REASON (IST – 2000 – 30193)

Research and Training Action
for System on Chip Design

Final Report
Period: 01.01.2002 – 31.08.2005

Classification: internal (for project consortium, project reviewers and European Commission only)

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Report Preparation Date: 02. 08. 2005

Contents

Introduction: structure of this report

The final report consists of two parts: the *main report* (this text) and the attached CD-ROM.

The main report is divided into three chapters. The first chapter contains overview of all project activities in the last period (January 1st, 2005 to August 31st, 2005). The second chapter summarizes all project activities for the entire duration of the project (January 1st, 2002 to August 31st, 2005) and presents its outcomes. The third chapter contains the exploitation plan.

The CD-ROM attached to this report contains all detailed reports submitted by the project partners to the central database of reports. The reports include individual reports on events, actions and activities, partners' overview reports summarizing their activities and workpackage overviews submitted by workpackage leaders. All the reports were collected via the project Web reporting site, "frozen" on July 21st, 2005 and linked by additional html pages so that it is easy to browse and find any of the reports. For selected groups of event reports statistical data are available. To start browsing the database, "open_me.html" file should be opened by a Web browser. It is also possible to connect directly to the database for online browsing, details can be found in the introductory page on the CD-ROM. The database of reports does *not* contain reports for the first project year (2002) because the Web reporting site was launched for the first time in summer 2003.

Executive summary

The project started on January 1st, 2002 and (after two extensions) the project termination date is August 31st, 2005. The contractual limit of EU funding was 2 476 000 □. The project consortium had 22 contractors from 18 European countries: 5 partners from EU countries (Belgium, Germany, France, the Netherlands and the United Kingdom), 13 partners from EU candidate countries in Central/Eastern Europe (3 from Poland, 2 from Slovakia and single partners from Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, and Slovenia) and 4 partners from the NIS countries (2 partners in Belarus, one in Russia and one in Ukraine). After EU enlargement (May 1st, 2004) 11 partners from the candidate countries found themselves in the enlarged EU and only two partners from Bulgaria and Romania remained in the candidate countries. Together with subcontractors the project involved about 50 institutions. The project included 13 workpackages: WP1 (Introductory actions), WP2-WP7 (Training actions), WP8-WP9 (Development of new tools for training), WP10-WP11 (Dissemination and promotion), WP12 (Watching new trends and developments) and WP13 (Coordination).

16 institutions from CEE and NIS countries (incl. 3 project partners) joined EUROPRACTICE. Several new design labs in partner institutions were established. Databases of enterprises interested in ASIC and SoC design were created in partners' countries (CEE and NIS) and many training and promotional events addressed specifically to SMEs were organized. Joint design works (university-SME) started in several countries, 2 "First use by industry" agreements were signed via EUROPRACTICE with software vendors.

The total number of all public training events (courses, tutorials, summer schools etc.) was 291 and the total number of participants in these events was about 7600, 3600 of them from REASON partner institutions (including subcontractors). 15% to 25% of persons attending training events were from local industries. The majority of attendees were from CEE and NIS countries, but the percentage of participants from "old 15" EU countries steadily increased from 9% in 2002 to 19% in 2005. 4% to 6% of participants were from other countries. Not less than 5500 school children and teachers attended various promotional events aimed and raising their interest in science and in particular in electronics and microelectronics. Quality and satisfaction of participants of training events were measured; the quality of events steadily increased (from about 40% "A" ratings in 2002 to more than 70% "A" ratings in 2005).

45 different software tools for distance training and e-learning have been developed. They will available via EuroTraining after termination of the project. Three educational ICs for experiments in student labs have been designed, prototyped and tested and at least two of them will be offered as commercial products. A book on testing of electronic system has been written jointly by authors from several partner institutions and is now in print.

Due to improved visibility of competencies of project partners from CEE and NIS countries the partners from these countries participate now in 5 running FP6 projects, 3 more are in negotiations.

The overall level of satisfaction of all project partners is very high. New knowledge, new teaching methods and tools, new contacts and creation of the community and experiences of participation in an international EU funded project are considered the most important outcomes. It is the feeling in the consortium that the mission of the project has been fulfilled.

Chapter 1
Project progress report
for the period January 1st - August 31st, 2005

1.1. Introduction and general information

The original project termination date was December 31st, 2004. On July 15th, 2004 the EC approved extension until June 30th, 2005. On 21st and 22nd February the third annual project review meeting was held in Sinaia, Romania. At two general meetings of all partners, which took place before and after the review meeting, the partners agreed to introduce major changes to the project budget. These changes included fund transfers between the partners as well as transfers between cost categories. There were several reasons for reallocation of project funds:

- underestimation and/or overestimation of costs by some partners, especially those less experienced in EU funded projects,
- underestimation of travel costs by majority of partners,
- extensions of the workplan beyond the original plans: more training events, more international events involving travels, more educational ICs designed and fabricated etc.,
- reduction of activities in WP12 (as suggested by the reviewers),
- extension of the project by additional 6 months,
- changes of economic conditions and legal regulations in partners' countries (resulting e.g. from EU enlargement but also from other factors).

Very good atmosphere in the consortium helped to achieve agreement easily despite fact that some partners had to allow for significant reduction of their budgets. The final budget was submitted to the EC in the beginning of April and approved in mid-June.

Annual cost statements were sent to the EC in the end of February. The response came quickly (in the end of April) but unfortunately the calculations done by the EC contained a major error. As a result of this error the coordinator received funds for five partners only, a small fraction of the full payment. After correction full payment from the EC was received in the end of May and distributed to partners in the first week of June. However, there were still obvious mistakes remaining in evaluation of some cost statements. Hopefully everything will be corrected when the final cost statements are evaluated.

In May the consortium applied for extension of the project by additional two months. This request was approved and the termination date is now August 31st, 2005. No new project activities were planned for July and August and the reasons for the extension were formal: to finish all payments (e.g. for the last prototypes of educational ICs) and to allow all partners to use their project funds for travel to Sofia, to attend the final project review meeting.

The level of activity of all partners in the extension period (6 months) was above expectations. 48 project events were reported (and additional 12 addressed to school children). The total number of participants in all events (training events, conferences with REASON sessions and events for school children) exceeded 2500. In comparison, all events in 2003 (12 months) gathered about 2600 participants, and in 2004 (also 12 months) the number participants was about 5700.

The official public project closing event was the MIXDES 2005 conference in Cracow, Poland (June 22-25). The program included special REASON plenary session presenting future of micro/nanoelectronics, with three talks given by prominent speakers (Ahmed Jerraya from UJF (France), Hannu Tenhunen from KTH (Sweden) and R. Muralidhar from Freescale (USA)), a special session on educational integrated circuits and three REASON tutorials (organized by Prof. Vladimir Lantsov, VSTU, by Prof. Lech Jozwiak, TUE, and by Dr. Bedrich

Weber, FEISTU). REASON related papers were also presented in regular sessions. MIXDES was attended by 173 participants from 25 countries including such remote countries as South Africa, Japan, Singapore, Australia, Canada and the USA.

In addition to normal project activities many partners participated in consortia, which prepared and submitted project proposals to IST Call 4 (closed on March 22). In many cases such participation was a direct consequence of participation in REASON. The final outcome is not known yet. However, even without new projects most partners are determined to maintain links and try to continue cooperation. This will be discussed in more detail in Part 3 of this report.

In the beginning of July the last reporting action started. As in 2003 and 2004, partners' reports were collected via REASON Web based reporting system. The last reports were submitted on July 21st. In addition, the coordinator asked the partners to write short text documents summarizing their experiences and impact of the project and send them via e-mail. 14 partners and one subcontractor responded. These documents are the basis for self-assessment of the results and impact of REASON and are summarized in Part 2 of this report.

1.2. Training actions (WP1 to WP7)

48 training events (courses, tutorials, lectures, special sessions at conferences etc.) took place in the first six months of 2005. 48 events are equal to ½ of the number of events in 2004 (96 during 12 months). The total number of participants reported was about 1500, 570 of them (38%) from REASON partner institutions. Again, this is slightly more than ½ of the number of participants in 2004 (2800 during 12 months). This indicates that in the extension period the partners continued their actions with the same energy as in 2004.

Out of these 48 training events 28 were international (58%) and 20 national (42%). Relatively low percentage of international events (in comparison with 75% in 2004) is not a surprise. In 2003 and 2004 the majority of international events took place in September and beginning of October, when it is easier for people from universities to find time slots for international travels. Moreover, events in 2005 were not initially planned; they were added to the workplan in the end of 2004. International events need for obvious reasons more time for planning and preparation than local ones.

The training actions were carried out in 13 countries, and their geographical distribution is shown in Fig. 1. This distribution is somewhat different than in 2003 and 2004. Relatively large number of events in Estonia results from big international conferences that took place in Estonia in May and had accompanying REASON events.

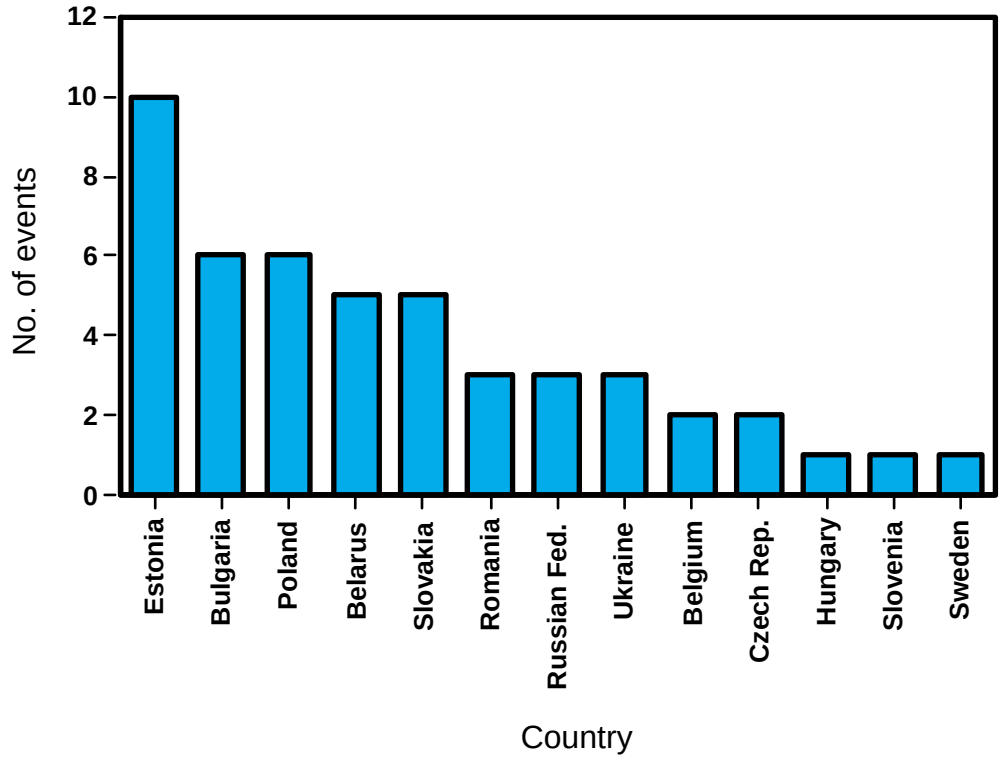


Fig. 1. Number of REASON training events (in WP1 to WP7) in various countries

The geographic distribution of the participants also changed in comparison with 2003 and 2004. The largest group was from new EU member states and candidate countries but the percentage of participants from “old 15” EU countries and other countries was much higher than in previous two years. This geographic distribution is illustrated in Fig. 2.

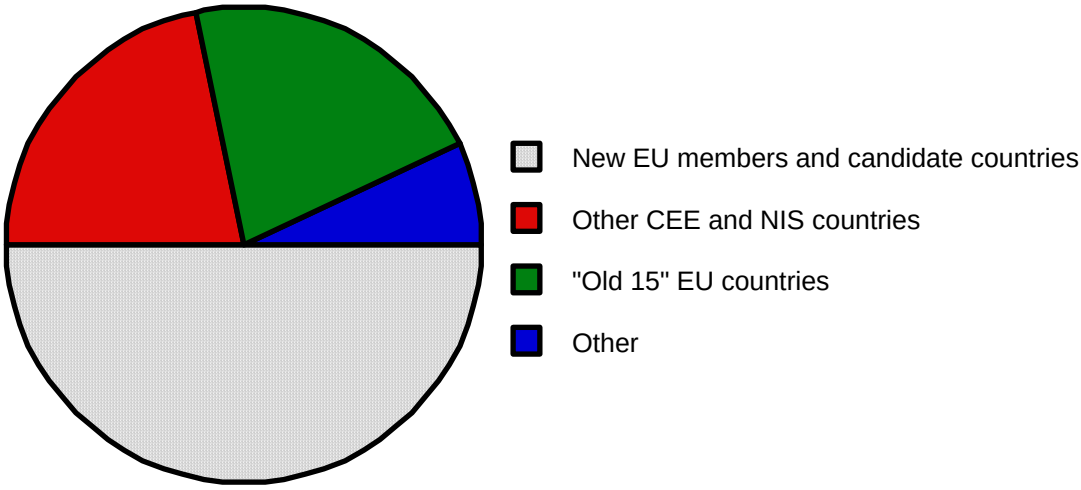


Fig. 2. Geographic distribution of participants in REASON training events

Although the overall percentage of international events in 2005 was lower than in 2004, international events dominated in WP3, WP4 and WP7. In WP1 there were only 3 local

events. The majority of training events in this workpackage took place in the initial phases of the project.

