed their fellowships, with very positive feedback from the fellows and the host. One concrete initiative (Book project) has resulted from the fellowship scheme in 2008.

## 2.12 CREDO: Evolutionary Structures for Distributed Services

**Staff responsible** Bernhard K. Aichernig (Associate Research Fellow)

**Project abstract** CREDO (<http://www.cwi.nl/projects/credo/>) is an EU-funded project on “Modeling and analysis of evolutionary structures for distributed services”. It has been accepted within the fifth call of the 6th Framework Program - Priority 2 “Information Society Technologies”, activity IST-2005-2.5.5- Software and Services. Total EU funding is Euro 2 786 000. It started September 1, 2006, and it will last for 36 months. CWI, the Netherlands, is the coordinator of the project involving 9 partners.

UNU-IIST's funding is Euro 200 000 over 3 years, which is funding the PhD-student Rudolf Schlatte and the post-doctoral researcher Andreas Griesmayer, who collaborate in particular with our Associate Research Fellow Dr. Bernhard Aichernig at the Graz University of Technology, Austria.

The objective of this project is the development and application of an integrated suite of tools for compositional modeling, testing, and validation of software for evolving networks of dynamically reconfigurable components. The group at UNU-IIST in particular is concerned with the development and implementation of methods to test models as well as implementations of concurrent systems.

**Achievements, status and plans** The CREDO development process comprises several layers of abstraction. While the most abstract automata models can be model checked, several applications of testing were identified for the more sophisticated executable models in Creol: (1) improvement of the model, (2) test case generation for the implementation, and (3) test case execution on the implementation. The theory of these topics was researched in 2008 and presented in two conference papers [28, 29], further publications and implementations of tools are work in progress.

**Improvement of the model:** given a higher level specification (like pre-/postconditions and assertions in the model), the model can be tested for compliance with this specification. Special attention has to be given to different interleavings of execution, which is inherent to concurrent systems.

An approach to generate test cases for components with application specific schedulers was published in [28]. The paper shows a method to define schedulers that account for the environment in which the component under test will be used, thus checking only paths that are possible in the specific application. This allows to remove false negatives during testing and to improve the accuracy of the generated test suite.

**Test case generation from the model:** Once the quality of the model is satisfactory, the goal of the development process is to create an implementation that conforms with it. Full verification (e.g. by using model checkers) usually is only feasible for relative simple properties, conformance with a detailed Creol-model is not practical. An approach was developed and implemented to perform dynamic symbolic execution on a Creol model. This results in a formal description of the input parameters that can perform a given path in the system. Systematic test case generation allows to select new test cases that perform new runs in the model, thus optimizing the achieved coverage while avoiding redundant test cases.

**Test conformance between implementation and model:** Standard testing theories like IOCO are not satisfactory in the setting of asynchronous systems like Creol-models, because they require a synchronization of implementation and test driver. A new method for testing asynchronous systems was presented in [29]. Rather than a fixed test-graph that gives the sequence of inputs and outputs of the test run, implementation and model are augmented with events and stimulated by input actions according to the test case. The reaction of the implementation is recorded and simulated in the model. Only if the same sequence of events is possible in the model, is the run valid in the implementation.

The theories for the before mentioned applications were combined to a testing theory for CREDO, which was published in form of a project Deliverable to the European Union. Further ongoing work is done for the implementation of test case generators in the setting of CREOL.

In addition, the foundational work on integrating a predicative testing theory of mutation testing into Unifying Theories of Programming (UTP) has been published [30].

**Sources of funding** The Project is funded by the European Union under contract IST-33826.

**Assessment** As European Union project, the project is subject to continuous assessment by reviewers. Regular progress reports as well as deliverables are submitted. In September '08 a deliverable with UNU-IIST as main author concerning a testing theory for CREDO was submitted. The next Deliverable with UNU-IIST as main author will concern a the implementation of a test case generator (March '09).

**Collaborations** Project partners within CREDO:

- Centrum voor Wiskunde en Informatica (CWI), Netherlands
- Universitetet I Oslo (UIO), Norway
- Christian-Albrechts-Universität zu Kiel (UNI-Kiel), Germany
- Technische Universität Dresden (TU Dresden), Germany
- Uppsala Universitet, Sweden
- Almende, Netherlands
- Rikshospitalet - Radiumhospitalet HF, Norway
- Norsk Regnesentral, Norway

Further collaborations are maintained with the testing group at the Institute for Software Technology at TU-Graz and the project “Formal Modeling and Analysis of Complex Systems” at UNU-IIST.

## 2.13 An incremental approach to information systems

**Staff responsible** J W Sanders, UNU-IIST.

**Project abstract** The purpose of this research is to expand the established approach of Formal Methods to produce incremental methods for specifying, designing, implementing and analysing information systems. Examples of target system behaviour are: distribution and action refinement, object-orientation (OO), probabilism, reconfigurability, testability, asynchronicity, quantum computation, security and complex systems. The approach is to build complex behaviour level-by-level (which might be viewed as being ‘orthogonal’ to module-by-module, which we take for granted), both for systems and for the theories used to construct and analyse them. To link the various levels, Galois connections are used that preserve specification and programming combinators (and so relate laws of behaviour)

to link levels of abstraction. However a single incremental (meta) discipline is to be followed. The planned outcome is progress in semantic models and laws for reasoning about systems like those mentioned above, as well as a general framework for incremental system development.

**Achievement, status and plans** The project has benefited by visits from Song (Nanjing) and postdoc Zuliani (Oxford) in quantum computing, Weber (Carneq, Berlin) in embedded systems, Krisnan (Bond) in testing of web services, Chen (Durham) in probability and OO, Ding (Zhejiang) in testing and continuous methods, and Zhu (Shanghai).

One postdoc is working on the PEARL project (PEARL: Process Expansion and Action Refinement in the Large, funded by the Macao Science and Technology Development Fund; held jointly with Wang Xu and Xu Qiwen of the University of Macao), but the second, UNU-IIST-funded postdoc has been curtailed due to the 25% cut in Research Fellows' budgets, one fellow is working on web services, and one on probabilistic systems.

In 2008 6 papers were written (all available as UNU-IIST Technical Reports). Seminars have been presented in: Cape Town, Tehran, Macao, London, Malaysia, Hangzhou, Cannes and Illinois. Particular progress has been made on application of the incremental method to the engineering of adaptive multiagent systems and systems exhibiting stochastic behaviour.

Sanders has been awarded an Honorary Visiting Professorship by Zhejiang Sci-Tech University, held a visiting Professorship at UKM and continued joint collaboration with them including PhD supervision, been appointed international domain expert as consultant for the EU ATEST2 project, acted as reviewer for Malta's second national science grant exercise, organised the first UNU-IIST research day, and continued collaboration with AIMS and AMI-Net across Africa.

**Sources of funding** UNU-IIST, MSTDF and almost every external organisation involved in the above.

## 2.14 Formal Modelling and Analysis of Complex Systems

**Staff responsible** Antonio Cerone

**Project abstract** This project is based on the use of formal methodologies for the modelling and analysis of complex systems, which may involve one or more of the following components: software, hardware, humans, groupware and bioware.

The projects exploits existing modelling methodologies, based on transition systems, process calculi and rewrite systems, and analysis tools based on model-checking. The analysis involves both qualitative and quantitative aspects of systems and also aims at the integration between model-checking and theorem-proving methodologies. Particular emphasis is given to the concept of interaction, which may involve software/hardware and humans/groupware (interactive systems), or individual molecules or cells in biological systems. In fact, interaction causes the emergence of system behaviours that affect the evolution, safety and security of the overall system.

**Achievements, status and plans** The first year of the project has been devoted to the exploration of alternative approaches to the modelling and analysis of complex systems.

The MAUDE rewrite system has been used to model interactive systems and biological systems, which have then been analysed using MAUDE model-checking tools. In particular, a real-time extension of MAUDE has been used for the stochastic analysis of biological systems by adapting the Gillespie algorithm.

