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Education

Distributed Computing Education, Part 3: The Winter School Online Experience

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The International Summer Schools in Grid Computing (ISSGC) have provided numerous international students with the opportunity to learn grid systems, as detailed in part 2 of this series (http://doi.ieeecomputersociety.org/10.1109/MDSO.2008.20). The International Winter School on Grid Computing 2008 (IWSGC 08) followed the successful summer schools, opening up the ISSGC experience to a wider range of students because of its online format. The previous summer schools made it clear that many students found the registration and travel costs and the time requirements prohibitive. The EU FP6 ICEAGE project held the first winter school from 6 February to 12 March 2008. The winter school repurposed summer school materials and added resources such as the ICEAGE digital library and summer-school-tested t-Infrastructures such as GILDA (Grid INFN Laboratory for Dissemination Activities).

The winter schools shared the goals of the summer school, which emphasized disseminating grid knowledge. The students act as multipliers, spreading the skills and knowledge they acquired at the winter school to their colleagues to build strong and enthusiastic local grid communities.

Initial planning for IWSGC 08

From the beginning, the intention had been to replicate as closely as possible the ISSGC experience. Of course, the distance learning format imposed limitations. The Integrating Exercise (see part 2) was the most obvious and important ISSGC feature omitted from IWSGC. The winter school's organizers recognized early in planning that none of the contributing groups could provide the necessary effort to support both tutorials and the Integrating Exercise using a new mode of delivery. Future IWSGC events should certainly include an Integrating Exercise.

Planning focused on providing a group of technologies that could be presented over a period of three to four weeks, considered the maximum sustainable effort from both students and tutors in an online mode. The admissions committee selected a maximum of 25–30 students, a manageable load for tutors unfamiliar with some of the technologies involved. The technologies also had to be compatible with GILDA. With these constraints in mind, IWSGC included four technologies:

- Condor,
- Globus,
- gLite, and
- OGSA-DAI.

UNICORE (Uniform Interface to Computing Resources) was not included in this case because materials in the correct formats weren't available. ISSGC presentations and video tutorials for each of the technologies were available in the ICEAGE digital library.UNICORE is now supported on the GILDA t-Infrastructure and was included in ISSGC 2008.

The practical work at the winter school required certain knowledge and skills. For this reason, a number of prerequisite exercises were provided in Unix, Java, XML, and obtaining GILDA certificates. Figure 1 shows the registration process for the winter school and student participation.