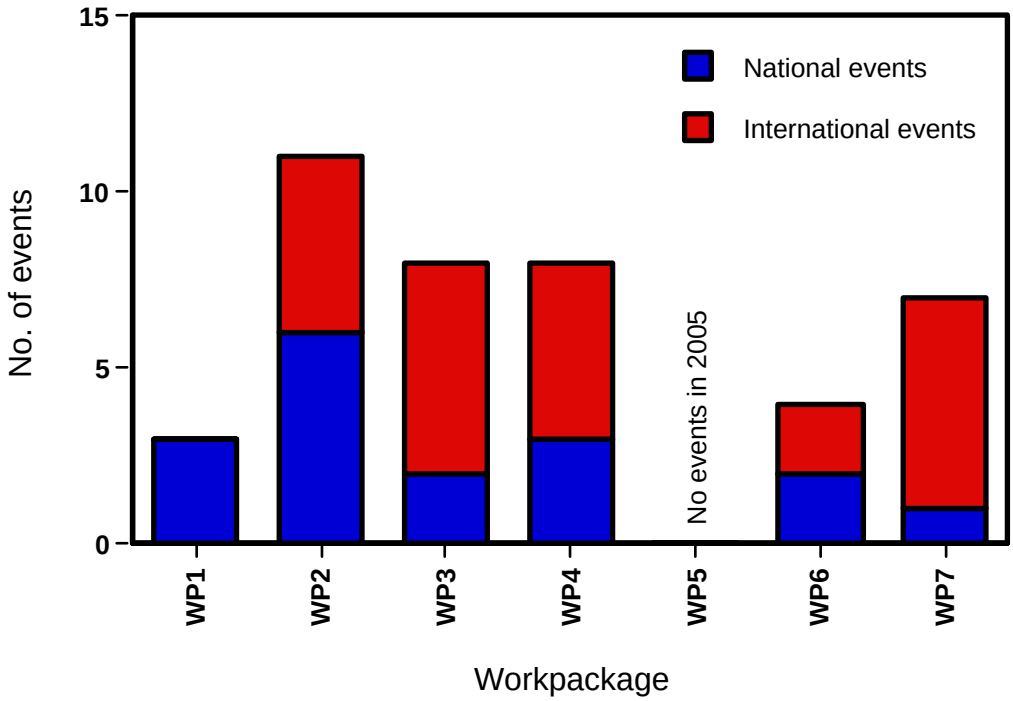


Fig. 3. Numbers of international and national training events in workpackages WP1 to WP7

These statistical data illustrate truly international dimension of the project. Additional confirmation comes from the statistics of the working languages. English dominated (67%) with Russian as the second one. It is very interesting to note that English was the working language also at some local events. The percentage of events with English reported as the working language was significantly higher (67%) than the percentage of international events.

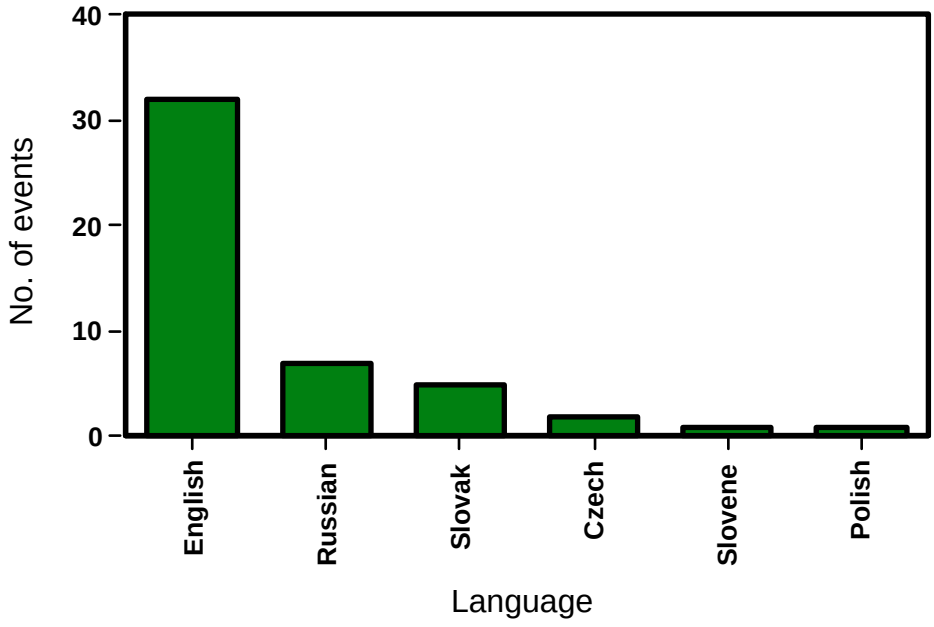


Fig. 4. Working languages of the training events

The percentage of participants from industry was at the same level as in 2003 (25%) and higher than in 2004 (15%). In all workpackages this percentage was comparable or higher in 2005 than in 2004 (except WP5 – in this WP there were no training events in 2005). Three training events in WP1 gathered more than 60% participants from industry. Although 25% industrial participation is higher than in 2004, this number seems to confirm earlier observation that the "market" for training of engineers from SMEs is rather shallow in most countries.

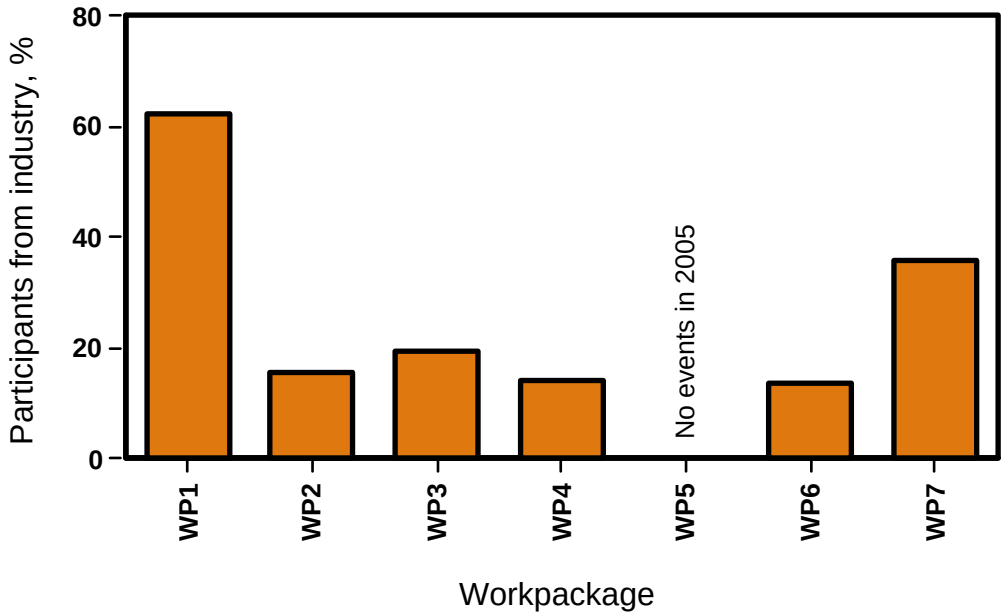


Fig. 5. Percentage of participants from industry

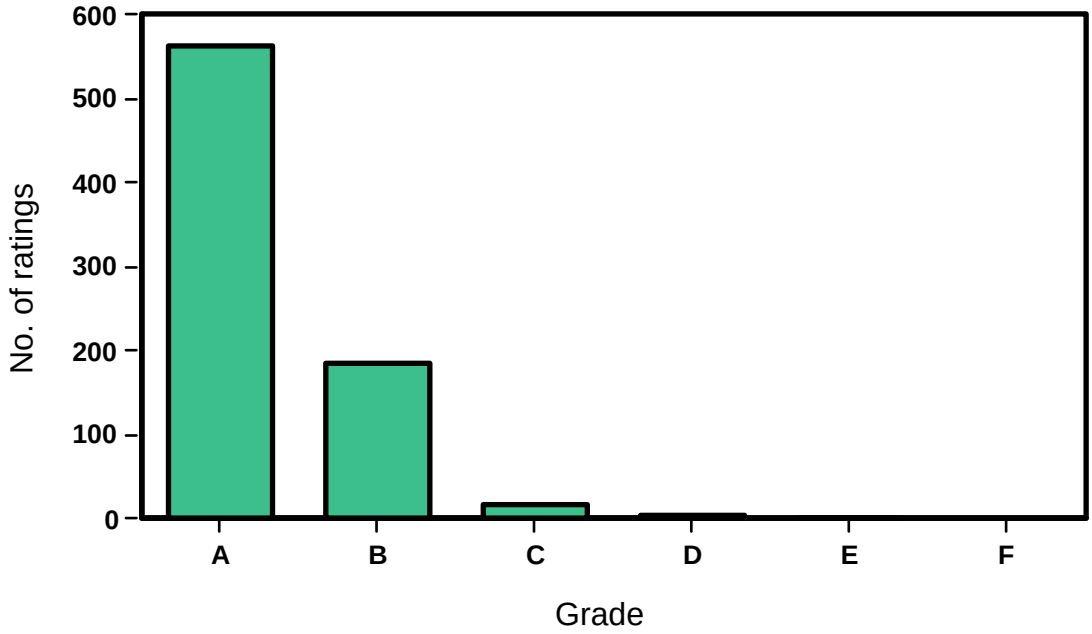


Fig. 6. Overall level of satisfaction of participants of training actions (WP1 to WP7)

The level of satisfaction of participants remained high, and the distribution of grades assigned by the participants is almost exactly the same as in 2003 and 2004, as it can be seen in Fig. 6.

Fig. 7 shows average effort (in person-months) per one training event. The average effort (1.27 p-m) is lower than in 2003 (1.67) and in 2004 (1.65). In 2005 in many cases training events were based on training materials already prepared. Events in WP1 and WP2 were new. In WP3 actual effort per event was much lower than 1.915 p-m shown on the graph. In WP3 major part of all efforts was in 2005 devoted to "AGBOT"[1] – a handbook on testing and design for testability jointly written and edited by the project partners.

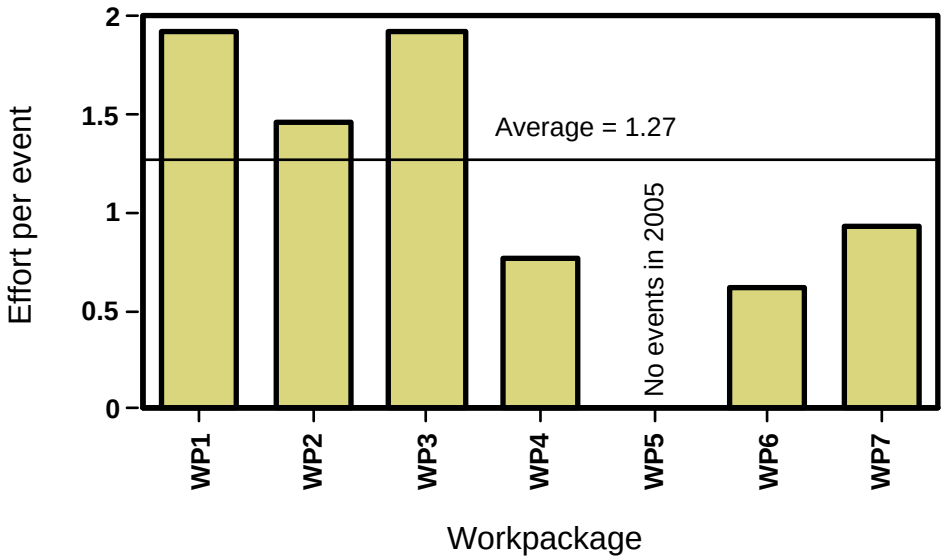


Fig. 7. Efforts in person-months per one training event (total effort declared by all partners in WPs divided by total number of events in these WPs)

1.3. Development of tools for training (WP8 and WP9)

Two workpackages are entirely devoted to development of new teaching tools: WP8 to development of new Web-based teaching tools (both new Web technologies and new contents) and WP9 to development of educational integrated circuits, to be used for students' experiments in university labs.

In WP8 extension of the project allowed to extend the portfolio of Web based tools and improve the existing ones. An agreement with EuroTraining has been reached in order to increase the cooperation with EuroTraining and other European projects and to include most of the training tools realized in WP8 into the EuroTraining catalogue. In the sense of EuroTraining, WP8 tools are module components targeted for the "Microsystems University Service". The Microsystems University Service was launched as an innovative training initiative to help the development of course modules in Microsystems technology. The initiative is inviting European universities, academic organizations and experts involved in Microsystems research and education to work alongside one another. The new programme

[1] AGBOT is an acronym which stands for "A Great Book On Testing" – our working code name of the book

will encourage them to combine competences, knowledge and know-how and to share educational resources. These might include laboratory and training facilities and newly created or updated lectures and exercise material. Universities that become a member of the Microsystems University Service will have the opportunity to select from the available educational components and include these in their own university programmes.

In WP9 design teams from 9 institutions (BUTE, FEISTU, IET, TUL, TULC, TUS, WUT and two subcontractors: AGH in Cracow and PUT in Poznan) three educational chips named: "DefSim", "TestAccess" and "AnaDig" have been designed and successfully prototyped.

In 2005 "DefSim2" chips manufactured in low volume batch (200+ pieces) were received by WUT from the foundry and all received chips were tested. About 10 faulty pieces were rejected, and good chips were sent in July to the partners. Special "plug and play" testing boxes were designed and their fabrication subcontracted to "VIGO System" commercial company (a Polish SME), which is now selling them to the partners. The testing boxes communicate with the host computer via USB interface and dedicated software. "AnaDig" prototypes were delivered to the partners in the beginning of 2005 and tested by all partners participating in this design work. Although the chip in general is functional, some design changes improving access to analog devices and blocks were introduced. The second version of the chip has been submitted by WUT to EUROPRACTICE in April. The prototypes came from the foundry in the end of July and were sent to the partners for testing.