Infinite state transition systems have been used to model recoverability aspects in human-computer interaction. Recoverability properties have been specified using logical patterns and analysed using several tools: refinement checking of an abstract finite version of the model has been carried out using FDR, bounded model-checking using SAL and, for those properties for which the reduction to a finite system is not appropriate, theorem proving has been used.

The work has been carried out together with Paddy Krishnan, Bond University, who is UNU-IIST Associate Research Fellow, Shaikh Ahmed Siraj, Cranfield University, who was Postdoc at UNU-IIST until September 2007, Thomas Anung Basuki, UNU-IIST PhD Student within the joint Programme with the University of Pisa, Andreas Griesmayer, UNU-IIST Postdoc within the CREDO project, Rudolf Schlatte, PhD student within the CREDO project, Rafael Viana de Carvalho, UNU-IIST Fellow, and Paolo Milazzo, University of Pisa.

In total 1 journal paper has been published, 1 book chapter accepted, 3 papers have been presented at international workshops, and 2 workshop proceedings, 1 conference proceedings, one journal special issue and one journal special section have been edited in 2008. Courses that contributed to disseminate the achievement of the project have been presented in Bangkok, Thailand, and Cape Town, South Africa.

The second year of the project will aim at the integration of the different techniques explored during the first year within an overall methodology that allows users to

- use as much as possible high level logical patterns to specify properties;
- select the most appropriate tool for the property under analysis;
- have visual representations (possibly 3D) of the analysis result.

**Sources of funding** UNU-IIST.

**Collaborations** Bond University, Gold Coast, Australia;

University of Queensland, Brisbane, Australia;

University of Pisa, Italy;

Queen Mary University London, UK;

Cranfield University, UK;

University of Minho, Portugal

University of Oslo, Norway.

**Assessment** The project has successfully progressed towards the objectives mentioned in the Project Proposal, in particular regarding to:

- quantitative analysis using real-time and probabilistic model-checking;

- integration between model-checking and theorem-proving methodologies.

Many collaborations have been started within the project and have contributed to the success of publications and organisation of events.

A number of publication and the teaching of courses have provided dissemination of the outcomes of the project.

## 2.15 Formal methods tools and applications

**Staff responsible** Chris George

**Project abstract** This project (a) maintains and extends the tools for the RAISE formal method and (b) uses RAISE on application projects by fellows.

**Achievements, status and plans** Activities in 2008 centred around model checking.

**SAL** The SAL model checker lacked a user guide. This was written by Ana Garis from Argentina, who was a visitor at UNU-IIST from September 2007 to July 2008.

**FDR** The SAL translator supports the model checking of applicative sequential RSL descriptions. A capacity to model check concurrent descriptions was needed, and this has now been completed by two fellows from Peru, plus some assistance from Ana Garis:

1. A translator from RSL to  $CSP_M$ , which can be input into the FDR tool, was written by Lizeth Tapia and integrated into the RSL tools. This is reported in the technical report [31]. At the same time:
2. A justification of the translation strategy was written by Abigail Parisaca Vargas [32]. She demonstrates that there is a (strong) bismulation between the RSL and translated CSP, and also that this means that properties of the translated CSP expressed in terms of traces, refusals and divergencies are properties of the original RSL, and hence that the translation to CSP and use of FDR to prove properties is sound. A paper based on Lizeth and Abigail's work has been published [33].
3. The translation to CSP and use of FDR only allows properties expressible as refinements to be proved. An extension to allow properties expressed in Linear Temporal Logic (LTL), based on the use of testing processes similar to Büchi automata, was produced by Abigail and Ana Garis.

**Sources of funding** UNU-IIST

**Assessment** The work by the two fellows from Peru was roughly the level of an MSc, which neither of them has. The work at UNU-IIST allowed Lizeth Tapia to take up a lecturing position at her university on her return: Abigail Vargas already had such a position.

The method of translating LTL formulae into testing processes was described previously in work by Leuschel, Massart and Currie [34].

## 2.16 Open Source Software for Environmental and Health Management

**Staff responsible** Chris George

**Project abstract** This project currently has two main components: water resource management and health management.

**Water Resource Management: WaterBase** Environmental modelling to support water management has a proven success record but is very expensive: so expensive that it cannot be afforded in most places in developing countries. At the same time watersheds, rivers and lakes are under increasing stress from growing populations, industries, and agriculture which both consume water and pollute water resources. The aim of the *WaterBase* project is to create a generic model of water resources together with a decision support system intended for use in developing countries that is cheap to instantiate while being effective in operation. The system will support the modelling of existing situations as well as the generation and comparison of results for possible alternative scenarios. Thus it will support such activities as development planning, the exploration of ways to counteract environmental degradation, and the mitigation of events such as global warming, storms, or polluting accidents.

The system will be free, open source, and instantiable using GIS data freely available on the internet.

**Health Management** Hospitals and other health care organisations have a considerable need for computerised systems. They have particularly strong requirements for data integrity and security. There are commercial systems available, but at costs that are prohibitive for most developing countries. UNU-IIST is starting to work with UNU-IIGH on providing open source systems for use in health care.

Open source software is being recognized as a highly beneficial approach to these and other areas. The reasons are not merely economic, strong as the cost justification would be on its own. Open source software is recognised as being very reliable: security through openness is much stronger than security through secrecy. The software can be easily localised, and the many collaborators, extending and sharing each others' output, can produce far more than the instigators alone.

**Achievements, status and plans** At the end of 2007 the first WaterBase product MWSWAT was published on the WaterBase website <http://www.waterbase.org>. MWSWAT is a tool built on top of the open source GIS system MapWindow and uses the hydrological model *Soil and Water Assessment Tool* SWAT. The WaterBase website includes elevation, soil, landuse and meteorological data covering the whole world, so that any river basin in the world can be modelled, even if there is no local data available. There is also substantial documentation, and example data sets for two river basins, San Juan in Mexico and Linthipe in Malawi.

The system has been reported in a journal article [35] and presented as a tutorial at the 2008 SWAT conference (Beijing, October).

Towards the end of May 2008 two new tools were added. SWATPlot allows the easy extraction of time series for particular variables for different runs of SWAT, or for measured data, and SWATGraph immediately draws graphs or histograms of the time series, so the two together provide a powerful and convenient visualisation tool.

At the same time a Google discussion group *waterbase* was started, and currently has 92 members.

A prototype of a central component of a health service financial system, a “grouper” for assigning codes to patient diagnosis and treatment episodes, was produced for UNU-IIGH and is being revised following a meeting there.

**Sources of funding** UNU-IIST. External funding is being sought. We were a partner (one of 30) in the EU project EnviroGRIDS, but were unfortunately not able to obtain funding from the EU for our work in this project. This resulted from the panel of experts, who rated the project very highly, remarking that “The panel ... does not see the compelling necessity for funding the Japan based organisation UNU-IIST.”

**Collaborations** WaterBase is a collaboration between UNU-IIST and UNU-INWEH. Also involved are the universities of Guelph and Waterloo in Ontario, Canada, the University of Idaho in the US, Texas A&M University in the US, and EAWAG in Switzerland.

We are also a partner in a proposed project on the Mekong River which involves 7 UNU centres.

The work on health management is a collaboration with UNU-IIGH.

We are also discussing collaboration on environmental modeling with Universiti Kebangsaan Malaysia.

**Assessment** MWSWAT seems to have been well received. Almost 700 downloads have been counted, some 250 people have registered their interest in being kept informed, and 82 have joined the Google group.

We expect to release another major tool in the Spring 2009. MWAGNPS will again be based on MapWindow, and provides an interface to the modelling tool AGNPS. This is an event-based rather than a time-based model, supporting the prediction of runoff volume, peak flow rate, erosion and various measures of water quality.

## 2.17 Independence and Concurrency in System Verification

**Staff responsible** Xu Wang

**Project abstract** The long-term goal of this project is to develop a new independence based (i.e. true concurrency) semantic model for CSP. It is hoped that the new semantic model, unlike its predecessors, can be profitably exploited in practical applications of either software or hardware nature. The project at the current stage is driven mainly by four promising applications where independence is of crucial importance, e.g. diamond mining

and FDR2, rule-based system verification, weak memory model verification, and asynchronous/GALS circuit verification.