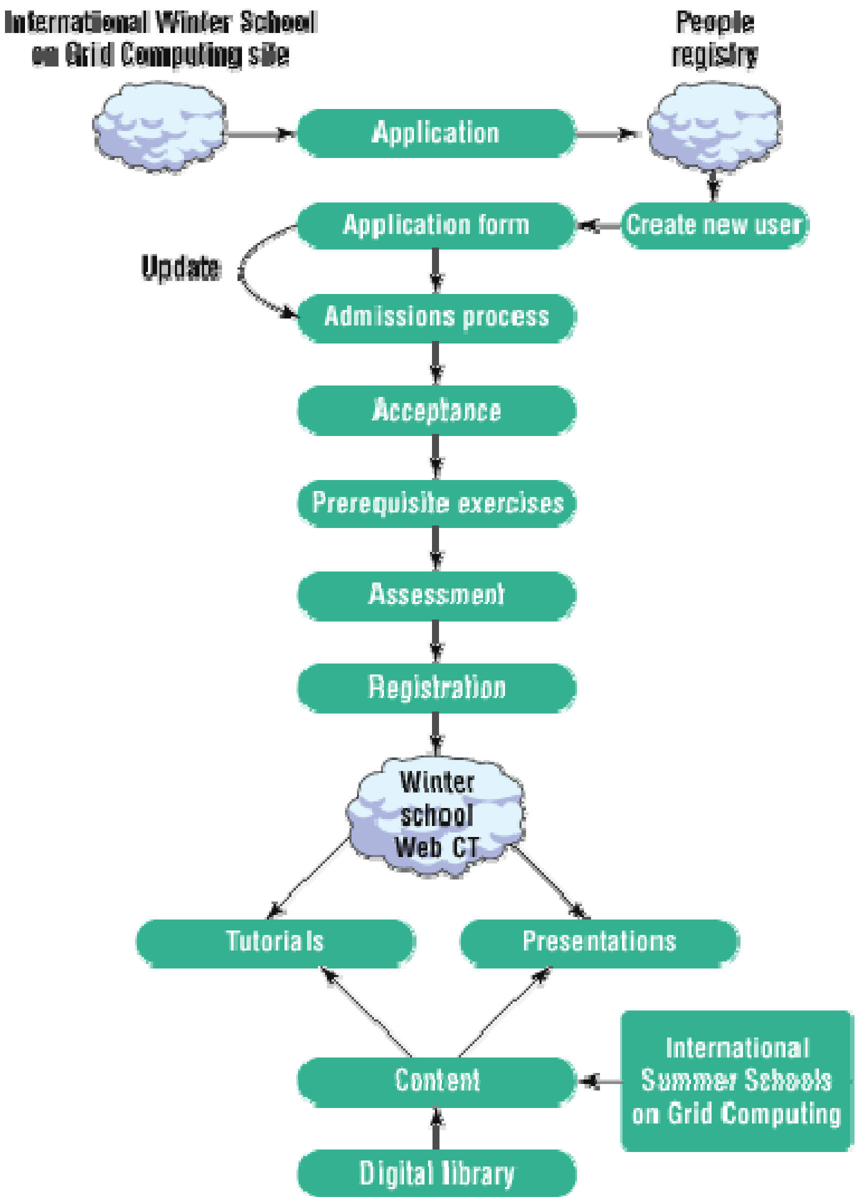

Figure 1. Winter school work flow.

Student statistics

The following list provides a broad overview of student details for IWSGC 08. Figure 2 shows a breakdown of successful applicants by country.

- 55 potential students completed applications.
- 38 prospective participants started working on preparatory exercises.
- 29 participants from 16 countries successfully completed all exercises and were invited to register.

- 28 participants successfully completed the school (1 participant quit because of unexpected commitments).