All chips were presented and discussed at special session at MIXDES2005. "DefSim" chips have also been presented at a plenary session at "Microelectronic System Education" conference in Anaheim, USA. It seems that DefSim chips together with testing boxes and lab manual (in preparation) may become a commercial product and the best ways to commercialize this product are now investigated. "AnaDig" chips and relevant hardware and software will also be commercialized, the Hungarian "MicRed" SME is interested in it.

1.4. Promotional actions (WP10 and WP11)

These actions include conferences and other similar events with special REASON sessions, tutorials etc. (workpackage WP10) and actions promoting information technologies and microelectronics among school children (WP11).

There were two major conferences with REASON events associated: MIXDES 2005 in Cracow, Poland (already mentioned in Section 1.1) which was the last public event of the project, and 10th IEEE European Test Symposium in Tallinn, Estonia. The program of the European Test Symposium included 2 REASON tutorials and a workshop. The lecturers were Jose Luis Huertas from IMSE-CNM (Spain) and Yervant Zorian - Virage Logic (USA). The tutorials had wide international audience. The workshop was organized mainly to share experiences between workpackages WP3, WP7 and WP8.

Other conferences with REASON sessions and/or tutorials included:

- DDECS 2005 conference in Sopron, Hungary,
- CADSM 2005 conference in Polyana, Ukraine,
- Biennial Conference "Perspective Technologies" in Vladimir, Russian Federation.

Promotional and dissemination activities were also reported at COFAX 05 ICT exhibition in Bratislava, MEMSTECH conference in Ukraine and at three conferences in Belarus.

Three international conferences will be held in September 2005:

- DSD Euromicro symposium in Porto, Portugal,
- Electronics ET 2005 in Sozopol, Bulgaria,
- EWDTW 2005 in Odessa, Ukraine.

All of them include contributions of REASON partners (including a full session at DSD), but they cannot be considered REASON events for formal reasons – they will be held after termination of the project.

REASON is also promoted on the Web (main Web site: `http://reason.imio.pw.edu.pl/` and 9 national Web sites in Belarus, Bulgaria, Czech Republic, Germany, Lithuania, Poland, Romania, Russia and Slovakia). The partners agreed to maintain the sites after termination of the project and use them as repositories of useful information and training materials available in the public domain.

In the framework of workpackage WP11 more than 1000 schoolgirls and boys in Belarus, Latvia, Russia, Slovakia and Ukraine participated in various actions such as visits in research labs, special lectures and demonstrations, competitions etc. There were 12 such actions reported. For obvious reasons these actions were local. These actions included National Contest on Electronics for children of secondary schools in Latvia. A Web based encyclopedia illustrating problems of electronics, and in particular microelectronics is almost completed by LPU.

1.5. Travel grants

Travel grants for participants from Central and Eastern Europe were an essential aid helping to overcome financial barriers associated with expensive international travels. 45 travel grants were reported in 2005. All applicants eligible for travel grants received their grants.

1.6. Other activities

All activities in WP1 other than training events (such as purchases of hardware and software, new EUROPRACTICE memberships, analysis of industrial needs) have been completed previously. No such activities were reported in 2005.

Activities in WP12 have been limited to a minimum, as suggested by the reviewers. Only one tutorial "Frontiers of molecular microscopy for nano-investigations" was organized by BSUIR in Minsk on the occasion of the 4th Int. Conference "NANOMEETING'2005".

1.7. Response to the recommendations of the reviewers

No formal document was received after the review meeting in Sinaia, only the notes prepared by the reviewers during the meeting. These notes didn’t contain any specific recommendations. There were only remarks suggesting continuation of the activities after termination of the project. It is the intention of most partners to continue cooperation, to disseminate the results and to commercialize some of them. This will be discussed in detail in Part 3 of this report.

1.8. Deliverables

All deliverables are available; in particular, self-assessment and exploitation plan (D13.11) are included in this document. The only exception is D13.13, i.e. input for PROSOMA database. This database of ESPRIT results (`http://www.prosoma.lu/`) is no longer maintained. Other means of information and dissemination are planned, including the project Web sites.

1.9. Summary of activities in 2005

In the last six months of the project the REASON community continued project activities without any signs of “fatigue”. Several big public events such as conferences in Tallinn and Cracow gathered prominent speakers and wide international audience. Percentage of participants from industry in project training events was at the same level as in 2003 and higher than in 2004. Actions for children and youth were also continued. Three educational integrated circuits have been successfully prototyped; one of them manufactured in low volume batch is now almost ready as a candidate for commercial exploitation. New teaching tools developed in WP8 are now becoming module components targeted for the "Microsystems University Service” – a EuroTraining action. New links between research teams in the “old 15” EU countries and research teams from Central and Eastern Europe have been established, as it was demonstrated by participation of many REASON partners in consortia submitting proposals to Call 4 IST. In the opinions expressed by many partners the last period (January – June 2005 plus two additional months of July and August) was a good ending of the project.

Chapter 2
Summary of all project activities and their outcomes: 2002 - 2005

2.1. Facts and numbers

2.1.1. General data[2]

The project started on January 1st, 2002. All project activities were finished on June 30th, 2005 and the official project termination date is August 31st, 2005. Thus, the total duration of the project was 42 months plus two additional months (July and August 2005). The contractual limit of EU funding was 2 476 000 □.

The project consortium had 22 contractors from 18 European countries (see Appendix 1). All contractors (called also project partners) can be divided into 3 groups. Before May 1st, 2004 there were 5 partners from EU countries (Belgium, Germany, France, the Netherlands and the United Kingdom), 13 partners from EU candidate countries in Central/Eastern Europe (3 from Poland, 2 from Slovakia and single partners from Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Romania, and Slovenia) and 4 partners from the NIS countries (2 partners in Belarus, one in Russia and one in Ukraine). Among the EU partners there were 3 universities and 2 research institutes, and among the partners in the CEE and NIS countries two contractors were research institutes and all other contractors were universities. After EU enlargement (May 1st, 2004) 11 partners from the candidate countries found themselves in the enlarged EU and only two partners from Bulgaria and Romania remained in the candidate countries. In this report for presentation of all statistical data the partners are still divided into initial three groups:

- Partners from “old 15” EU countries: Belgium, Germany, France, the Netherlands and the United Kingdom (5 contractors),
- Partners from “new” EU member states and candidate countries: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia (13 contractors),
- Partners from NIS countries: Belarus, Russian Federation, Ukraine (4 contractors).

Many of the partners in the CEE and NIS countries had subcontractors (both commercial companies and academic institutions). It is worth noting that there were also institutions (in Bulgaria, Poland, Romania, Russia, Slovakia and Ukraine) that actively collaborated with the project consortium in spite of the fact that they were neither contractors nor even subcontractors and received no direct financial support from the project. Taking this into account one can estimate the total number of institutions directly involved in the project, with financial support or without, as not less than 50.

The project was divided into 13 workpackages (see Appendix 2).

2.1.2. Introductory actions (WP1)

These actions (workpackage WP1) included getting access to European research and educational infrastructure via EUROPRACTICE membership (for “newcomer” institutions), purchases and installation of state-of-the-art hardware and software, basic training, analysis of needs of local industries in CEE and NIS countries and informational and promotional

[2] In summer 2003 a special Web site for submission of reports about project events and activities has been developed and central database of all reports has been created. All statistical data related to years 2003, 2004 and 2005 were collected and processed using this database. In 2002 the database didn’t exist yet. Statistical data was extracted manually from dozens of reports (Word files) sent via e-mail to the coordinator. As a result, data for 2002 are probably somewhat less accurate.

actions. These actions were planned for the first 18 months but, following suggestions of the reviewers, they were extended until termination of the project.

RAL reported 16 new EUROPRACTICE members in CEE and NIS countries (including 3 project partners in Belarus, Russia and Ukraine) as a result of project actions. Project partners in CEE and NIS countries purchased 22 new workstations (4 of them not funded by the project) and many new PCs. New VLSI design labs for training and research were established in several partners' institutions. All project partners from CEE and NIS countries updated and extended their portfolios of EDA tools. New EUROPRACTICE members purchased licenses of EDA toolsets from CADENCE, MENTOR GRAPHICS, SYNOPSYS, ALTERA, XILINX and others. As a result, all project partners and many other academic institutions in CEE and NIS countries have now state-of-the-art hardware and software infrastructure for training and research in microelectronics. Basic training courses in usage of EDA tools were organized: international ones in Poland, local ones in many other countries. In almost all cases the lecturers were from experienced partner institutions from CEE and NIS countries (a lecturer from RAL took part in one of international courses in Warsaw).

One of the goals of introductory actions was to establish links with local industries. Project partners in Belarus, Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Russia, Slovakia, Slovenia and Ukraine attempted to find companies interested (at least potentially) in applications of microelectronics and microelectronic design, created databases of such companies and organized information events, seminars and intensive courses for local companies (mainly, but not only, SMEs). Since the countries involved are very different in size and economic conditions (ranging from the smallest new EU members: Estonia and Slovenia up to Russian Federation and Ukraine), the scale and scope of partner activities and results obtained also varied from country to country. In largest countries (Russia, Ukraine) REASON partners had possibilities to reach only SMEs from some parts of their countries. It was not possible to extend their activities to entire territories of Russia and Ukraine. In smaller countries REASON partners attempted to find and get in touch with all SMEs interested in applications of microelectronics and microelectronic design. The most promising results were reported from:

- Belarus, where two project partners helped to establish and launch new industrially oriented ASIC design centre and close collaboration with local IC manufacturer "Integral" has been established,
- Bulgaria, where the database of 350 enterprises has been created and direct links between technical universities and several industrial design centers have been established,
- Estonia and Slovenia, where total numbers of SMEs is not big but tight collaboration contacts (including joint projects) have been established,
- Romania, where large database of interested SMEs has been created,
- Slovakia, with good cooperation between technical universities and local semiconductor manufacturers (also in Czech Republic): ON Semiconductor and Freescale (formerly Motorola).

In all these countries and also in the Czech Republic and Russia[3] hundreds of engineers from local enterprises participated in numerous informational and promotional events and actions and also in other project training events not addressed directly to them. Details are provided in the next Section.

[3] Poland is not listed here because in Poland systematic actions of identification of SMEs and their needs started long ago (in 1995). They were continued at a somewhat smaller scale in the framework of REASON.

It is difficult to quantify practical results of the project actions addressed to local companies. Economic conditions in CEE and NIS countries are not favorable for development of high tech products by small companies. In surveys conducted by project partners most SMEs responded that they could use FPGAs in their new designs but could not invest in ASIC design. Even in these circumstances RAL reported two “First Use by Industry” agreements signed by companies for new ASIC designs. A new phenomenon is subcontracting of IC designs by large European and US companies to local design centers in Poland, Bulgaria and other CEE and NIS countries. These design centers are either independent companies or R&D centers established by parent companies. In both cases the centers benefited from project training actions and knowledge transfer.

2.1.3. Training, knowledge transfer and knowledge sharing (WP2 – WP7)

The total number of all public training events (courses, tutorials, lectures, special sessions at conferences etc.) organized in the years 2002 – 2005 was 291. The total number of participants in these events was about 7600. These numbers do not include participants in conferences, but do include participants in special REASON tutorials etc. accompanying conferences. About 3600 persons (47%) were from REASON partner institutions (including subcontractors). It is obvious that many participants, especially participants from REASON partner institutions, attended more than one event. Unfortunately it is not possible to estimate how many *different* persons attended REASON training events.

The next two figures illustrate development of the project training activities in time: numbers of events (Fig. 8) and total numbers of participants (Fig. 9). In 2002 the number of events and participants was relatively low because most events were in preparation. 2003, 2004 and 2005 were years of “full speed” of the project (note that for six months of 2005 the numbers of events and participants were approximately equal to 50% of the numbers for full 2003 and 2004 years).