**Achievements, status and plans** The progress made so far in the four areas of application is as follows.

- Building on our past work on ‘untangled actions’, which provides a compositional (and thus cheap) way to find diamonds, a new technique was developed on independence decorated LTSes. The independence decorated LTSes is an extension of asynchronous transition systems and concurrent automata. Guided by the dynamic refinement of independence information, preliminary experiments show that more diamonds can be found more cheaply. It is still work in progress. However, collaboration for implementation in FDR2 is planned with the Oxford FDR2 team if further experiments confirm the reduction.
- A research proposal on rule-based system verification was written jointly with Brian Logan and Natasha Alechina of Nottingham University and submitted to EPSRC for funding in 2007. Early this year we learnt that we were not successful (three ‘Could proceed as proposed’ and one ‘Should proceed’). Currently we are looking for other funding opportunities.
- A research proposal was written jointly with Jeff Sanders and Xu Qiwen of University of Macau and submitted to MSTDF in 2007. In the middle of this year we learnt that the project (PEARL) was funded for 3 years. Two postdoc researchers (one related to Java memory model) and one PhD student are going to be recruited.
- Currently one fellow, Michael Adeniyi Akingbade, is also working on a pilot project for PEARL, i.e. verification of atomic register algorithms using CSP/FDR2.
- One fellow, Kamel Boumaza, was recruited in 2007 to work on verification of timed asynchronous circuits. He finished early this year and published one technical report.

**Sources of funding** UNU-IIST and Macao Science and Technology Development Fund (USD 225 000 over 3 years, shared with University of Macau)

**Assessment** The project is in its very early stage of development. Initial successes include securing external funding for part of the project and attracting good research assistants. Foundation works on independence decorated LTSes have made good progress as well and will form the basis for our full-blown theories in the future.

**Collaborations** University of Macau, University of Oxford, University of Nottingham, and Macau University of Science and Technology

## 2.18 IT training courses and schools in developing countries

**Staff responsible** Antonio Cerone, Chris George, Tomasz Janowski, Zhiming Liu, Adegboyega Ojo, Jeff Sanders, Volker Stolz, Xu Wang.

**Project abstract** Under the project *IT Training Courses and Schools in Developing Countries*, UNU-IIST aims to disseminate sound modern approaches to software development in developing countries. IT Schools and Courses are organised jointly with host institutions. The courses are in three categories: formal methods; software engineering and system development; and Electronic Governance. The aim of the courses is to propagate research into and application of formal software development techniques, with the hope that developing countries can accelerate their progress in being self sufficient in software technology, and even become providers of services and products elsewhere.

The courses on software engineering and system development aim to introduce the advanced methods, techniques and tools that are widely used in industries for software development. They cover Project Management, Object-Oriented Software Development with UML and the Rational Unified Development Process, Component-Based Software Development, and Software Testing. These topics are often taught together with the those on formal methods so that the participants can integrate formal methods and practical software engineering in their further study and practice.

IT Schools, however, have a wide range of topics in computer science not just in software technology, and consist of several courses. Courses in a school are taught by experts invited from universities and industries as well, not just by UNU-IIST staff. Typically an IT School lasts a fortnight and consists of four courses.

An Electronic Governance School typically lasts three days and comprises seven roughly half-day modules. For instance, a school on Foundations of Electronic Governance comprises the following modules: (1) Introducing Electronic Government; (2) Strategic Planning for Electronic Government; (3) Developing Technical Solutions for Electronic Government; (4) Engineering Structures and Processes for Electronic Government; (5) Aligning Technological and Organizational Development; (6) Sharing Best Practices in Electronic Governance; and (7) Building a Community of Practice for Electronic Governance.

**Status of implementation** In 2008 UNU-IIST organized 12 schools and courses on various computer science and software engineering topics in 7 developing countries (South Africa, Iran, India, China, Nigeria, Malaysia and Thailand). It also organized 7 UNeGov.net schools on electronic governance in 7 developing countries (Nigeria, Cameroon, Kyrgyzstan, Afghanistan, Colombia, Ecuador and Mongolia). Full details may be found in Appendix B.

**Sources of funding** All schools and courses are organized in conjunction with local partners, and we always ask them to cover local costs, and sometimes they cover our travel as well.

**Assessment** Schools and courses are an integral part of your work in developing countries. As well as the training itself, we enhance our image and find most of our fellow candidates through this activity.

### 3 Postgraduate training/teaching activities

#### 3.1 Fellowships

During 2008 UNU-IIST has hosted 10 post-doctoral fellows, trained 11 fellows from 9 developing countries, and 4 fellows from 3 developing countries have studied at universities in developed countries. See appendix A for details.

#### 3.2 Supervisions

UNU-IIST staff have been involved in supervising 10 post-doctoral fellows, 11 PhD students and 5 Masters students during 2008.

- Chris George is Postdoc supervisor for Dr Luis Leon, University of Waterloo, Ontario, Canada. Subject: Hydrology for the WaterBase project.
- Jeff Sanders is
  - Postdoc supervisor for Dr Hu Jun. Subject: Multiagent Systems.
  - Postdoc supervisor for Dr Yang Shaofa within the PEARL Project. Subject: to be decided.
  - PhD supervisor for Mr Ravie Chandran, UKM, Malaysia Subject: Biological Applications of Membrane Computing.
  - PhD supervisor for Ms Salmi Binti Baharom, UKM, Malaysia Subject: Module Testing based on the Grey-Box Approach.
- Tomasz Janowski is
  - PhD supervisor for Ms Elsa Estevez, National University of the South, Argentina. Subject: Programmable Messaging for Electronic Government.
  - MSc supervisor for Ms Maria Clara Casalini, National University of the South, Argentina. Subject: Semantic Web and Collaborative Problem Solving in Communities of Practice.
  - MEng supervisor for Mr Sohag Sundar Nanda, Utkal University, India. Subject: A Multi-Criteria Automated Text Summarizer.
  - MSc supervisor for Mr Alejandro Sanchez, National University of San Luis, Argentina. Subject: Semantic Interoperability for Programmable Messaging Middleware.
- Zhiming Liu is
  - Postdoc supervisor for Dr Volker Stolz. Subject: Theories and Tools of Component-Based Systems.

- Postdoc supervisor for Dr Charles Morisset. Subject: Harnessing Theories for Tool Support in Software.
- Postdoc supervisor for Dr E-Y Kang Subject: Harnessing Theories for Tool Support in Software.
- Postdoc supervisor for Dr Kehua Yang, Hunnan University, China, within the rCos project
- Postdoc supervisor for Dr Naijun Zhan, Institute of Software, Chinese Academy of Sciences. Subjec: rCOS model of coordination.
- PhD supervisor for Mr Liang Zhao within UNU-IIST joint PhD Programme with the University of Pisa, Italy. Subject: Formal Theories and Methods of Computing.
- PhD supervisor for Mr Chen Xin, Nanjing University, China. Subject: Formal method of component and object systems.
- PhD supervisor for Bin Lei, Nanjing University. Subject: Robustness testing of component software
- PhD supervisor for Dan Li, University of Macau. Subject: Theory and Tool for Model Driven Design
- PhD supervisor for Mr Chen Zhenbang, National Lab of Parllel and Distributed Computing, China. Subject: Formal Method of Component and Object Systems.
- MSc supervisor for Mr Liu Jicong, Zhongshan University, China. Subject: Prototyping Tools of Component-based Software Development.
- Wang Xu is
  - Postdoc supervisor (jointly with Zhiming Liu) for Dr Shuling Wang, within the rCos and Pearl projects
  - MSc supervisor for Mr Michael Adeniyi Akingbade, Obafemi Awolowo Univeristy, Ile-Ife, Nigeria Subject: Model checking using CSP and FDR 2
- Antonio Cerone is
  - PhD supervisor for Mr Thomas Anung Basuki within UNU-IIST joint PhD Programme with the University of Pisa, Italy. Subject: A Formalism to Model Biological Systems.
- Adegboyega Ojo is
  - PhD supervisor for Mr. Rilwan Basanya, University of Lagos, Nigeria. Subject: Ontological Annotations
- Bernhard Aichernig, supported by Antonio Cerone, is
  - Postdoc supervisor for Dr Andreas Griesmayer within the CREDO Project. Subject: Computing Preconditions in Concurrent Systems.
  - PhD supervisor for Mr Rudolf Schlatte within the CREDO Project. Subject: Test Case Generation from Formal Specifications for Functional Testing.