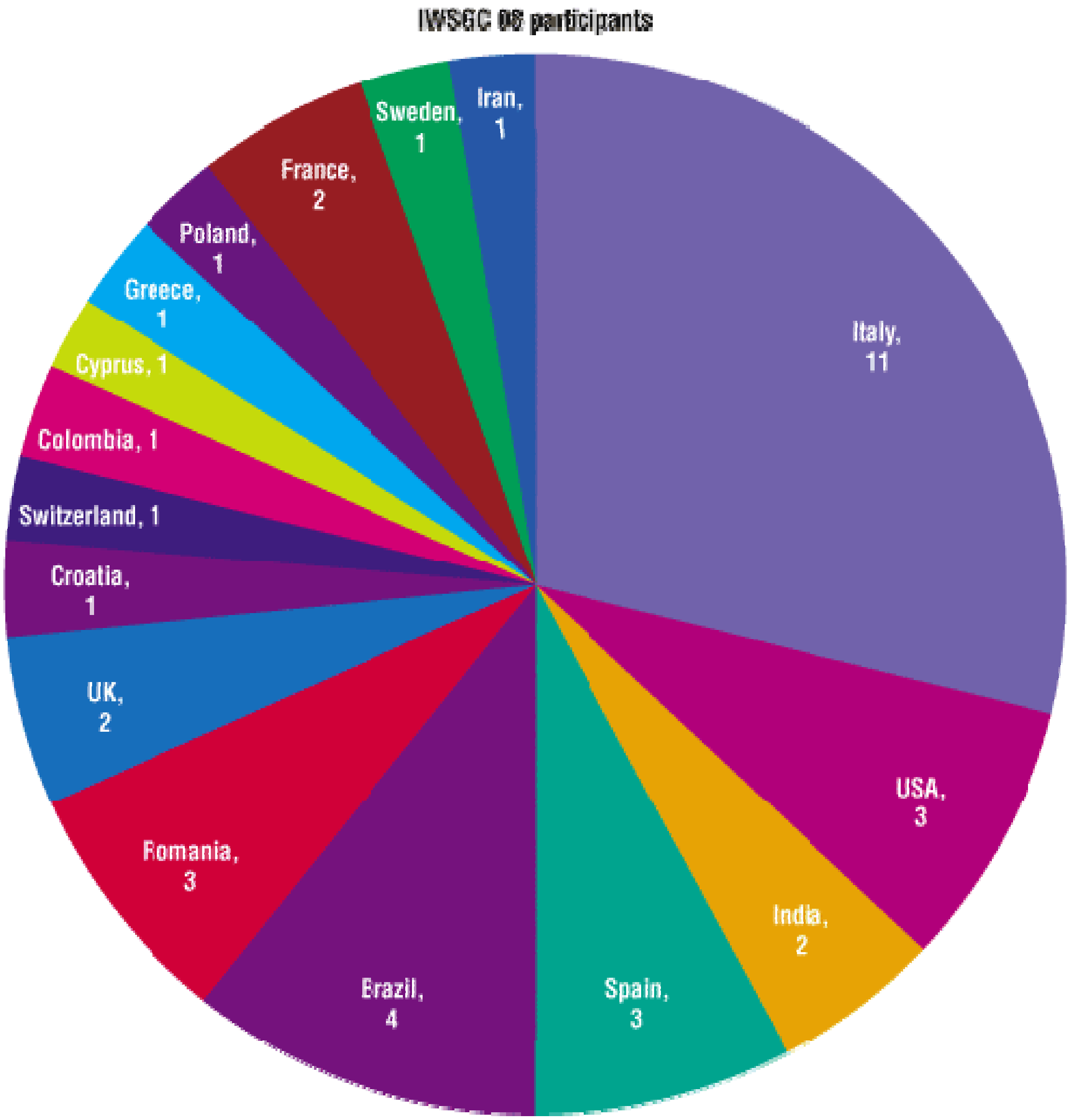

Figure 2. Distribution of successful applicants by countries of residence.

Curriculum

IWSGC 08's educational goals were to

- provide participants with the necessary theoretical background for practical use of the Grid,
- enable participants to use Condor, gLite, and OGSA-DAI,
- direct participants toward available Grid services, and
- encourage collaboration between participants.

The representative selection of ISSGC materials available in the ICEAGE digital library served as the basis for the IWSGC 08 core curriculum. Development of high-quality materials such as those in the digital library required substantial primary investments, which ICEAGE and other projects had already made. For this reason, the IWSGC 08 curriculum was strongly oriented toward reusing ISSGC materials.

The curriculum consisted of two main parts: concepts or general knowledge and example technologies. Concepts or general knowledge was divided into the following subcategories:

- general talks and materials,
- security,
- applications,
- production grids, and
- Web 2.0.

Example technologies, illustrating concepts using real-life examples, included

- Condor,
- OGSA-DAI,
- Globus, and
- gLite.

Besides offering digital library materials, the winter school boosted participants' research and innovation capabilities through keynote lectures by Miron Livny, Ian Foster, and Malcolm Atkinson, three high-profile speakers invited especially for the event. The decision to include keynote speakers followed the successful summer schools' example. After the lectures, winter school students were able to interact with these experts. Keynote speakers build a sense of community, and students gain a sense of inclusion and continuity by having an opportunity to see live lectures and participate in chats with well-known people in the field. In e-learning, participants can often get lost in cyberspace, so this format kept students interacting and engaged.

Table 1 shows that the numbers of students involved in live presentations remained constant across the winter school period. This represents a major achievement for the school in maintaining the active interest of all students during the event.

Table 1. Engagement in live presentations.

Date	Presenter	Type	Numbers
Wednesday 6 February, 15:00 GMT	Ian Foster	Invited	39
		Attendees	25
		Peak users	34
Tuesday 26 February, 15:00 GMT	Miron Livny	Invited	40
		Attendees	28
		Peak users	34
Wednesday 12 March, 15:00 GMT	Malcolm Atkinson	Invited	39
		Attendees	30
		Peak users	40

Besides live keynotes, the IWSGC 08 curriculum consisted of numerous lectures produced for the winter school and tutorials adapted for e-learning, all available in the digital library.

Course design

The ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model (see Figure 3) is the generic course design process that instructional designers and training developers have traditionally used. The initial steps in this model are to analyze educational needs, profile prospective school participants, and identify available resources. IWSGC course designers concluded that prospective participants should be enthusiastic and ambitious researchers who have recently started or are about to start working on Grid projects.

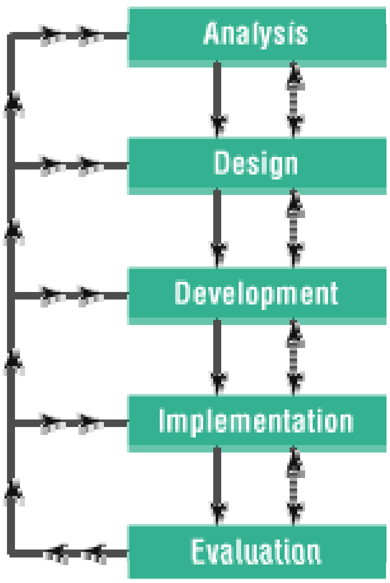

Figure 3. ADDIE model of instructional design.