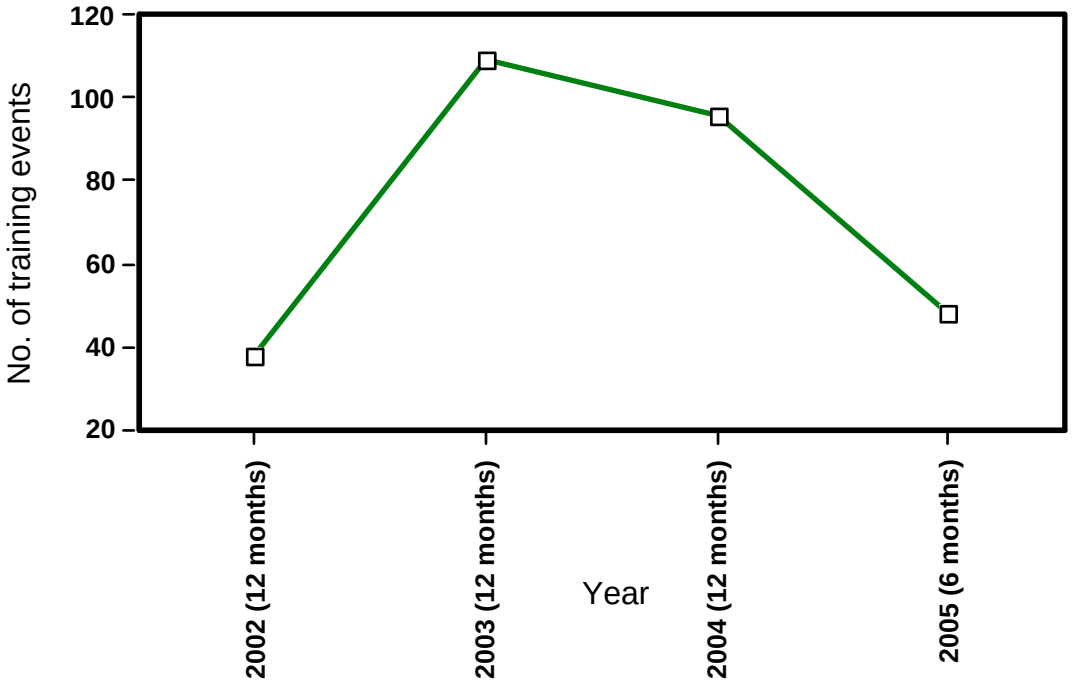


Fig. 8. Numbers of training events (note: in 2005 for 6 months only)

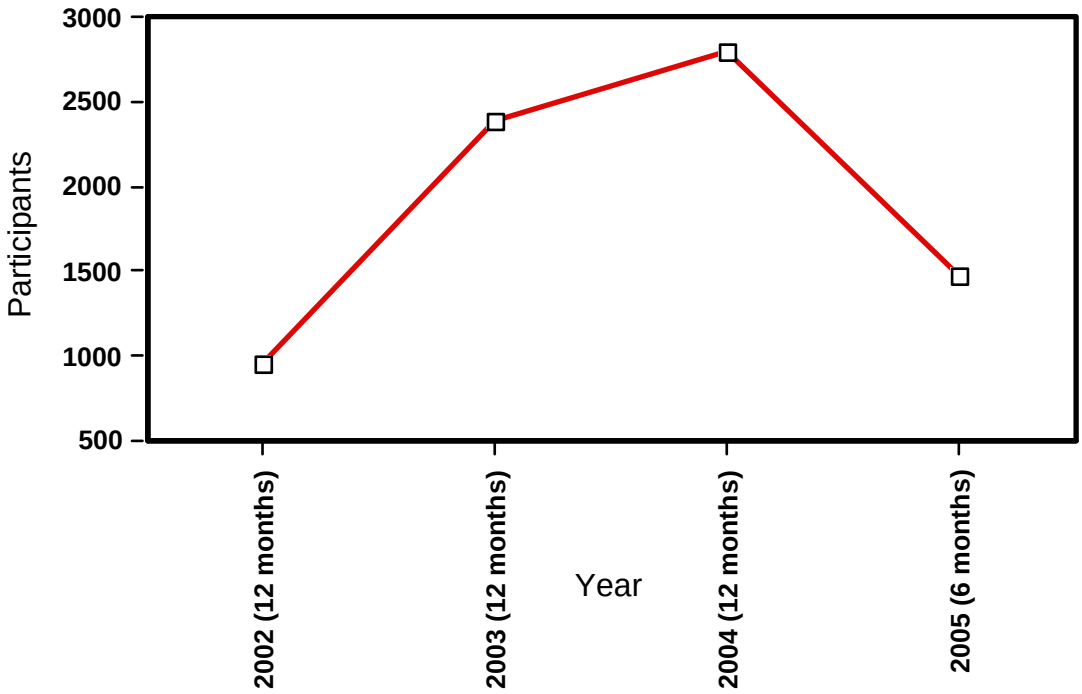


Fig. 9. Numbers of participants in training events (note: in 2005 for 6 months only)

All training events can be divided into two groups: national (local) ones and international ones. Local events were addressed to local audiences (many of them to local industries) and in most cases their working languages were national languages. International events were addressed to international audience. Their working language was English. Fig. 10 shows percentage of national and international events.

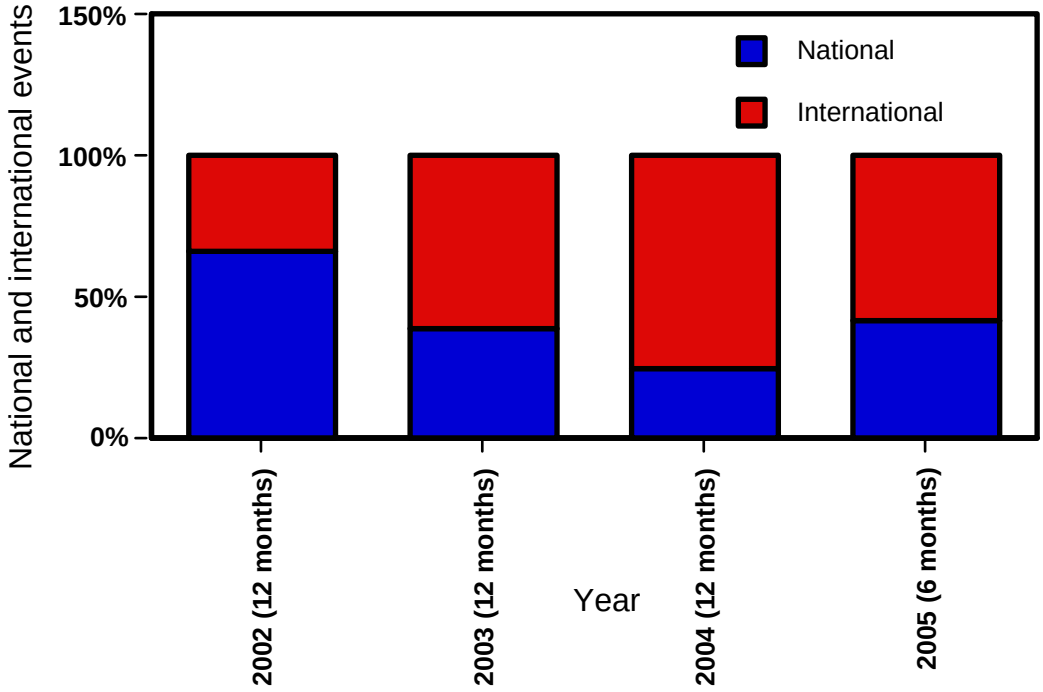


Fig. 10. Percentage of national and international training events

In the first project year (2002) most international training events were events already prepared by project partners from “old 15” EU countries, e.g. public intensive courses offered by IMEC to participants from REASON partner institutions at very favorable conditions. In 2003 and 2004 major part of international events were events organized by partners from CEE and NIS countries. Many events were organized jointly by two or more partner institutions. The lecturers in these events were from CEE and NIS countries as well as from “old 15” EU countries, some lecturers were invited from institutions outside the REASON consortium. They were from EU countries (France, UK, the Netherlands, Sweden) and from Switzerland, Canada and the USA. In 2003, 2003 and 2005 several events organized by partners from CEE countries were held in “old 15” EU countries (Sweden, Germany) and gathered mostly students from the “old 15” EU countries.

Relatively lower percentage of international events in 2005 resulted from time limitations. The best time for international training events is September and in 2003 and 2004 many international events were organized in September and first days of October. In 2005 all project activities were finished in the end of June.

Fig. 11 illustrates the geographic distribution of participants in REASON training events, and percentage of participants from REASON partner institutions.

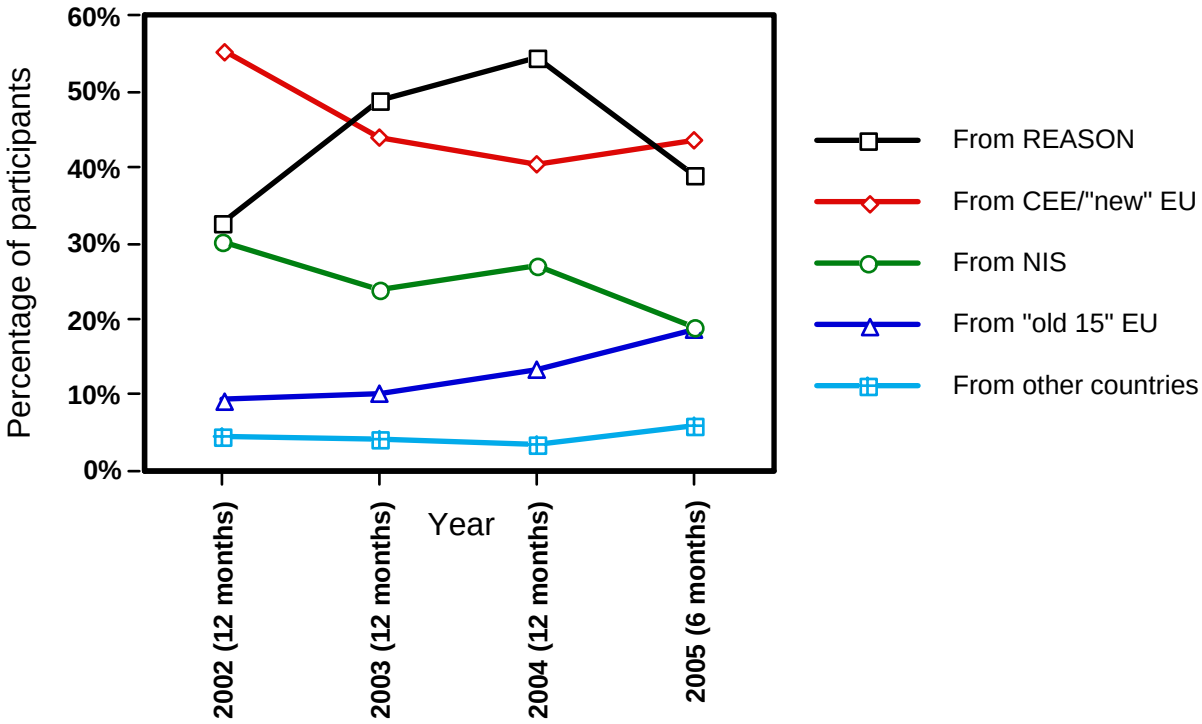


Fig. 11. Geographic distribution of participants in REASON training events, and percentage of participants from REASON partner institutions

The training events were organized in 19 countries: all partners’ countries (except United Kingdom) and in Sweden and Turkey. The geographic extension of the project is illustrated in Fig. 12 (next page). This area extends from the Atlantic Ocean in the west (France) to the Pacific Ocean in the east (Vladivostok in Russian Far East), from the Baltic Sea in the north (Sweden, Germany, Poland and Baltic states) to the Mediterranean and Black Seas (Bulgaria, Romania, Turkey, Crimea in Ukraine).

Fig. 12. Sites of REASON partner institutions (red dots) and sites of international REASON events (green stars)

The majority of participants of international events were from Central/Eastern Europe and NIS countries. However, it is worth noting that percentage of participants from "old 15" EU countries steadily increased from initial 9% in 2002 to final 19% in 2005. 4% to 6% of all participants were from third countries[4]. Among them there were people not only from Europe but also from such remote countries as Armenia, Brazil, Canada, China, India, Israel, Japan, Korea, Mongolia, South Africa, Turkey, Yemen, Vietnam and the USA.

International events gathered mainly academic audience (students and academic teachers) while many local training events were addressed to participants from local enterprises. On average, 15% to 25% of all people attending training events were from industry (Fig. 13).

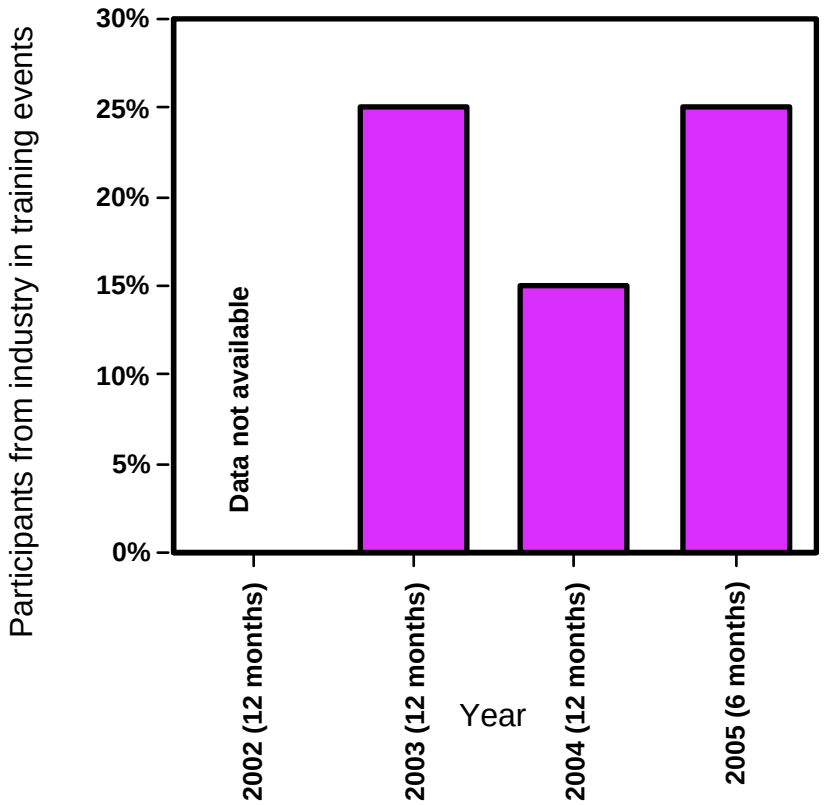


Fig 13. Percentage of participants from local enterprises in all training events[5].

