What is?

GPU4EO 2015 is a challenge among researchers aimed at improving the performance of a processing software of remotely sensed data using the processing capacity of the GPU (*graphics processing unit*).

The challenge is open to teams composed by students/researchers belonging to research institutions and / or professionals who want to face up it.

A global amount of € 5,000, as well as other awards, will be assigned to winner teams.

Challenge Objectives

The goal of GPU4EO Challenge 2015 is to stimulate the adoption of GPUs in the field of image processing and more specifically in the field of remote sensing applications aimed at the development of a favourable framework for the synergy between research and business.

To fully exploit the potential of GPUs, it is essential to modify the processing algorithms by considering appropriate libraries that could be even customized for the processing of geospatial data. This activity can only be carried out by combining transversal skills concerning the hardware and the development of libraries and algorithms specific for the wide business opportunities of the each relevant market.

GPU4EO Challenge intends to promote the integration of transversal skills useful for the development of processing algorithms specifically designed and optimized to maximize the processing capabilities of the latest graphics boards.

To this end, DORIS open source software has been selected as target for performance enhancement. This software is specific for the processing of remote sensing images and is composed of a number of computing processes that lend themselves to the optimization and porting to the GPU platforms. The teams that will join the Challenge will have the opportunity to modify these computing processes in order to reduce the overall processing execution time.

This activity will be carried out on one or even more steps of the computing chain through the redesign of the algorithms in order to foster a better exploitation of the GPU platform potential.

The output generated by the redesigned computing chain will have to be consistent with the reference output provided to participants and produced by using the original DORIS version.

Therefore the expected result is a drastic reduction of the processing execution time without entailing any substantial change in the output.

Activities

Participants should download a copy of DORIS software from the web site http://doris.tudelft.nl/. On the same web site there are also available all the information for the installation and configuration of the software.
Both **input data** (SAR interferometric pair and DEM of the area of interest) and expected **output data** (Differential interferogram and Coherence Map) will be made available to subscribers.
The developments will have to be optimized for **NVIDIA K40 GPU**.
A reference **hardware platform** will be made available to participants by ReCaS data center; it is based on the NVIDIA K40 board and will be exploitable for testing the developments and assessing the performance achieved.

A **workshop** will be organized, in order to clarify the modalities of execution and carrying out of the Challenge activities. It will illustrate:

- the organization of DORIS software and its processing steps;
- the access modalities to the reference hardware platform;
- the criteria, methods and tools adopted by the evaluation committee for the qualitative and quantitative evaluation (processing time) of the processing results.

The workshop will end with a Matching session aimed at team building among participants.

By the end of activities, the teams who want to submit their applications for the evaluation must release the following outputs:

- the source code developed;
- the executable code for the reference platform;
- a report with the illustration of the activities carried out including the description of the code portions that have been modified (max 2000 characters). Moreover, details must be provided concerning the identification of the source code and executable on the reference platform.

How to apply

To participate the Challenge you must sign up through the website www.planetek.it/eng/gpu4eo.

Any requests for clarification or support can be sent via e-mail at **gpu4eo@planetek.it**.

In the registration request, the contact person must specify the affiliation, the e-mail address and telephone to be used for communications. In case of participation of a team, with more

than one participant, the contact person will communicate via e-mail, after the registration, the composition of the team directly to the organizing committee.

Teams can belong to:

- Researchers coming from research centers and / or students and professionals who operate outside of Puglia region;
- Researchers coming from public research centers operating in the territory of the Puglia region; Teams of students and / or professionals coming from Puglia or studying at the Universities of Puglia.

It is not allowed to a single person to participate in more than one team.

Save the date

The subscription is open from **April 1, 2015** until **June 2, 2015**.
Workshop: April 15 from 15.00 to 17.00 c/o Department of Physics - Campus of Bari and webinar.
Closing: June 15, 2015. By this date the participants must send to gpu4eo@planetek.it the report of activities. With the closure of the activities will be inhibited access to the reference platform.
Award ceremony: June 25, 2015.