## 4 Publications and dissemination

### 4.1 Publications

#### 4.1.1 UNU-IIST Reports

In 2008, UNU-IIST staff and fellows have produced 14 reports, which are available for downloading via the UNU-IIST web page and also available in the UNU-IIST library. These reports are [36, 37, 31, 38, 32, 39, 40, 41, 42, 43, 44, 45, 46, 47]

#### 4.1.2 External Publications

A total of 25 papers have been published in conference proceedings, 11 have been published in journals or as book chapters, 5 conference proceedings have been edited, and 5 papers await publication. See Appendix D.5 for the full list of external publications in 2008.

UNU-IIST staff have served on the Programme Committees of 30 international or national conferences: AFM 2008, APSEC 2008, ATVA 2008, CBSE 2008, CHINA 2008, ECEG 2008, EGOV 2008, FACS 2008, FAVO 2008, FLOSS-FM/OpenCert 2008, HASE 2008, HICCS 2008, ICDIM 2008, ICECCS 2008, ICEGOV 2008, ICFEM 2008, ICSoft 2008, ICTAC 2008, ISOLA 2008, IWFST 2008, I3E 2008, PROVE 2008, SEFM 2008, SETP 2008, TASE 2008, TTSS 2008, UNESST 2008, UTP 2008, VSTTE 2008 and WISBD 2008. These included 5 PC Chair positions. See appendix C for the full list of conferences in 2008.

## 5 List of academic meetings and events

Academic meetings and events comprise the workshops, conferences and seminars that UNU-IIST has (jointly) organised with other institutions.

**ICTAC 2008** 30 August - 3 September 2008, Istanbul, Turkey. The 5th International Colloquium on Theoretical Aspects of Computing was jointly organised by Sabanci University and Mike Reed was the Conference Chair.

**TTSS 2008** 30 August, Istanbul, Turkey. The 2nd International Workshop on Harnessing Theories for Tool Support in Software was jointly organised by Sabanci University (Turkey), UNU-IIST and Najing University (China) and Volker Stolz was Program Co-Chair. There were 15 participants.

**ISoLA 2008** 13-15 October 2008, Porto Sani (Kassandra, Chalkidiki), Greece. UNU-IIST jointly organised the Special Track on Trustworthy Computing: Theories, Methods, Tools

and Experience in China and South East Asia of the 3rd International Symposium on Leveraging Applications of Formal Methods, Verification and Validation. Zhiming Liu was Track Coordinator.

**SEFM 2008** 10–14 November 2008, Cape Town, South Africa. The 6th International Conference on Software Engineering and Formal Methods was co-organised by the University of Cape Town and UNU-IIST (Antonio Cerone was Program Co-chair).

**OpenCert 2008** 10 September 2008, Milan Italy. The 2nd International Workshop on Foundations and Techniques for Open Source Software Certification was co-organised by University of Minho and UNU-IIST (Antonio Cerone was Program Co-chair).

**HICSS 2008** 6 January 2008, Big Island, Hawaii. Global Electronic Government Research and Practice Symposium at the 41st Hawaii International Conference on System Sciences was co-organized by the Center for Electronic Governance.

**UNeGov.net Network-Building Workshops** A series of five UNeGov.net Network-Building Workshops on Electronic Governance in Developing Countries were organised by the Center for Electronic Governance with local government or academic partners:

1. 12th UNeGov.net Workshop, Yaounde, Cameroon, 11 March 2008. Jointly organised with: National Agency for Information Technology Development, Government of Cameroon; and University Yaounde I.
2. 13th UNeGov.net Workshop, Bishkek, Kyrgyzstan 23 May 2008. Jointly organised with: National Information Technology Center, Kyrgyz Republic; e-Government Department, Prime Minister Office, Kyrgyz Republic; and United Nations Development Program, Kyrgyzstan.
3. 14th UNeGov.net Workshop, Kabul, Afghanistan, 29 June 2008. Jointly organised with: Ministry of Communication and Information Technology, Islamic Republic of Afghanistan; ICT Institute, Afghanistan.
4. 15th UNeGov.net Workshop, Loja, Ecuador, 10 September 2008. Jointly organised with: Subsecretary for Informatics, Presidency of the Ecuador Republic; and Universidad Tecnica Popular de Loja.
5. 16th UNeGov.net Workshop, Ulanbaatar, Mongolia, 14 November 2008. Jointly organised with: ICT Authority, Government of Mongolia.

**ICEGOV 2008** 1–4 December 2008, Cairo, Egypt. The 2nd International Conference on Theory and Practice of Electronic Governance was co-organised by the Center for Electronic Governance; UN Department of Economic and Social Affairs; German University in Cairo; Ministry of State for Administrative Development, Egypt (patron).

**EMGKR** 9–10 December 2008, Macao, China. The 1st Meeting of the Executive Committee for the E/M-Government Knowledge Repository in Asia-Pacific Region was co-organized by the Center for Electronic Governance and United Nations Department for Economic and Social Affairs (UNDESA).

**WaterBase** 17–21 March 2008, Workshop on SWAT (Soil and Water Assessment Tool) organised jointly with the Water Surveillance and Research Institute, Jalgaon, Maharashtra, India. Attended by 20 people, mostly from the Institute, but also by two professors from neighbouring universities.

**African Institute for Mathematical Sciences (AIMS)** 26 January 2008, one day seminar at the University of Stellenbosch, organised jointly with Associate Professors Ingrid Rewitzky and Annabelle McIver. About 35 participants.

**IWFST 2008** 22–24 November 2008, the International Workshop on Future Software Technology organised jointly with Software Research Associates of Tokyo was held at UNU-IIST, attended by 15 people from India, China, Japan and UNU-IIST.

## 6 UN and host country linkages

### 6.1 Collaboration within the UN

1. The WaterBase project is joint with UNU-INWEH. See Section 2.16 for details.
2. Work on health management software is joint with UNU-IIGH. See Section 2.16 for details.
3. We are building partnerships on Electronic Governance with UNDESA and UNDP. See Section 2.2 for details.
4. Open Courseware is a joint project with UNU-HQ, UNU-MERIT, UNU-WIDER, and UNU-ONY. See Section 2.8 for details.
5. A proposed environmental project on the Mekong Delta involves UNU-IIST and 6 other UNU centres.

### 6.2 Collaboration within Macao

We continue to have good relations with the Macao Government and other local institutions, particularly the Macao Foundation and the University of Macau:

**e-Macao Program** funded by Macao SAR Government involves a number of government and academic partners from Macao.

**Macao Science and Technology Committee** is a major funding source within Macao and we currently have three projects partly funded by it, Integrating Methods and Tools for High Quality Software Development (HighQSoftD), Harnessing Theories for Tool Support (HTTS), and Process Expansion and Action Refinement in the Large (PEARL).

**University of Macau** is a partner in the three research projects HighQSoftD, HTTS, and PEARL.

### 6.3 Other collaborative projects

**Semantic Interoperability for Electronic Government** This project is a collaboration between the Center for Electronic Governance and Microsoft to carry out research, development and community-building on semantic interoperability in the context of public organizations, funded by Microsoft and UNU-IIST. See Section 2.7 for details.

**UNeGov.net Initiative** This project, described in Section 2.3, collaborates with various government, non-government and international organizations to build a Community of Practice for Electronic Governance. Established partnerships include: Federal Capital Territory Administration, Abuja, Nigeria; National IT Development Agency, Federal Government of Nigeria; National Agency for IT Development, Government of Cameroon; University of Yaounde I; National Information Technology Center, Kyrgyz Republic; e-Government Department at Prime Minister's Office, Kyrgyz Republic; United Nations Development Program, Kyrgyzstan; Ministry of Communications and IT, Islamic Republic of Afghanistan (MCIT); ICT Institute, MCIT; Observatory for Society, Government and Information Technology, Externado University of Colombia; Agenda for Connectivity, Government of Colombia; and Information and Communication Authority, Government of Mongolia.