The quality of training events and level of satisfaction of participants were measured by means of event evaluation forms (see Appendix 3). The same forms were used for all events (except for IMEC courses; IMEC has its own quality assurance system). The participants could assign the overall rating from A (highest) to F (lowest). The number of forms returned by the participants varied from 53% to nearly 100%. In general, the satisfaction level was quite high and steadily increasing. Only in the first year there were more "B" than "A" ratings. The percentage of "C" ratings dropped from 9% in 2002 to 2% in 2005 (Fig. 14).

[4] Third countries mean here all countries except the 18 REASON partner countries.
[5] For 2002 reliable data are not available. Some event organizers didn't provide this information. Starting from 2003 Web based reporting system enforced completeness of statistical data.

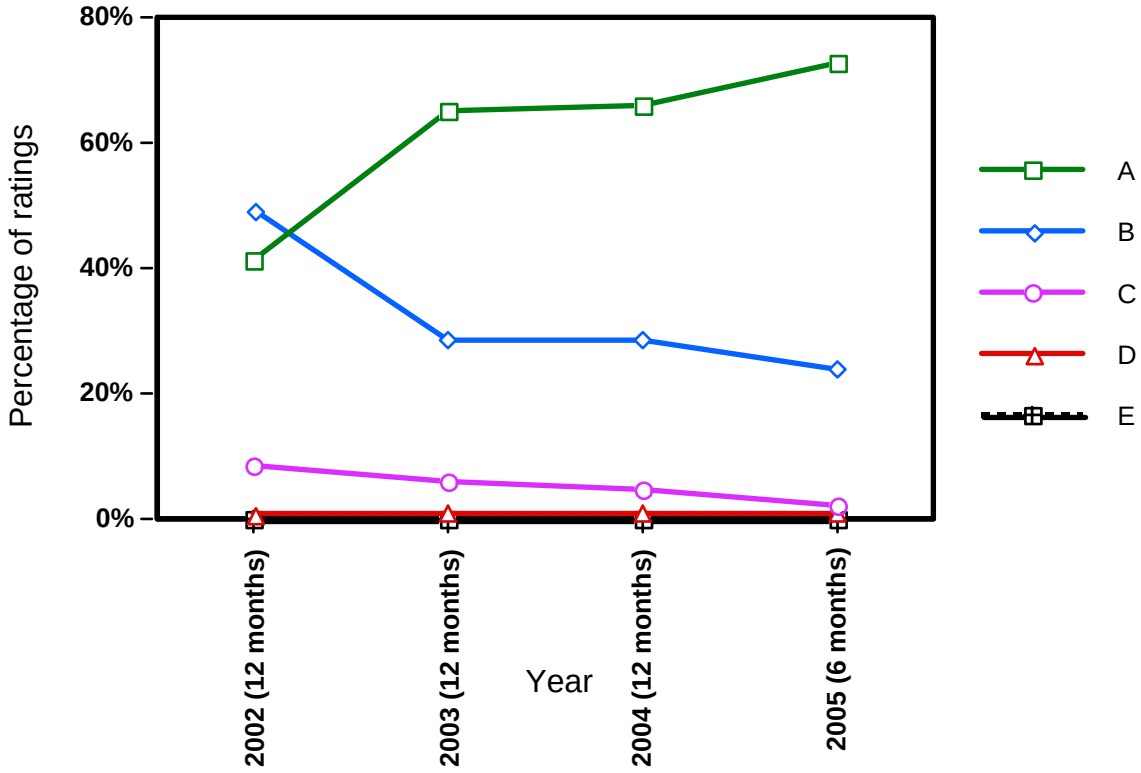


Fig. 14. Results of quality evaluation of training events[6]

Finally, dividing number of events by efforts in person-months declared by the partners one can estimate the average amount of labor necessary to prepare one training event. Fig. 15 shows results of such calculation. The average for the whole project is 1.87 person-months per one event.

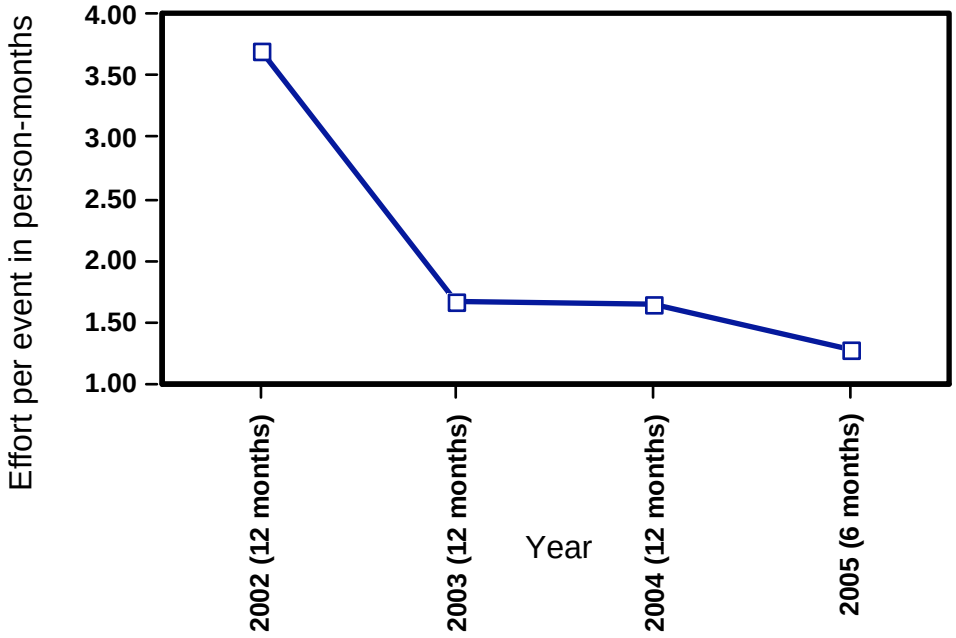


Fig. 15. Average effort per one training event in workpackages WP1 to WP7

[6] Results from IMEC courses not included

Actual efforts necessary to prepare one training event were lower than the estimates shown above. In some workpackages, especially in WP1 and WP3, large part of the overall efforts was devoted to activities other than preparation of training events[7]. In 2002 the average effort was much higher than in the years 2003 to 2005 because many events prepared partially or fully in 2002 took place in 2003 and 2004.

2.1.4. Development of new tools for training (WP8, WP9)

The aim of two workpackages was to develop new tools for training: new software tools (technologies and contents for distance training - WP8) and educational integrated circuits for demonstration of various aspects of microelectronic design in student labs (WP9).

In the frame of WP8 45 various software based teaching tools were developed by 10 project partners. Most of them are complex interactive Java applets illustrating various problems of microelectronics: semiconductor processing and IC technology, digital design, testing etc. Among the tools there is also one full multimedia based interactive course on System C developed by IMEC. A special Web site hosting these tools has been set up and is maintained by TUI. It provides rapid access to the tools, allows to test them and to submit new ones. The tools are at this moment accessible only by the project partners but will be made available via the EuroTraining "Microsystems University Service" action.

The outcomes of WP9 are three CMOS integrated circuits:

- “DefSim” – for experimenting with various classes of physical defects in digital CMOS circuits, training in testing and design for testability,
- “TestAccess” – for experimenting with various techniques of scan based testing,
- “AnaDig” – for demonstrations of properties of components of analog and digital ICs, from single devices (active, passive and parasitic) to basic building blocks (digital gates, analog blocks) and more complex circuits (e.g. SC filter clocks).

DefSim has been prototyped, tested and low volume batch of chips (200 pieces) has been ordered. These chips (called “DefSim2”) have been delivered to interested partners. A special test box for experiments in student labs has been designed and is now manufactured and sold as a commercial product by VIGO S.A. – a Polish SME. This test box is computer controlled by means of USB interface and dedicated software.

TestAccess has been prototyped and tested. It is functional but its designers are planning to design a new, improved version.

AnaDig has also been prototyped and successfully tested. A second improved version (AnaDig2) has been designed and prototyped and is in testing at the moment of writing this report[8].

Laboratory manuals with examples of students’ exercises are in preparation.

[7] In WP1: installation and mastering of new hardware and software, establishing links to local enterprises and analysis of their needs; in WP3: writing and editing a textbook on testing and design for testability.

[8] Works on this chip have been seriously delayed due to problems beyond control of the REASON consortium: problems with design kit and cell libraries and manufacturing problems in the foundry.

Design of these chips was an interesting organizational exercise: all three chips were jointly designed by design teams from several partners' institutions (BUTE, FEISTU, IET, TUL, TTU, TULC, TUS, WUT and two subcontractors: AGH in Cracow and PUT in Poznan).

2.1.5. Promotional activities (WP10, WP11)

Promotion of the project beyond the REASON consortium was the topic of WP10. Public REASON events were organized at the following international conferences[9]:

- MIXDES ("Mixed Design of Integrated Circuits And Systems") 2002, 2003, 2004 and 2005 (Wroclaw, Lodz, Szczecin, Cracow in Poland),
- IEEE workshops DDECS ("Design and Diagnostics of Electronic Circuits and Systems Workshop") 2003, 2004, 2005 (Poznan, Poland; Stara Lesna, Slovakia; Sopron, Hungary),
- DSD Euromicro Symposium 2002, 2003, 2004 (Dortmund, Germany; Antalya, Turkey; Rennes, France),
- ECS ("International Conference on Electronic Circuits and Systems") 2003 (Bratislava, Slovakia),
- BEC ("Baltic Electronic Conference") 2002, 2004 (Tallinn, Estonia),
- WDDT ("Workshop on Digital Design and Test") 2004 (Tallinn, Estonia),
- CADSM/TCSET series of conferences 2003, 2004, 2005 (Slavskie, Ukraine),
- IEEE European Test Symposium and IEEE European Board Test Worshop, 2005 (Tallinn, Estonia),
- "Electronics ET" 2002, 2003, 2004 (Sozopol, Bulgaria),
- CAS ("International Semiconductor Conference") 2003, 2004 (Sinaia, Romania),
- "Nanomeeting" 2003 (Minsk, Belarus),
- International Scientific and Practical Conference "Higher educational institutions' science, industry, international co-operation", 2004, (Minsk, Belarus),

and at several conferences held in Belarus and Russia for Russian-speaking audiences[10].

One new conference (EWDTW: "East-West Design & Test Workshop") with wide international participation and rich REASON program has been organized for the first time in Alushta (Crimea – Ukraine) in 2003 and became a permanent annual event.

The project was also promoted at annual COFAX ICT Exhibitions in Bratislava, Slovakia, at a special workshop organized in Bucharest on the occasion of the EC conference "IST for Broadband Europe" (2002) and on promotional events addressing industrial audiences in Belarus, Bulgaria, Romania, Russia, Slovakia. REASON related papers were presented at many other international conferences. The total number of such journal and conference papers (based on the partners' lists of publications) is not lower than 260.

[9] Either as parts of the conference program such as special sessions or as additional accompanying events such as intensive courses or tutorial days.

[10] Details can be found in Workpackage 10 overviews available in the database of reports on the attached CD-ROM.

Another important promotional channel was the Web. The main Web site[11] has been set up and is maintained since January 2002. It is linked to 9 national Web sites (in Belarus, Bulgaria, Czech Republic, Germany, Lithuania, Poland, Romania, Russia and Slovakia).

Information about the project could be found in professional journals in several countries, including widely distributed “IEEE Devices and Circuits” journal. In Ukraine in 2003 two TV channels presented two different programs about the project.

Workpackage WP11 was devoted to promotional actions addressed to schoolchildren and students. The main aim was to raise their interest in science and technology in general, and in electronics and microelectronics in particular. All actions for schoolchildren were local for obvious reasons. They included visits to university labs and industrial plants, lectures, demonstrations and seminars in schools and also courses and seminars for teachers. 86 such events were reported, and the total number of participants was not less than 5500[12]. These events were organized in Belarus, Bulgaria, Estonia, Latvia, Romania, Russia, Slovakia and Ukraine. Fig. 16 shows numbers of events in the years 2002 to 2005.

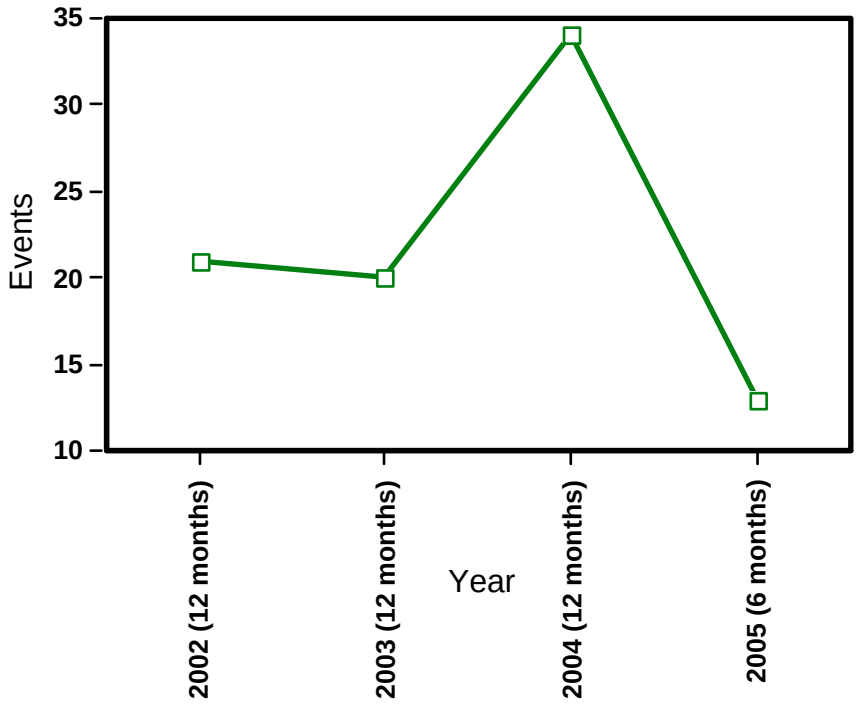


Fig. 16. Events addressed to schoolchildren, teachers and students

In Bulgaria, Estonia, Latvia and Slovakia REASON partners organized contests for secondary school students. University students participated in two international competitions organized on occasions of international conferences:

- International Student Contest "Microelectronic and Microsystem Design" associated with the ECS 2003 conference in Bratislava, Slovakia, organized by FEISTU,

[11] http://reason.imio.pw.edu.pl/

[12] The exact number is not known because it was not possible to count all participants in some events such as “Open Door” days at university labs.