Criteria and evaluation process

The evaluation committee will draw up a ranking by running the instance provided by each participant on the reference platform and assessing the performances of the proposed developments. The benchmark will be executed on a data set different from the input provided to participants.

The evaluation criteria are:

- Execution time of the processing: 80 points.

  80 points will be awarded to the fastest processing chain whereas no points will be awarded to the slowest of all the participants.
  To score the intermediate values, a linear criterion will be adopted.
  0 points will be assigned to competitors that do not exceed the minimum performance requirement which is equal to a processing time reduction of 50%, taking as reference the processing time (on the same dataset) of the unmodified DORIS chain available on the reference platform.

- Quality of the result: 20 points.
  The quality of the results will be assessed by comparing the coherence map produced by each Team and the one generated by the unmodified DORIS chain available on the reference platform. 20 points will be awarded to the best coherence map (provided that it is even better than the reference coherence map) whereas no points

will be awarded for interferometric coherence maps with a quality equal to (or slightly less than) the reference coherence map.

To score the intermediate values, a linear criterion will be adopted.

The teams that will present interferometric coherence maps with a quality significantly lower than the reference one will be excluded from the ranking. During the Challenge development period, each team will be enabled to perform coherence maps comparisons through a specific software module that will be delivered during the Workshop.

The evaluation committee
The Committee is composed of representatives from the world of research and industry.

The members of the evaluation committee are:

- Cristoforo Abbattista, Planetek Italia srl
- Giacinto Donvito, Datacenter ReCas-INFN
- Francesca De Leo, CNR
- Raffaele Nutricato, GAP
- Alex Pompili, Uniba

Awards and honors
Registrants will receive a communication from the organizers about the details of the progress of the awards ceremony.
The award ceremony will be preceded by a technical workshop in which participants in the Challenge will present the team's work and will illustrate the activities and achievements.
On the base of the ranks, prepared by the evaluation committee, prizes will be awarded as follows:

• to the first ranked team: € 3,000
• to the first ranked team operating in Puglia: € 2,000

The organizing committee will take care of submiting the developments achieved by the first ranked to the Delft Institute of Earth Observation and Space Systems, the structure that developed the software DORIS, recognizing the ownership of the development team.
The committee will also cooperate in submiting a scientific paper in which the results will be illustrated by the winning team.

Software licence
The implemented code, which will be provided by the participants, acquires the same license to use of DORIS as defined on the site http://doris.tudelft.nl/.
The ownership of the results belong to the entities that produced them, without prejudice to the possibility of organizers to use the results of the Challenge, also for marketing and communication.

Organization of the event

The "**Challenge GPU4EO**" is organized by **Planetek Italia srl**, as part of the Project "“**RIESCO - Ricerca ImprESa COnoscenza: l'innovazione dal laboratorio all'impresa in Puglia**”", which involves CNR, ENEA, INFN with the participation of Confindustria Puglia. Partners in the initiative are GAP LTD to support use of the software DORIS, INFN and the Department of Physics, University of Bari who have provided the reference platform in the datacenter RECAS.

The organizer reserves the right to make changes to this announcement on the basis of proposals and suggestions received from participants.

*The initiative was realized as part of the Project "**RIESCO - Ricerca ImprESa COnoscenza: l'innovazione dal laboratorio all'impresa in Puglia” Attività cofinanziata dall’Unione Europea a valere sul PO FESR 2007–2013, ASSE I, Linea di intervento 1.2, Azione 1.2.3 “Rete Regionale per il Trasferimento di Conoscenza” Progetto “Alleanza tra ricerca e impresa per la Smart Puglia - Programma Operativo per la fase conclusiva del Progetto ILO2**", by CNR, ENEA and INFN and Confindustria Puglia in collaboration with Planetek Italia Srl.*