**CREDO** is an EU-funded project on "Modeling and analysis of evolutionary structures for distributed services". UNU-IIST's funding is Euro 200 000 over 3 years, which will pay for a post-doctoral researcher, who will collaborate in particular with Dr. Bernhard Aichernig at the University of Graz, Austria: see section 2.12.

**EnviroGRIDS** is an EU-funded project on environmental modeling and management. UNU-IIST is a partner but has not succeeded in obtaining EU funding.

**Tata** in India is a partner in one of our research projects and in an annual school.

## 7 Personnel/staffing situation

### 7.1 Staff

The following is the staffing situation in 2008:

1. Dr. George Michael Reed, Director
2. Mr. Chris George, Associate Director
3. Dr. Jeffrey Sanders, Principal Research Fellow
4. Dr. Tomasz Janowski, Senior Research Fellow
5. Dr. Zhiming Liu, Senior Research Fellow

6. Dr. Antonio Cerone, Research Fellow
7. Dr. Xu Wang, Research Fellow
8. Dr. Adegboyega Kolawole Ojo, Research Fellow
9. Dr. Volker Stolz, Research Fellow
10. Ms. (Wendy) Hoi Lok Wa, Administrative and Programme Services Officer
11. Ms. (Kitty) Chan Iok Sam, Computer Systems Assistant
12. Ms. (Sandy) Lee Yuen Kwan, Administrative Assistant
13. Ms. (Michelle) Ho Sut Meng, Finance Assistant
14. Ms. (Alice) Pun Chong Iu, Programme Assistant
15. Ms. (Coffee) Ieong Soi Cheng das Dores, Library Clerk
16. Ms. Lei Sao Chi, Messenger

## 7.2 Temporary Staff

1. Mr. Chan Heng, 11 February - 31 July 2008, Macau

## 7.3 Post-doctoral Fellows and Project Staff

1. Ms. Elsa Clara Estevez, 1 November 2004 - 31 December 2009, Argentina
2. Dr. Volker Stolz, 1 August 2006 - 31 July 2009, Germany
3. Dr. Rudolf Schlatter, 1 February 2007 - 31 January 2010, Austria
4. Dr. Andreas Griesmayer, 15 February 2007 - 14 February 2010, Austria
5. Dr. Charles Morisset, 17 October 2007 - 16 October 2009, France
6. Mr. Remi Chandran, 4 November 2007 - 31 March 2009, India
7. Mr. Khoi Viet Nguyen, 1 January - 31 July 2008, Vietnam
8. Mr. Rilwan Basanya, 1 January - 31 December 2009, Nigeria
9. Dr. Luis Leon, 1 January - 31 March 2009, Canada
10. Mr. Alejandro Sanchez, 1 January - 30 June 2008, Argentina
11. Mr. Bimal Pratap Shah, 25 January - 11 July 2008, Nepal

12. Dr. Eun-Young Kang, 1 February 2008 - 31 January 2010, South Korea
13. Mr. Li Dan, 22 February 2008 - 21 February 2009, China
14. Mr. Vincent Douwe, 1 July - 31 December 2009, Cameroon
15. Ms. Wang Shuling, 1 August 2008 - 31 July 2009, China
16. Ms. Zamira Djusupova, 19 August - 31 December 2009, Kyrgyzstan
17. Mr. Mohamed Shareef, 1 September - 31 December 2009, Maldives
18. Dr. Shaofa Yang, 30 September 2008 - 30 September 2009, Singapore

#### 7.4 Visiting Researchers

The following were Visiting Researchers at UNU-IIST during 2008:

1. Mr. Fabrizio Luccio, 5-27 February 2008, Italy
2. Dr. Bernhard Aichernig, 13-28 March 2008, Austria
3. Drs. Matthias Weber & Viktor Froesen, 15-28 March 2008, Germany
4. Dr. Yifeng Chen, 30 March - 11 April 2008, U.K.
5. Prof. Song Fangmin & Mr. Wu Nan, 9-11 April 2008, China
6. Dr. Michael Weber, 12-23 April 2008, Netherlands
7. Prof. Zuohua Ding, 21-24 April 2008, China
8. Dr. Dang van Hung, 27 April - 2 May 2008, Vietnam
9. Profs. Ibrahim bin Komoo, Abdul Razak Hamdan & Abdullah Mohd Zin, 26 May 2008, Malaysia
10. Dr. Pieter Mosterman, 30 June 2008, USA
11. Dr. Leonor Barroca, 9-12 July 2008, U.K.
12. Dr. Dang van Hung, 18-30 July 2008, Vietnam
13. Dr. Jan Rutten, 7-21 November 2008, Netherlands
14. Dr. Anders P. Ravn, 6 October - 5 November 2008, Denmark

Fellows' Continents	2004	2005	2006	2007	2008
Asia	12	16	21	17	7
Africa	3	5	2	6	6
South America	5	3	3	3	2
Europe	2	1	0	2	1
Total	22	25	26	28	16

Table 1: UNU-IIST fellowships

## 8 Tables of fellowships, schools and courses

Fellowships in table 1 include fellowships at UNU-IIST and at other universities.

Schools and Courses	2004		2005		2006		2007		2008	
	S/Cs	Parts	S/Cs	Parts	S/Cs	Parts	S/Cs	Parts	S/Cs	Parts
Asia	4	207	6	180	6	213	9	654	13	405
Africa	2	57	0	0	3	191	3	124	8	230
S America	4	95	3	90			7	242	4	280
Europe					1	21	0	0		
Total	10	359	9	270	10	425	19	1020	23	915

Table 2: Schools and courses organised by UNU-IIST with numbers of participants

Publications	2004	2005	2006	2007	2008
Conference papers	25	21	16	32	25
Journal articles and book chapters	7	4	12	13	11
Books and Journals	0	5	4	6	5
Total	32	30	32	51	41

Table 3: UNU-IIST publications

## A Fellowships

### Fellows at UNU-IIST (2008)

	Period of fellowship	Country	Project
Sohag Sundar Nanda	01/02/08 -- 30/06/08	India	E-government
Luisa Franco	02/02/08 -- 06/02/09	Colombia	E-government
Michael Akingbade	20/04/08 -- 22/01/09	Nigeria	Model checking
Mohamed Shareef	05/05/08 -- 30/06/08	Maldives	E-government
Radha Chauhan	05/05/08 -- 27/06/08	India	E-government
Rafael Viana Carvalho	27/06/08 -- 24/03/09	Brazil	Complex Sys.
Mercy Njeri Njima	01/07/08 -- 31/03/09	Kenya	Long run. trans.
Jean Dieu Soupkodjou	05/07/08 -- 31/12/08	Cameroon	E-government
Tahiry Rabehaja	31/07/08 -- 30/04/09	Madagascar	Action Refinement

### Fellows for Development of Computer Science Departments

	Period of fellowship	Country	Partner Univ.
Kang Sang Mun	27/10/08 -- 26/04/09	DPR Korea	University of Singapore
Kang Chol Min	27/10/08 -- 26/04/09	DPR Korea	University of Singapore
Laure Fotso	21/08/08 -- 12/12/08	Cameroon	Ball State University Indiana, USA
Olutayo Boyinbode	21/08/08 -- 12/12/08	Nigeria	Ball State University Indiana, USA

### Fellows for PhD Programme

	Period of fellowship	Country	Partner Univ.
Thomas Anung Basuki	01/02/07 -- 31/01/10	Indonesia	Pisa University, Italy
Zhao Liang	02/09/07 -- 31/08/10	China	Pisa University, Italy

## B Schools and Courses

NAME: Course: Functional Programming

DATE: January 7-25 2008

PLACE: The African Institute for Mathematical Sciences, Muizenberg, South Africa

ORGANISERS: AIMS and UNU-IIST

LECTURERS: Associate Professors A K McIver and I M Rewitzky and Dr J W Sanders

<http://www.aims.ac.za/english>

PARTICIPANTS: 40

NAME: IPM-UNU Winter School on Foundations and Trends in Computer Science

DATE: 31 January 2007 - 10 February 2008

PLACE: IPM, Tehran, Iran

ORGANISERS: School of Computer Science, IPM, Tehran and UNU-IIST

COURSES:

(a) The Spirit of Distributed Computing, lectured by Prof Wan Fokkink, CWI, NL

(b) Relational methods for sequential systems, lectured by Dr Zhiming Liu, UNU-IIST

(c) The Foundations of Parallel Systems, lectured by Dr J W Sanders, UNU-IIST

(d) Logics in computer Science, lectured by Dr Saeed Salehi, Tabriz University, Iran

SITE: <http://cs.ipm.ac.ir/ftcs08>

PARTICIPANTS: 25

NAME: 10th UNeGov.net School on Electronic Governance - Foundation Training

DATE: 7-8 March 2008

PLACE: Abuja, Nigeria

ORGANIZERS: National Information Technology Development Agency,

Federal Government of Nigeria; Federal Capital Territory Administration, Nigeria;

UNU-IIST-EGOV

PARTICIPANTS: 30

NAME: 11th UNeGov.net School on Electronic Governance - Foundation Training

DATE: 13-15 March 2008

PLACE: Yaounde, Cameroon

ORGANIZERS: National Agency for Information Technology Development,

Government of Cameroon; University Yaounde I; UNU-IIST-EGOV

PARTICIPANTS: 70

NAME: Course on Watershed Modelling with SWAT  
DATE: 18--21 March 2008  
PLACE: JalaSRI, Maharashtra, India  
ORGANISERS: Jalgaon Water Surveillance and Research Institute (JalaSRI), Maharashtra, India and UNU-IIST  
LECTUERS: (a) Mr C George: The MWSWAT tool produced by the WaterBase project  
(b) Drs A Gosain and S Rao (IIT New Delhi): SWAT  
PARTICIPANTS: 20, mostly from JalaSRI

NAME: Guizhou Spring School, FAISE 2008, on Foundations and Advances in Information Science and Engineering  
DATE: 28 April - 10 May 2008  
PLACE: Guizhou Normal University  
ORGANISERS: Guizhou Academy of Sciences, Guizhou Normal University and UNU-IIST  
COURSES: (a) The rCOS Method of Component-Based Model Drvien Development, lectured by Dr Zhiming Liu  
(b) The Incremental Approach to Information Engineering, lectured by Dr J W Sanders  
SITE: <http://www.iist.unu.edu/faise08>  
PARTICIPANTS: 40

NAME: 12th UNeGov.net School on Electronic Governance - Foundation Training  
DATE: 19 and 22-23 May 2008  
PLACE: Bishkek, Kyrgyzstan  
ORGANIZERS: National Information Technology Center, Kyrgyz Republic;  
e-Government Department, Prime Minister Office, Kyrgyz Republic;  
United Nations Development Program, Kyrgyzstan; UNU-IIST-EGOV  
PARTICIPANTS: 60

NAME: 13th UNeGov.net School on Electronic Governance - Leadership Training  
DATE: 20 May 2008  
PLACE: Bishkek, Kyrgyzstan  
ORGANIZERS: National Information Technology Center, Kyrgyz Republic;  
e-Government Department, Prime Minister Office, Kyrgyz Republic;  
United Nations Development Program, Kyrgyzstan; UNU-IIST-EGOV  
PARTICIPANTS: 50

NAME: 14th UNeGov.net School on Electronic Governance - Leadership Training  
DATE: 21 May 2008  
PLACE: Bishkek, Kyrgyzstan  
ORGANIZERS: National Information Technology Center, Kyrgyz Republic;  
e-Government Department, Prime Minister Office, Kyrgyz Republic;  
United Nations Development Program, Kyrgyzstan; UNU-IIST-EGOV  
PARTICIPANTS: 70

NAME: 15th UNeGov.net School on Electronic Governance - Foundation Training  
DATE: 1-3 July 2008  
PLACE: Kabul, Afghanistan  
ORGANIZERS: Ministry of Communication and Information Technology,  
Islamic Republic of Afghanistan; ICT Institute, Afghanistan; UNU-IIST-EGOV  
PARTICIPANTS: 80

NAME: Course: Programming in Java  
DATE: 30 June - 18 July 2008  
PLACE: AUST, Abuja, Nigeria  
ORGANISERS: AUST and UNU-IIST  
LECTURER: Dr V Stolz  
SITE: <http://www.aust-abuja.org>  
PARTICIPANTS: 18

NAME: 2008 International Training Course on Computer  
Software/Hardware/Network Technology  
DATE: 8-25 July 2008  
PLACE: Guiyang  
ORGANISERS: Guizhou Academy of Sciences and UNU-IIST  
LECTURERS: Including Mr C George: Formal Specification Using RAISE  
PARTICIPANTS: 41 attendees from 22 countries, mostly from the  
Asia-Pacific region but also including the Middle East and the  
Caribbean

NAME: 16th UNeGov.net School on Electronic Governance - Leadership Training  
DATE: 28-29 August 2008  
PLACE: Bogota, Colombia  
ORGANIZERS: Universidad Externado Colombia; Agenda Connectividad,  
Ministry of Communication, Colombia; UNU-IIST-EGOV  
PARTICIPANTS: 90

NAME: 17th UNeGov.net School on Electronic Governance - Foundation Training  
DATE: 1-3 September 2008  
PLACE: Santa Marta, Colombia  
ORGANIZERS: Universidad Externado Colombia; Agenda Connectividad,  
Ministry of Communication, Colombia; UNU-IIST-EGOV  
PARTICIPANTS: 80

NAME: 18th UNeGov.net School on Electronic Governance - Foundation Training  
DATE: 4-6 September 2008  
PLACE: Cucuta, Colombia  
ORGANIZERS: Universidad Externado Colombia; Agenda Connectividad,  
Ministry of Communication, Colombia; UNU-IIST-EGOV  
PARTICIPANTS: 60

NAME: 19th UNeGov.net School on Electronic Governance - Foundation Training

DATE: 9-11 September 2008

PLACE: Loja, Ecuador

ORGANIZERS: Subsecretary for Informatics, Presidency of the Ecuador Republic;  
Universidad Tecnica Popular de Loja; UNU-IIST-EGOV

PARTICIPANTS: 50

NAME: 20th UNeGov.net School on Electronic Governance - Implementation

DATE: 30 September - 1 October 2008

PLACE: Ulanbaatar, Mongolia

ORGANIZERS: ICT Authority, Government of Mongolia; UNU-IIST-EGOV

PARTICIPANTS: 36

NAME: 1st International School on Software Engineering and Formal Methods

DATE: 27 October - 7 November 2008

PLACE: Cape Town, South Africa

ORGANISERS: The University of Cape Town and UNU-IIST

COURSES:

(a) Dr A Cerone: Software Engineering and Formal Methods

(b) Dr S A Shaikh: Formal verification of security protocols

(c) Dr A Cerone: Formal Methods for Human-computer Interaction

(d) Dr G Schneider: Specification and verification of e-contracts

(e) Prof H Schlingloff: Specification-based Testing of Embedded Systems

(f) Dr M Roggenbach: Algebraic Specification of Software and Hardware

SITE: <http://www.iist.unu.edu/SEFM08/School/>

PARTICIPANTS: 12 attendees from 7 countries, mostly from Africa  
but also including Brazil and Ireland

NAME: 20th UNeGov.net School on Electronic Governance - Implementation Training

DATE: 11 November - 13 November 2008

PLACE: Ulanbaatar, Mongolia

ORGANIZERS: ICT Authority, Government of Mongolia; UNU-IIST-EGOV

PARTICIPANTS: 38

NAME: Course: Concurrency

DATE: 17-20 November 2008

PLACE: UKM, Malaysia

ORGANISERS: UKM and UNU-IIST

LECTURER: Dr J W Sanders

SITE: <http://www.ukm.my/english/ftsm.htm>

PARTICIPANTS: 20

NAME: Course: Algorithm Design

DATE: 3 weeks in November 2008

PLACE: AUST, Abuja, Nigeria  
ORGANISERS: AUST and UNU-IIST  
LECTURER: Dr C Morriset  
SITE: <http://www.aust-abuja.org>  
PARTICIPANTS: 30 from across Africa