- international "Young Scientists Competition" associated with the COE 2004 (Optoelectronic and Electronic Sensors) conference in Wroclaw, Poland (organized by Wroclaw University of Technology in cooperation with FEISTU).

A very interesting initiative is the “Teenager Microelectronic Encyclopedia” – a Web based collection of texts, illustrations, applets illustrating basic concepts and physical phenomena, biographies of famous scientists etc. in attractive graphic form. It has been developed by LPU, and is currently available in English[13].

2.1.6. WP12 – an “open” workpackage

The main objective of this workpackage was to include in the project new actions that would address new developments in microelectronic technology, microelectronic design and microsystems such as nanotechnologies, biology inspired technologies etc. However, following suggestions of the project reviewers activities in this WP were limited to a minimum. 10 events were reported (in Belarus, Bulgaria and Poland, organized by BSUIR, BSU and TUS), 8 of them international (lectures and a very interesting tutorial on foundations of nanoelectronics prepared by prominent scientists from Belarus and Russia and presented twice: in Minsk, Belarus (in Russian) and in Szczecin, Poland (in English). All events were attended by 431 participants. Resources initally allocated to actions in this workpackage have been reallocated to other workpackages, mainly for actions addressing local industries.

2.1.7. Travel grants

Wide international participation in project events, and especially in events taking place in “old 15” EU countries, would not be possible without travel grants. Travel grants for participants from Central and Eastern Europe were an essential aid helping to overcome financial barriers associated with expensive international travels. Travel grants were available mainly for REASON events organized in “old 15” EU countries. For most events in CEE and NIS countries travel grants were not available, with some exceptions (such as travel grants for students participating in student design contests or in some intensive courses and summer schools). The total number of travel grants was 292, and average amount of a grant was about 270 €. Financial support was provided for travel and lodging expenses only, all other expenses had to be paid by grantholders themselves. All requests for travel grants received from eligible persons were approved. Three travel grants were provided for non-European participants[14] (one from Mongolia, two from Armenia). Most grants were paid from the budget of the project coordinator, but other project partners organizing international events also provided grants. Fig. 17 shows numbers of travel grants provided in the years 2002 – 2005.

Travels of scientists invited as lecturers to REASON training events from outside the consortium were also in many (but not all) cases supported financially from the project budget, but these expenses are classified as travel and subsistence costs, not travel grants.

[13] At the moment of writing this report the “Teenager Microelectronic Encyclopedia” is being moved from temporary Web host: `www.omegatech.com.ua/tme` to the permanent one: `www.tme.org.ua`
[14] With approval of the EC project officer.

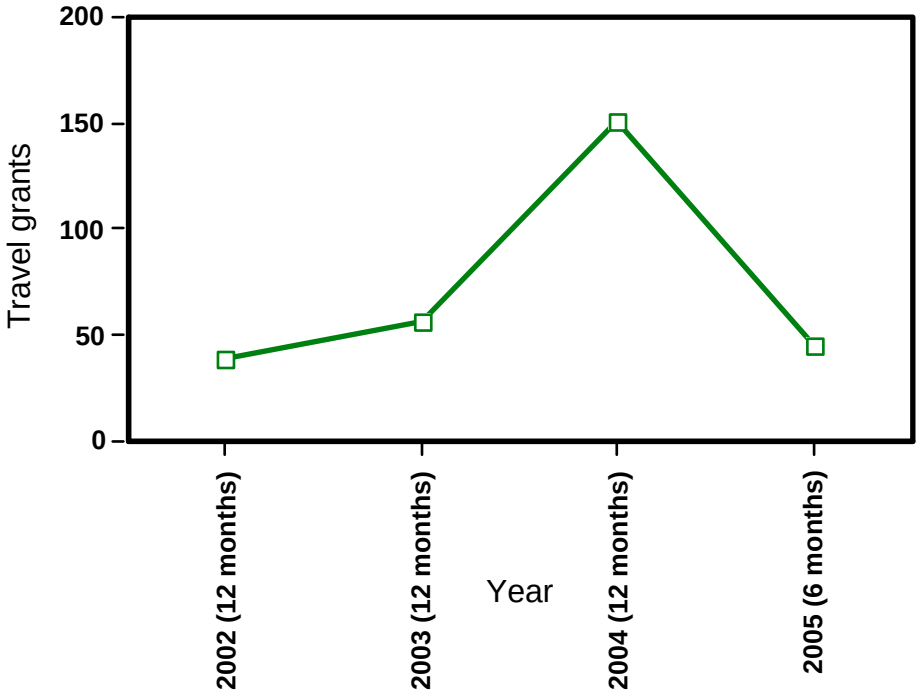


Fig. 17. Number of travel grants in the years 2002 – 2005

2.1.8. Coordination

The project had 22 contractors and 13 workpackages. Every WP had many contributors, and every partner contributed to several WPs. This resulted in a complex "network" of dependencies. Planning and especially scheduling events in time was in this situation quite difficult. Fortunately all workpackage leaders did an excellent job coordinating their WPs. Good atmosphere in the consortium helped a lot to overcome coordination problems. Two technical aids were essential: the main project Web site with private “for partners only” domain (maintained by the project coordinator) and the REASON e-mail reflector maintained by Dr Bedrich Weber from FEISTU. E-mail communication between project partners was very intensive. E-mail archive of the coordinator contains from 100 to 300 e-mails per month.

Reporting after the first project year was a nightmare. 22 contractors, 13 workpackages, dozens of project events and actions resulted in submission of hundreds of files in various formats with materials for reports and hundreds of megabytes of deliverables in electronic form to the workpackage leaders and the coordinator. Even introduction of standard templates for preparation of partners’ reports didn’t help much. Tracking what was submitted, what was missing, which version was the most recent etc. and presentation of all information in a uniform and well-structured form proved to be extremely difficult and time consuming. To streamline the reporting process, simplify collection of information from partners and enforce completeness and uniformity, special Web-based reporting system has been developed. It was used for the first time in summer 2003 for preparation of semi-annual progress report. In December 2003 and July 2004 its functionality has been enhanced, bugs fixed and the system became the main tool for delivery of reports and collection of data for project progress reports. Appendix 4 describes functionality of the reporting system in more detail.

2.1.9. Allocation of efforts

The sum of all efforts reported by the partners equals 1042.5 person-months, and the EU financial support for personnel costs equals 1 166 464 €[15]. This gives about 1120 € per one person-month (without overheads). The cost of one person-month varies from one partner to another, with the minimum value of 211 € and the maximum value of 8363 €.

Figures 18, 19, 20 and 21 illustrate allocation of efforts to workpackages. Sums of efforts declared by all partners are shown.

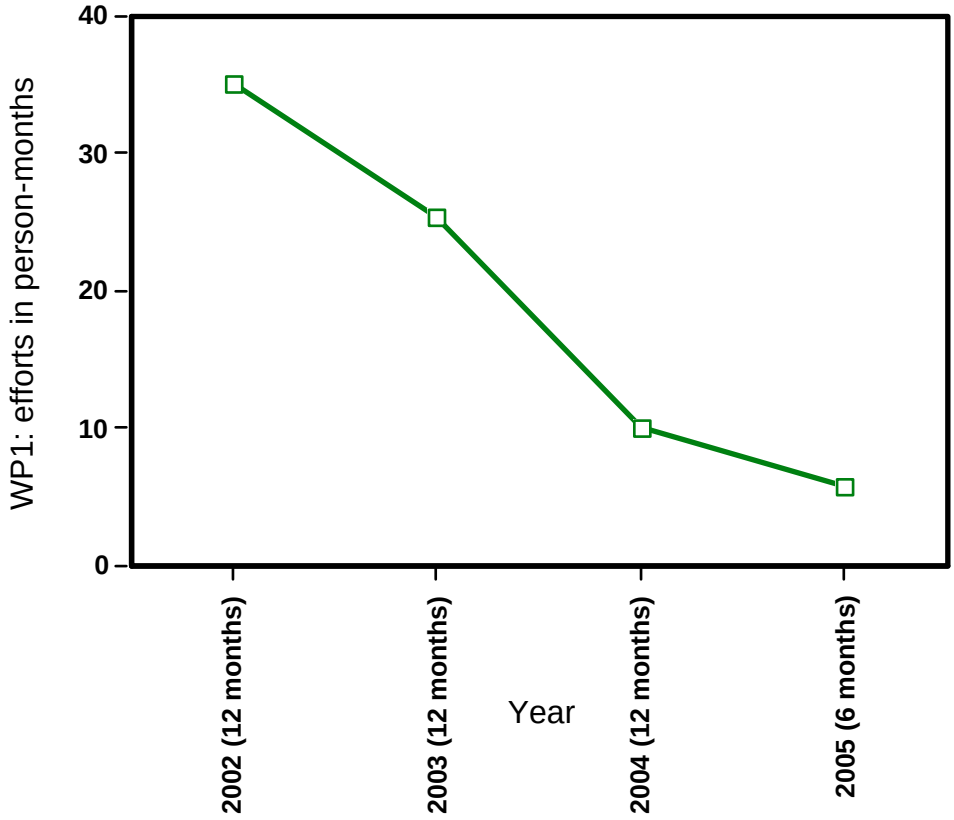


Fig. 18. Efforts in person-months in workpackage 1

As expected, efforts in WP1 (introductory actions) were the highest in the first year and quickly decreased.

Efforts in workpackages WP2 – WP7 (training events, Fig. 19 on the next page) show correlation with the number of training events (see Fig. 8). The only exception is WP4, where the peak was observed in 2004, not 2003. This is a result of intensification of activities in this workpackage (suggested after 2nd project review). New international training events were added to the workplan for 2004 and successfully completed.

[15] Predicted in the project budget. Actual amount is not known at the moment of writing this report because cost statements for 2005 are not prepared yet.