Participants with diverse backgrounds were encouraged to apply. Aiming at a roughly beginner audience scattered across the world, the IWSGC design involved a fully distributed (online) delivery mode.

School development started off by identifying precise timescales. Participants would need to devote 20 hours a week for the event's duration. Recommended scheduling was set at four hours a day, Monday through Friday. Course designers determined that the total participant workload would average 100 hours over five weeks, plus time for preparatory exercises (the amount of time spent on these exercises would depend on the students' individual backgrounds). If students missed a part of the course, they could catch up during weekends (until Monday 9:00 GMT). GMT scheduling was applied because the school was open to participants from all over the world.

IWSGC 08 consisted of seven live online events and asynchronous work in between. To successfully complete the course, participants had to attend at least five live events in their duration and complete all required asynchronous activities. Tutoring was offered during weekdays; each technology provided several tutors, while the school coordinator offered academic and administrative support for school participants from start to finish. Figure 4 shows sequential details of the winter school structure.

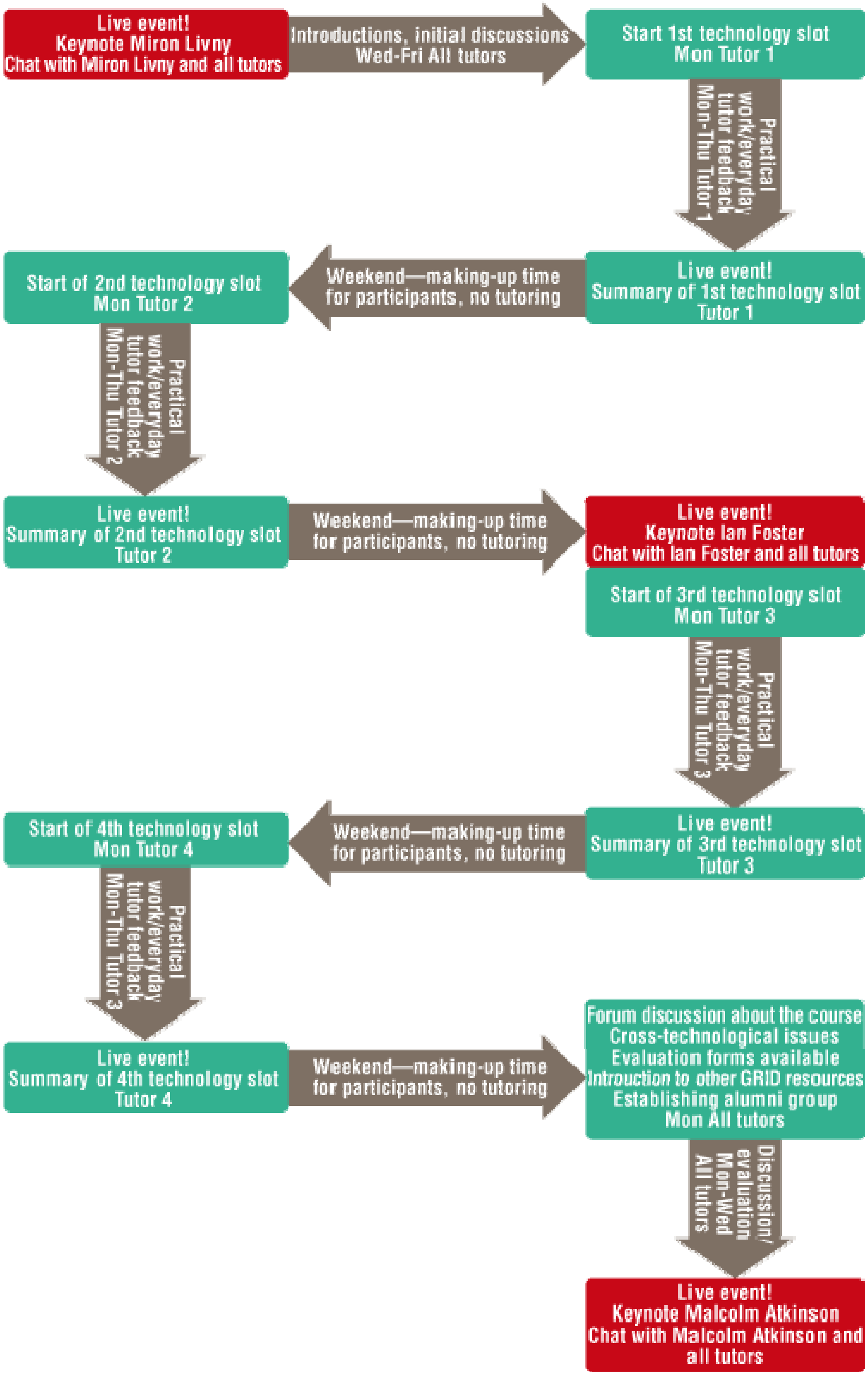

Figure 4. IWSGC 08 structure.