NAME: Course: Functional Programming  
DATE: 8-19 December 2008  
PLACE: AUST, Abuja, Nigeria  
ORGANISERS: AUST and UNU-IIST  
LECTURERS: Associate Professor A K McIver and Dr J W Sanders  
SITE: <http://www.aust-abuja.org>  
PARTICIPANTS: 30 from across Africa

NAME: Course: Concurrency  
DATE: 8-19 December 2008  
PLACE: AUST, Abuja, Nigeria  
ORGANISERS: AUST and UNU-IIST  
LECTURERS: Associate Professor A K McIver and Dr J W Sanders  
SITE: <http://www.aust-abuja.org>  
PARTICIPANTS: 30 from across Africa

NAME: Course: Security: Principles, Techniques and Verification  
DATE: 3-7 March 2008  
PLACE: Bangkok, Thailand  
ORGANISERS: The Sirindhorn International Thai-German Graduate School  
of Engineering (TGGS) and UNU-IIST  
PARTICIPANTS: 20 from Thailand

NAME: School on Software Quality Assurance  
DATE: 3-14 November 2008  
PLACE: Hanoi, Vietnam  
COURSES:  
(a) Dr Liu Zhiming: Component-based Software Engineering and rCos  
(b) Dr Dang Van Hung: Model Checking with SPIN  
(c) Chris George: Software Project Management  
(d) Chris George: Foundations of Software Testing  
PARTICIPANTS: 15 from Vietnam

## C Conferences

**AFM 2008** Automated Formal Methods, Princeton, New Jersey, USA, 14 July, Chris George  
as PC Member

- APSEC 2008** 15th Asia-Pacific Software Engineering Conference, 3–5 December 2008, Beijing, China, Liu Zhiming as PC Member
- ATVA 2008** 6th International Symposium on Automated Technology for Verification and Analysis, 20–23 October 2008, Seoul, South Korea, Liu Zhiming as PC Member
- CBSE 2008** Service and Component-Based Software Engineering Track, 34th EUROMICRO Conference on Software Engineering and Advanced Applications (SEAA), 3–5 September 2008, Parma, Italy, Liu Zhiming as PC Member.
- CHINA 2008** Workshop on Concurrency metHods: Issues aNd Applications, 24 June 2008, Xi'an, China, Liu Zhiming as PC Member
- ECEG 2008** 8th European Conference on e-Government, Ecole Polytechnique, Lausanne, Switzerland, 10–11 July 2008, Elsa Estevez and Adegboyega Ojo as PC Members
- EGOV 2008** 7th International EGOV Conference, Torino, Italy, 31 August - 5 September 2008, Tomasz Janowski as PC Member and Member of the Awards Committee
- FACS 2008** 5th International Workshop on Formal Aspects of Component Software, 10–12 September 2008, Malaga, Spain, Liu Zhiming as PC Member.
- FAVO 2008** Formal Aspects of Virtual Organisations, Turku, Finland, 26 May 2008, Tomasz Janowski as PC Member
- FLOSS-FM and OpenCert 2008** Joint International Workshop on "Foundation and Techniques bringing together Free/Libre Open Source Software and Formal Methods" and "Foundation and Techniques for Open Source Software and Certification", Milan, Italy, 10 September 2008, Antonio Cerone as PC Chair, Tomasz Janowski as PC Member
- HASE 2008** 11th High Assurance Systems Engineering Symposium, 3–5 December 2008, Nanjing, China, Liu Zhiming as PC Member
- HICCS 2008** Global EGOV Research and Practice Symposium, Hawaii International Conference on System Sciences, Hawaii, USA, 7 January 2008, Tomasz Janowski as Co-Organizer
- ICDIM 2008** e-Government Track, Third International Conference on Digital Information Management, London, UK, 13–16 November 2008, Tomasz Janowski as PC Member
- ICECCS 2008** 13th IEEE International Conference on Engineering of Complex Computer Systems, 31 March - 4 April 2008, Belfast, Northern Ireland, Liu Zhiming as PC Member
- ICEGOV 2008** 2nd International Conference on Theory and Practice of Electronic Governance, Cairo, Egypt, 1–4 December 2008, Antonio Cerone, Elsa Estevez and Adegboyega Ojo as PC Members, Tomasz Janowski as PC Chair
- ICFEM 2008** 10th International Conference on Formal Engineering Methods, 27–31 October 2008, Kitakyushu-City, Japan, Liu Zhiming as PC Member
- ICSOFT 2008** 3rd International Conference on Software Data Technologies, Porto, Portugal, 5–8 July 2008, Antonio Cerone as PC Member

- ICTAC 2008** 5th International Colloquium on Theoretical Aspects of Computing, Istanbul Turkey, 1–3 September, Chris George and Tomasz Janowski as PC Members
- ISOLA 2008** 3rd International Conference on Leveraging Applications of Formal Methods, Verification and Validation, 13–16 October 2008, Porto Sani Resort, Kassandra, Greece, Liu Zhiming as Track Organiser and PC Member
- IWFST 2008** International Workshop on Future Software Technology, Macao, China, 22–24 November 2008, Chris George as Organizer
- I3E 2008** 8th IFIP Conference on e-Business, e-Services and e-Society, Tokyo, Japan, 24–26 September 2008, Tomasz Janowski as PC Member
- PROVE 2008** 9th IFIP Working Conference on Virtual Enterprises, Poznan, Poland, 8–10 September 2008, Tomasz Janowski as PC Member
- SEFM 2008** 6th IEEE International Conference on Software Engineering and Formal Methods, Cape Town, South Africa, 10–14 November 2008, Antonio Cerone as PC Chair, Tomasz Janowski as PC Member
- SETP 2008** International Conference on Software Engineering Theory and Practice, Orlando, Florida, 7–10 July 2008, Tomasz Janowski and Adegboyega Ojo as PC Members
- TASE 2008** 2nd IEEE and IFIP International Conference on Theoretical Aspects Software Engineering, 17–19 June 2008, Nanjing, China, Liu Zhiming as PC Member.
- TTSS 2008** 2nd International Workshop on Harnessing Theories for Tool Support in Software, Istanbul, Turkey, 30 August 2008, Volker Stolz as PC Chair
- UNESST 2008** 1st International Conference on u- and e-Service, Science and Technology, 13–15 December 2008, Hainan Island, China, Tomasz Janowski as PC Member
- UTP 2008** Unifying Theories of Programming, First International Symposium, 8–10 September 2008, Trinity College Dublin, Ireland, Liu Zhiming as PC Member
- VSTTE 2008** 2nd IFIP Working Conference on Verified Software: Theories, Tools, and Experiments, Toronto, Canada, 6–10 October, Chris George and Liu Zhiming as PC Members
- WISBD 2008** 5th Workshop on Software Engineering and Databases, 14th Argentinean Conference on Computer Science, Chilecito, La Rioja, Argentina, 6–10 October 2008, Elsa Estevez as PC Chair, Tomasz Janowski as Member of Scientific Committee

## D Partners

### D.1 UN Partners

- UNU-INWEH
- UNU-IIGH

- UNU-MERIT
- United Nations Development Program (UNDP) Kyrgyzstan
- United Nations Department for Economic and Social Affairs (UNDESA)

## **D.2 Government Partners:**

- The Government of Macao SAR, China, and many of its agencies
- ICT Authority, Government of Mongolia
- NITC and HLCIT, Government of Nepal
- Agenda Conectividad, Government of Colombia
- National IT Development Agency and Federal Capital Territory Administration, Government of Nigeria
- National Agency for IT Development, Government of Cameroon
- National IT Center and e-Government Department at Prime Minister's Office, Kyrgyz Republic
- Ministry of Communication and IT, Islamic Republic of Afghanistan
- Canada School for Public Service
- Korea Agency for Digital Opportunity and Promotion (KADO)
- Kalinga Institute for Industrial Technology, India
- Ministry of Environment and Forests, Government of India