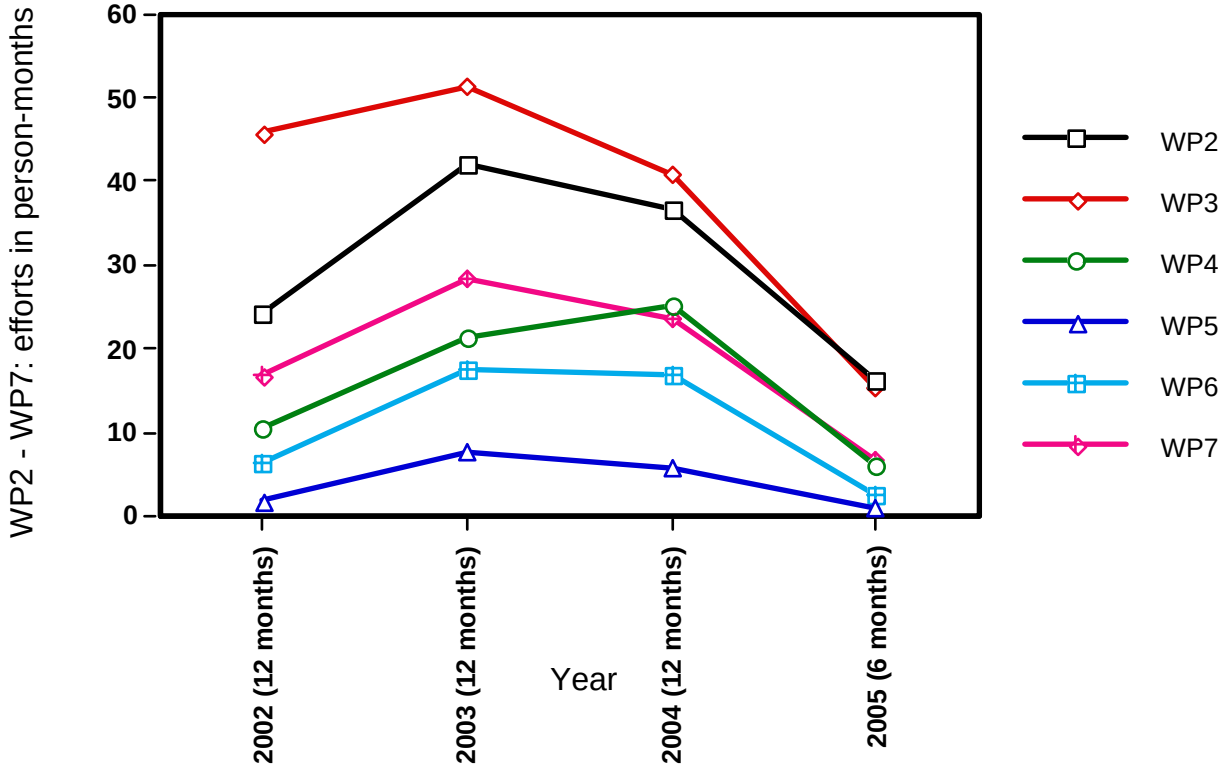


Fig. 19. Efforts in person-months in workpackages 2 – 7

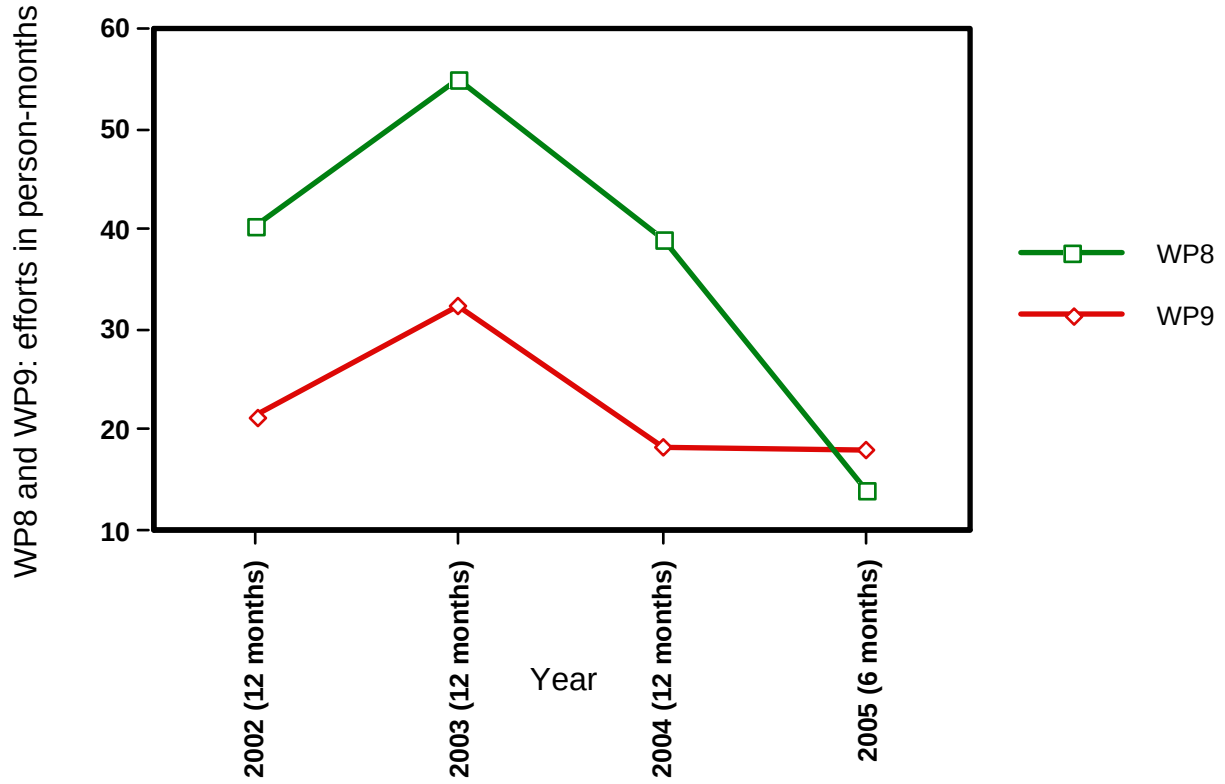


Fig. 20. Efforts in person-months in workpackages 8 and 9

Efforts in WP8 (Fig. 20) follow the same trend as efforts related to training events. Efforts in WP9 also show a maximum in 2003 but do not decrease in 2005. 2003 and 2004 were the years of design of three educational ICs and in 2005 efforts were focused mainly on development of laboratory boards and measurements. One of the chips has been partly redesigned and submitted to EUROPRACTICE for prototyping. This is why the efforts in the 6 months of 2005 were at the same level as during 12 months of 2004.

Efforts in workpackages WP10 to WP13 are shown in Fig. 21.

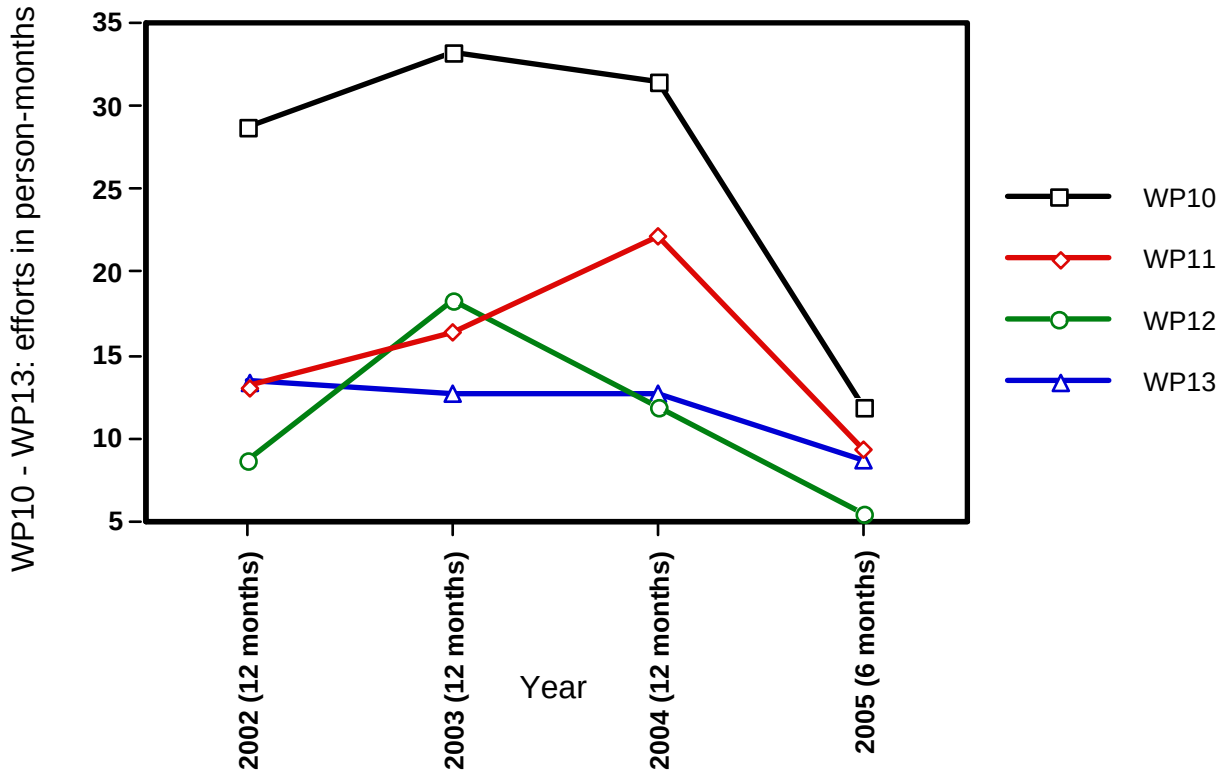


Fig. 21. Efforts in person-months in workpackages 10 – 13

In WP10 efforts were devoted mainly to organization of special events accompanying conferences. The conferences that are held in September and later could no longer be supported in 2005. This explains much lower effort level in 2005 than in 2002, 2003 and 2004. In WP11 (actions for schoolchildren) efforts were distributed rather evenly with exception of one partner who organized large number of events in 2004 and created the peak of efforts in this year. In WP12 efforts decreased quickly in 2004 and 2005 following recommendations suggesting to limit activities in this WP to a minimum. Finally, coordination efforts (WP13) were approximately the same in all project years.

2.2. Outcomes vs. project goals

In this Section outcomes of the project will be compared with the expected results defined in Annex I to the contract. Quotations from Annex I will be printed in italics.

> *Direct results for the project partner institutions from Central and Eastern Europe:*
>
> *(…) It is expected that, as a result of this project, the following goals will be achieved:*
>
> • *three academic institutions will join the EUROPRACTICE action, purchase new equipment and install CAD software from EUROPRACTICE; this will allow them to upgrade their training in microelectronic design and base this training on industry standard CAD tools,*
>
> • *all other project partners will enhance their portfolio of installed and used CAD tools by new tools (mainly from EUROPRACTICE) for system on chip design, and as a result will be able to offer new or updated courses in microelectronic design;*
>
> • *all project partners will participate in advanced courses, summer schools, workshops and seminars organized together with EU partners and as a result will be able to enhance their research competencies, start new research projects and offer more advanced training to their students; it is expected that these actions will involve at least 100 to 150 researchers and academic teachers from partners' institutions;*
>
> • *joint action of development, prototyping and fabrication of educational VLSI chip (EDUCHIP) will result in acquiring more practical skills at partner institutions concentrating so far on more academic way of teaching and doing research.*
>
> *Results for institutions from Central and Eastern Europe associated with the project as subcontractors*
>
> *(...) The academic and research subcontractors will be able to enhance their portfolio of installed CAD tools and acquire new skills in their usage. The industrial partners will be able to strengthen their links with academia by participation in actions of the project and joint work with academic partners. It is expected that some subcontracting institutions will join EUROPRACTICE.*

As expected, 3 project partners from Belarus and Ukraine joined EUROPRACTICE. In addition, 13 other institutions from CEE and NIS countries became EUROPRACTICE members. Some of them were subcontractors but there were also institutions participating actively in project actions without any direct financial support. All new EUROPRACTICE members as well as many “old” members purchased and installed new CAD software. 22 new workstations and other hardware together with extended software base resulted in substantial enhancement of resources for training in the countries of Central/Eastern Europe including Belarus, Russia and Ukraine. Basic training organized in the framework of workpackage 1 helped to start using the new hardware and software. It is worth noting that this training was arranged in most cases by more experienced partners from Central and Eastern Europe. Training was extended also to local industries (15% to 25% of participants in training events were from local industries but in some courses, especially in WP1, this participation was at the level of 60% - 80%).

As a result of purchases of new hardware, software and EUROPRACTICE memberships new VLSI design labs have been created in several partners' institutions and academic curricula have been enriched with VLSI and SoC design topics and practical training in usage of world standard state-of-the-art CAD tools.

About 5700 persons from academic and research institutions (among them about 3600 from REASON partner institutions) attended REASON training events. Obviously many of them attended more than one event and were counted several times, but even if we assume that every person attended on average 5 different events, we see that the target of 100 to 150 academic teachers and researchers involved in training has been exceeded by an order of magnitude.

Development of three (instead of planned one) educational integrated circuits indeed helped some partners to acquire practical skills in VLSI design. Two partners have never before tried to design a real chip. Even experienced partners learned a lot because the educational chips needed many nonstandard technical solutions. Development of these chips was also an exercise in distributed engineering: two, three or more design teams in different institutions and countries working together on the same piece of silicon. All three designs were completed successfully, and an important side effect was that joint work created very tight links between design teams and paved the way toward future cooperation.

Subcontractors – both academic and industrial – participated in numerous project actions cooperating in organization of project training events and even organizing some events independently, taking part in design of educational chips and attending project events. As already mentioned, even some institutions receiving no direct financial support took active part in some project actions. A very good example is Kharkov National University of Radio Electronics in Kharkov, Ukraine, which has become the main organizer of East-West Design and Test Workshop – an international conference launched as one of REASON events in 2003, which became a permanent annual event. As already mentioned above, 13 institutions from CEE and NIS countries, many of them being REASON subcontractors, became EUROPRACTICE members.

> *Results for other academic and research institutions in Central and Eastern Europe*
>
> *There are many more academic and research institutions in CEE countries that will neither participate as contractors nor as subcontractors. However, many project actions will be open to everybody. Therefore, it is expected that these institutions will also be able to achieve such goals as enhancing their competencies and skills and as a result offer more advanced training and start new research projects. It is difficult to quantify these results, but it is expected that the total number of researchers, academic teachers, PhD students and engineers directly participating in open project actions (workshops, seminars, special sessions at conferences etc.) will be not less than several hundred.*
>
> *It is expected that some academic institutions, which are neither project partners nor subcontractors, will join EUROPRACTICE.*

The majority of project training events (nearly 100%) were open to everybody. About 4000 persons from institutions not in the REASON consortium attended project training events. Although it is not possible to determine precisely how many *different* persons attended these events, it is rather obvious that the expected number ("*not less than several hundred*") was exceeded. REASON partners in such countries as Bulgaria, Romania, Russia, Ukraine

reported that some universities started new directions of training and research as a result of project actions and became EUROPRACTICE members. Examples include technical universities in Varna and Gabrovo (Bulgaria) or Technical University in Tomsk, Russia.

> *Results for local industries in Central and Eastern Europe*
>
> *(…) One of the actions of the project is aimed at identification of potential industrial target institutions in CEE countries. Once completed, it will help to address the real needs of all the identified interested enterprises.*
>
> *Actions of the project include information and promotional events addressed to SMEs and other industrial institutions and development and deployment of Web-based information and training materials addressed to engineers from the industry. As a result, the following goals will be achieved:*
>
> • *databases of enterprises interested in microelectronic design will be created and links with these enterprises will be established,*
>
> • *Web sites addressed to local industries in CEE countries, with information and training materials, will be open in these countries,*
>
> • *training courses for local industries will be developed and offered in the countries where this will be justified by sufficient demand.*

Extensive databases were created in most partners' countries. In big countries (Russia, Ukraine) they are "local", i.e. limited to regions close enough to the project partner institutions. About[16] 30 training events addressing specifically SMEs were organized in Belarus, Bulgaria, Czech Republic, Romania, Russia, Slovakia, Slovenia. Many other events, although not directed specifically to industry, had significant percentage of participants from industry. As mentioned previously, 20% to 25% of all persons attending REASON training events were from industry. However, demand for such training varies very strongly from country to country. For example, two REASON partners in Poland prepared in 2003 a special one day promotional and training event for Polish SMEs specializing in electronic equipment for security applications. About 40 such companies were identified in Poland. Despite wide distribution of information (via e-mails, Web portals, technical journals and at specialized trade fair) the event had to be cancelled – only one person registered for it[17]! On the other hand, training events in other countries mentioned above were reported as quite successful. Information for SMEs is available on some national REASON sites and at specialized sites[18].