The winter school designers developed the event using WebCT (Blackboard), the off-the-shelf system hosted at the University of Edinburgh, the ICEAGE Project leading partner. Because the course design team members and tutors were geographically scattered (in Scotland, Italy, Switzerland, and the US), all school preparations were done online.

Course delivery

A virtual learning environment of some sort is, of course, central to supporting an online distance learning course. Various levels of sophistication can be selected, from a basic online notice board implemented in static HTML to a fully integrated dynamic environment. Careful resource analysis showed that the timeframe and finances did not allow for either development or implementation of our own course delivery vehicles. Course planners examined many possibilities for presenting the course, including the University of Edinburgh's island in 2nd Life, Sakai, and Moodle. As we mentioned earlier, the designers decided to use WebCT (Blackboard). Although this might not have been the most recent or versatile implementation, it has been extensively tested and has a support network available. This led to minimal input from the IWSGC team; they directed their efforts to supporting services not available through WebCT (for instance, assessments).

The course designers decided early in the planning process that live video presentations were important to the winter school. These had two purposes:

- attracting potential students by using live presentations from well-known research leaders, and
- bolstering student engagement with the school and avoiding dropouts.

To ease access for all students, IWSGC planners felt that minimal special components should be required to view the video stream. Similarly, planners felt the video stream should be persistent to allow asynchronous access. To attract students, the planners needed engagement from the most influential researchers in distributed computing, often the busiest people in the field. It was therefore critical to minimize video production constraints on the presenters. These two constraints meant that the video system should have minimal requirements at both ends (student and presenter) and should be mediated by a central service. Given the potential drain on resources that supporting a Web streaming application can produce, a service that already had support was also desirable. After considering several tools, ICEAGE bought an Adobe Connect license to deliver the live keynote talks after seeing evidence of Adobe's superior support services.

Preparatory exercises and applications were conducted through the ICEAGE Grid People Registry (www.iceage-eu.org). This is a specialist application developed by the ICEAGE project to support aspects of the schools that couldn't easily be provided using off-the-shelf components. The University of Edinburgh's e-Science MSc has adopted this system, and it is being generalized for use throughout the university.

Student satisfaction

After the winter school ended, course organizers gave participants open-answer questionnaires. To make the results comparable to those of the summer schools, the existing ISSGC questionnaire was slightly modified to accommodate the school's online nature. To elicit suggestions that could be used to help develop future online events, the IWSGC questionnaire was also more detailed than the one used for the summer schools. Ninety-three percent of participants (26 of 28) answered this questionnaire. An online quantitative feedback form, used in other events, was also circulated to students and presenters, but a low response rate meant that results could not be easily evaluated.

Overall, IWSGC 08 participants expressed high satisfaction with the winter school. The majority of questions, such as those about school duration or commitment, were answered equally on both sides of the spectrum—that is, roughly equal numbers of participants wanted the school longer or shorter, more or less demanding, and so forth. Students identified no problems with infrastructure or technical support. They rated the tutoring and keynote talks the strongest parts of the school and pointed out no particular weak points.

The case of IWSGC 08 is a prime example of organic design. It bears significant heritage from the successful ISSGC series—it grows rapidly, assimilates new technologies such as learning management systems and podcasting tools, and adapts to instruction in an online environment. Finally, it's heavily rooted in its environment: the choice of the WebCT learning management system, for instance, is almost completely based on available resources.

Based on such a model, it's possible to have a regular series of such events with significantly less effort in terms of material preparation. All IWSGC 08 materials are fully reusable and platform independent; the next winter school is expected to take up to 50 percent less commitment in preparatory phases. Future IWSGCs can continue to address the needs of the growing distributed computing community by producing well-trained and enthusiastic teachers, as well as reusable teaching materials, using a democratic online format. Subsequent articles in this series will present further details of means by which we can help the widest range of domains and institutions provide education in the area of distributed computing, considering teaching infrastructures, intellectual property rights issues, curriculum design, and related supportive policy frameworks.

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