## **D.3 NGO/NPO Partners:**

- Macao Foundation, Macao SAR, China
- International Fund for Animal Welfare (IFAW), United States

## **D.4 Academic Partners**

- University of Macau
- Macau University of Science and Technology
- Aalborg University, Denmark
- Institute of Software of the Chinese Academy of Sciences
- Nanjing University, China
- East China Normal University
- National Key Laboratory for Parallel and Distributed Computing, China
- Vietnam National University
- AIMS, Muizenberg, Cape Town, South Africa
- AUST, Abuja, Nigeria
- UKM, Bangi, Malaysia
- UPM, Tehran, Iran
- University of Tehran, Tehran, Iran

- Guizhou Academy of Sciences, Guiyang, China
- Guiyang Normal University, Guiyang, China
- ECNU, Shanghai, China
- Zhejiang Sci-Tech University, Hangzhou, Zhejiang, China
- University of Peking, Beijing, China
- Tsinghua University, Beijing, China
- Bond University, Australia
- University of Queensland, Brisbane, Australia
- University of Pisa, Italy
- Queen Mary University London, UK
- Cranfield University, UK
- University of Minho, Portugal
- University of Oslo, Norway
- University of Guelph, Ontario, Canada
- University of Waterloo, Ontario, Canada
- University of Yaounde I, Cameroon
- Universidad de Externado, Colombia
- Center for Technology in Government, University at Albany, State University of New York
- Pennsylvania State University, USA
- Utkal University, India
- Graz University of Technology, Austria
- Centrum voor Wiskunde en Informatica (CWI), Netherlands

## D.5 Private Sector Partners

- Carmeq, Berlin, Germany
- Microsoft Corporation
- Environmental System Research Institute (ESRI), United States

## E External Publications

- [1] Bernhard Aichernig, Andreas Griesmayer, Rudolf Schlatte, and Andries Stam. Modeling and Testing Multi-Threaded Asynchronous Systems with Creol. In *Proceedings of the 2nd International Workshop on Harnessing Theories for Tool Support in Software (TTSS'08)*, ENTCS. Elsevier, 2008.
- [2] Bernhard K. Aichernig and Jifeng He. Mutation testing in UTP. *Formal Aspects of Computing*, 2008. Online First, DOI: 10.1007/s00165-008-0083-6.
- [3] P. Ayrault, M. Carlier, D. Delahaye, C. Dubois, D. Doligez, L. Habib, T. Hardin, M. Jaume, Charles Morisset, F. Pessaux, R. Rioboo, and P. Weis. Secure Software within Focal. In *Computer & Electronics Security Applications Rendez-vous*, 2008.

- [4] Luis Barbosa, Peter T. Breuer, Antonio Cerone, and Simon Pickin, editors. *Proceedings of the 1st International Workshop on Foundations and Techniques Bringing Together Free/Libre Open Source Software and Formal Methods, and 2nd International Workshop on Foundations and Techniques for Open Source Software Certification, Milan, Italy, UNU-IIST TR 398*, 2008.
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- [7] Antonio Cerone and Paul Curzon, editors. *2nd International Workshop on Formal Methods and Interactive Systems, Lancaster, UK, 4 September 2007*, Electronic Notes in Theoretical Computer Science. Elsevier, 2008.
- [8] Antonio Cerone and Stefan Gruner, editors. *Proceedings of the 6th IEEE International Conference on Software Engineering and Formal Methods, Cape Town, South Africa, 10–14 November 2008*. IEEE Press, 2008.
- [9] Antonio Cerone and Shaikh A. Siraj. Incorporating Formal Methods in the Open Source Software Development Process. In *Luis Barbosa, Peter T. Breuer, Antonio Cerone and Simon Pickin (Eds.), Proceedings of the 1st International Workshop on Foundations and Techniques Bringing Together Free/Libre Open Source Software and Formal Methods, and 2nd International Workshop on Foundations and Techniques for Open Source Software Certification, Milan, Italy*, 2008.
- [10] Remi Chandran, Tomasz Janowski, Srikantha Herath, Adegboyega Ojo, Elsa Estevez, and Obi Aginam. Will Regional Monitoring Systems Help in Environmental Governance? A case study on the WEMS Model for Monitoring Enforcement of CITES Convention. In *UNITAR/Yale Conference on Environmental Governance and Democracy*, 2008.
- [11] Radha Chauhan, Elsa Estevez, and Tomasz Janowski. A Model for Policy Interventions in Support of Electronic Governance. In *Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance, Cairo, Egypt*. ACM Press, 2008.
- [12] Zhenbang Chen, Abdel Hakim Hannousse, Dang Van Hung, Istvan Knoll, Xiaoshan Li, Yang Liu, Zhiming Liu, Qu Nan, Joseph C. Okika, Anders P. Ravn, Volker Stolz, Lu Yang, and Naijun Zhan. Modelling with Relational Calculus of Object and Component Systems – rCOS. In *The Common Component Modeling Example*, Lecture Notes in Computer Science 5153, chapter 3. Springer, 2008.
- [13] Zhenbang Chen, Zhiming Liu, Anders P. Ravn, Volker Stolz, and Naijun Zhan. Refinement and Verification in Component-based Model Driven Design. *Science of Computer Programming*, 2008. To be published.

- [14] Zhenbang Chen, Zhiming Liu, and Volker Stolz. The rCOS Tool. In *Modelling and Analysis in VDM: Proceedings of the Fourth VDM/Overture Workshop*, number CS-TR-1099 in Technical Report Series. Newcastle University, May 2008.
- [15] Zhenbang Chen, Charles Morisset, and Volker Stolz. Specification and validation of behavioural protocols in the rcos modeler. In *Proc. 3rd International Conference on Foundations of Software Engineering*, Lecture Notes in Computer Science, 2009. to be published.
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- [19] Tomasz Janowski and Theresa Pardo, editors. *Proceedings of the 2nd International Conference on Theory and Practice of Electronic Governance, Cairo, Egypt, 1-4 December*. ACM Press, 2008.
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- [29] Quan Long, Zongyan Qiu, and Zhiming Liu. Formal Use of Design Patterns and Refactoring. In *International Symposium on Leveraging Applications of Formal Methods, Verification and Validation*, volume 17 of *Communications in Computer and Information Science*, 2008.
- [30] Adegboyega Ojo and Tomasz Janowski. Increasing trust in public service delivery contract-based software infrastructure for electronic government. In *Proceedings of the 2nd Workshop on Formal Languages and Analysis of Contract-Oriented Software (FLACOS'08)*, Malta. University of Oslo, 2008.
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- [33] Alejandro Sanchez, Elsa Estevez, Tomasz Janowski, and Adegboyega Ojo. Semantic Interoperability Middleware - Cases and Applications in Electronic Government. In *"e-Government and e-Participation at the Crossroad", 3rd International Conference on Digital Information Management, London, November (submitted)*, 2008.
- [34] Alejandro Sanchez, Elsa Estevez, Tomasz Janowski, and Adegboyega Ojo. Semantic Interoperability Middleware - Enabling Collaborative Networks in the Public Sector. In *Workshop on Formal Aspects of Virtual Organisations, Helsinki, Finland, May 2008. Submitted to the Workshop on Software Engineering and Databases, 14th Argentinian Conference on Computer Science, October, 2008*.
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- [41] Lu Yang and Volker Stolz. Integrating Refinement into Software Development Tools. In *1st Workshop on Harnessing Theories for Tool Support in Software*, volume 207 of *Electronic Notes in Theoretical Computer Science*, pages 69–88, April 2008.
- [42] Miaomiao Zhang, Dang Van Hung, and Zhiming Liu. Verification of Linear Duration Invariants by Model Checking CTL Properties. In *5th International Colloquium on Theoretical Aspects of Computing*, Lecture Notes in Computer Science 5160. Springer, 2008.
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- [2] L. Zhao, X. Liu, Z. Liu, and Z Qiu. Graph Transformations for Object-Oriented Refinement. *Formal Aspects of Computing*, 21(1), 2008.
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