Analysis of the needs of local enterprises confirmed widespread opinion that SMEs in CEE and NIS countries consider only FPGAs as application specific microelectronic technology affordable for them. Several partners (VSTU, TULC, UOL, TUS, KTU, FEISTU; also TUE contributed) answered to this need organizing training in FPGA oriented SoC synthesis.

It is worth noting here that response of SMEs to actions promoting applications of microelectronics, microsystems and SoCs depends not only on the quantity and quality of these actions, but on economic conditions and market needs. Development of state-of-the-art deep submicron technologies is dictated by trends toward high speed computing and wireless

[16] It is not possible to count exactly how many such events were organized because many events had mixed academic-industrial audiences.
[17] Participation was free of charge.
[18] See e.g.: http://www.adec.elka.pw.edu.pl/

communication technologies and, on the other hand, by competition on the market of commodity products manufactured in large volumes (memories, microprocessors etc.). As a result, older relatively inexpensive technologies are being phased out and replaced by more advanced ones, offering better performance and higher circuit complexity but raising the cost of prototyping and low volume manufacturing to levels prohibitive for most SMEs. The existing ASIC business model is becoming economically obsolete. Either a new one suitable for SMEs will be worked out or SMEs will have to abandon dreams about ASIC design. Broader discussion of this topic is, however, beyond the scope of this report.

Even in these circumstances RAL reported two “First use by industry” agreements signed by companies from CEE countries.

Many REASON partners (In Bulgaria, Poland, Romania, Slovakia) reported new links with industrial design centers of companies (large and small, within these countries or abroad). A good example is Bulgaria where new IBM and AMI Semiconductor design centers were established in Sofia with the active participation of the ECAD laboratory of TUS. Many designers from Fabless, Melexis and Raysat companies were retrained and actively participated in the REASON events. Other examples can be found in partners’ reports in the database of reports on the attached CD-ROM.

> *Practical results for microelectronic education in Europe*
>
> *Many project events such as workshops and special sessions at conferences will be open to everybody, and information about them will be widely distributed throughout Europe. Partners from Central and Eastern Europe will be actively contributing to these project events in the areas where they have already developed high level of competencies and experiences. In this way diffusion of knowledge will be in both directions: West to East and East to West. Training experiences will be also shared with partners from EU countries at such events as European Workshops on Microelectronic Education (EWME). Other important expected results are:*
>
> • *design, prototyping and fabrication of EDUCHIP - a special VLSI chip for microelectronic education, which will be available for universities throughout Europe,*
>
> • *development of several training courses that will be later offered to everybody under the EUROTRAINING umbrella.*
>
> *In addition, actions aimed at raising interest in science, technology and in particular in microelectronics among high school students will result in increased number of good candidates for university studies related to microelectronic design.*

Almost all partners reported that the project helped and encouraged them to develop new curricula in microelectronics, microsystems, SoC design, testing and testability of electronic systems.

“*Diffusion of knowledge in both directions: West to East and East to West”* is one of key achievements of the project. Although it is obvious that “*West to East”* was the prevailing direction, diffusion in the opposite direction was quite substantial, leading to demonstration of high competencies of partners from CEE and NIS countries to their “Western” colleagues. Examples include:

- courses prepared by TTU given in Sweden and Germany,

- summer schools in Poland and Slovakia with lecturers from both “West” and “East”,
- tutorials and tutorial days associated with international conferences (MIXDES, BEC, ECS, EWDTW, European Test Symposium) with lecturers from CEE and NIS countries and participants from “old 15” EU countries and other countries,
- educational VLSI chips developed exclusively by partners from CEE countries but ordered also by two project partners from “old 15” EU countries[19],
- development of training materials which are now included in EuroTraining "Microsystems University Service",
- TUS became a "Strategic Alliance Partner" of EuroTraining and organized a EuroTraining Train-the-Trainers course in Sofia.

A good indicator of “*East to West knowledge diffusion”* is the percentage of participants from “old 15” EU countries in REASON training events, steadily raising from initial 9% in 2002 to final 19% in 2005.

A paper on “DefSim” educational chip was presented at the International Conference on Microelectronic Systems Education “MSE 2005” in the USA (it was one of very few papers selected for plenary oral presentation). Presentations for the European Workshop on Microelectronic Education in 2006 will be prepared after termination of the project.

Tutorials and invited talks based on material prepared earlier in the framework of REASON were also presented at other international events. A good example here is workpackage 5: the tutorial prepared by BUTE on "Measurement, modeling and simulation of thermal dynamics in microelectronic structures" was extended and presented at XXI IEEE SEMI-THERM Symposium held on 13 March 2005 in San Jose, USA, and REASON WP5 thermal measurement course material (also prepared by BUTE) has been tailored to the specific issues of measuring power LED-s and was invited to the LEDexpo'05 Seminar held on 27 May 2005 in Seoul, Korea. Other examples can be found in partners’ reports in the database of reports on the attached CD-ROM.

> *Long term results*
>
> *Previous experience from numerous INCO-COPERNICUS and ESPRIT projects shows that projects like this one always lead to new links and new ideas and result in more specific RTD projects. It is expected that this project will bring the same result, but it is not possible now to predict how many new projects will be successfully launched and who will participate in them.*
>
> *The exact number of students educated in microelectronic design in Central and Eastern Europe is not known, but it may be safely estimated that it is not less than several thousand per academic year (at various levels: introductory courses, graduate courses, PhD programs). This is the number of young electronic engineers who will benefit from this project in the CEE countries. They will be available for employment both by local enterprises and by European manufacturers. In this way the project will address the problem of microelectronic skills shortage in Europe.*
>
> *One of future outcomes of the project could be formation of a network of excellence in the next Framework Programme.*

[19] These chips will soon become available for all European universities, see the next chapter for details.

No network of excellence being direct continuation of REASON has been proposed. However, the project partners participate in many other projects.

According to partners' reports the project partners from CEE countries participate in 5 already accepted and running FP6 projects:

- PATENT (NoE, IST in FP6) involving SMEs from Romania, Hungary, France, UK and the Netherlands,
- 4M (NoE, NMP in FP6) with participants from the Western and Eastern European Countries and SMEs from Romania, Hungary, France, UK and Germany,
- MINOS (SSA, IST in FP6) with 5 REASON partners from the Central and Eastern European Countries: Romania, Hungary (BUTE), Bulgaria (TUS), Poland (IET) and Slovakia (FEISTU) and Slovenia (UL,
- MINAEAST-NET with 3 REASON partners from Slovenia, Poland and Hungary,
- MINA TSI (ERA Pilot).

REASON helped to improve visibility of project partners on the international scene, and as a result REASON partners from CEE countries participated in about 10 proposals[20] submitted to FP6 IST Call 4 (closed on March 22). One of these proposals was initiated by a group of REASON partners with additionally invited universities from France, Sweden and Israel. Unfortunately most of these proposals were not accepted. At the moment of writing this report the REASON coordinator is aware of 3 projects with participation of REASON partners which passed the thresholds and have pretty good chances to be accepted: two integrated projects and one coordination action.

2.3. Self-assessment

In addition to formal reports submitted to the database of reports all partners were asked in June 2005 to send their informal opinions summarizing the outcomes and impact of the project seen from the perspective of their institutions and their countries. Partners were also asked to write frankly about weaknesses of the project.

Responses were received from 14 project partners: 2 in "old 15" EU countries (TUI, TUE), 3 in NIS countries (BSU, BSUIR, LPU) and 9 in new EU and candidate countries (FEISTU, IET, IISAS, KTU, RTU, TUL, TULC, TUS, TTU). Response was also received from Prof. Vladimir Hahanov, Kharkov National University of Radio Electronics (KNURE, Ukraine), who very actively cooperated in many project actions.

All responses were positive. In what follows the most important issues raised by the partners are illustrated by excerpts from their responses. In these responses many partners described facts that were already presented elsewhere in this report. These parts of their responses are omitted.

According to the partners the most important achievements of the project were:

[20] This number can be higher. The proposals were written and submitted in confidence, this number is the REASON coordinators' estimate based on informal talks with REASON partners.

Raising the level of competencies and skills of academic teachers and researchers by means of participation in courses, tutorials, summer schools etc.

Dr Elena Gramatova from IISAS wrote: “Participation of Slovak researchers, teachers and PhD students in courses and summer schools (enabled thanks to travel grants and low fees) lectured by the best experts (IMEC, TIMA, etc.) allowed receiving “state of art” knowledge based on new technologies in the fields of SOC design and test helpful for pushing our future research activities, gaining new skills in training activities and improving teaching materials.”

Prof. Vladimir Stepanets from BSU wrote[21]: “To maintain the necessary level of research works and training of research staff, one of key factors is possibility of exchange of experiences, participation in internships and training in leading European universities and research centers. Costs of such contacts are adequate to living standards in the most developed European countries, what makes them practically inaccessible even for specialists from leading universities and enterprises of Belarus. Participation in the REASON project allowed to overcome in part this problem. A number of specialists from BSU could get training at courses organized at WUT and IMEC.”

Prof. Peteris Misans from RTU wrote: “REASON offered possibilities for students and teachers to participate in several summer schools (Ljubljana, Krakow, Smolenice, Warsaw). These schools have significant consequences:

- increasing of knowledge level,
- stimulation of interest about different topics of microelectronics,
- personal contacts - the chance for collaboration in the future, (…).”

In the opinion of Prof. Lech Jozwiak (TUE) partners from “old 15” EU countries could also benefit. He wrote: “Several TUE academic staff members and Ph.D. students directly profited from training delivered in the scope of REASON through participation in the international summer schools, tutorial events accompanying international conferences (DSD and MIXDES) and courses organized by IMEC, raising their level of knowledge, competencies and skills.”

Raising the level of education and training: new or updated courses, new curricula, new teaching techniques and tools.

Prof. V. Hahanov from KNURE wrote: “"The tutorials and invited lectures organized by REASON often as a part of European conferences and symposiums have been invaluable in terms of learning how to implement new technologies and educational methodologies in university teaching. The lecturers of our University use the presentations and materials of scientists, who participate in REASON, in preparation of their lectures on Design and Test. As for the overall impact of the project, this program and its outcomes made an invaluable contribution to preparation of specialists in Ukraine.”

Prof. Vera Stopjakova from FEISTU wrote: “The results achieved might have considerable impact on education e.g. the developed educational integrated circuit DefSim that has been integrated into a complex test system for defect simulation

[21] Translated from Russian

providing test pattern generation and circuit responses evaluation could be used as helpful laboratory equipment for exercises within IC testing courses at universities".

Prof. Rimantas Seinauskas from KTU wrote: "New study program for Masters of SoC design was constructed and has been approved by Lithuanian Ministry of higher education. In year 2005 was graduated first students for Master of Science in SoC design."

Prof. Raimund Ubar from TTU wrote: "The project has had a very strong impact in improving the level of teaching. Four new courses have been developed in frame of WP3 of the project and have received a broad international recognition. The courses have been introduced not only into the curricula of TU Tallinn, but have been taught also in other leading universities in Europe. For example, the courses of Digital Test and Design for Testability have been carried out six times outside the REASON network – three times at the TU Darmstadt (Germany) and three times at the University of Jönköping (Sweden)".

Prof. Marin Hristov from TUS indicated as one of important outcomes: "Preparation and introduction of new educational subjects in the education of full-time BEng and MEng students at the Technical University of Sofia (EDA Tools in Microelectronics, IC Testing, and others) and the Technical University of Gabrovo (CAD in Electronics and Computers)".

Prof. Vladimir Stepanets from BSU wrote[22]: "Participation in the REASON project allowed to extend significantly research in the area of electronics, and on this basis to prepare large set of state-of-the-art teaching materials and to carry out a number of courses and practical trainings".

New links, productive cooperation and creation of a community

Dr Zdenek Pliva from TULC wrote: "Although this is my first experience with European grant I was surprised how this kind of mixture of partners should be powerful. (…) We have found a lot of new connections with our local industry, with universities namely in Poland and Estonia; I also have found a few new friends and I hope that these connections will survive the end of REASON project. Generally speaking it is a miracle that such a team was built and it is a pity that it is not possible to continue under similar EU umbrella."

Prof. Raimund Ubar from TTU wrote: "Since beginning of the project, very quickly good cooperation contacts were established between the Tallinn University of Technology and the partner-universities of the project, which has been resulted in a lot of new useful knowledge, skills and experiences. Open contacts and continuous cooperation have inspired and have given new ideas resulting in new courses, new lecture materials, intensive joint research, educational SW and HW tool developments, and several new national and international joint projects. (…) One of the most important consequences of the project was to stimulate creation of interfaces between partners tools which has resulted now in the end of the project in a broad virtual laboratory, and in a lot of synergy via integrating the competences, knowhow and experiences of different partners."

Prof. Lech Jozwiak from TUE wrote: "It has to be stressed that the participation in this training was truly international, with many participants from both the "new" and "old" EU

[22] Translated from Russian

member states, and several participants from NIS countries and outside of Europe (US, Canada, Japan etc.). This way TUE not only realized an international knowledge transfer on at least the European scale, but also increased the awareness of TUE competences among the European universities, R&D institutes and industry. (…) Moreover, through taking part in REASON, TUE gained much extra knowledge on the competences of both Central and East European, and West European universities, R&D institutes and industry, as well as, established new contacts and collaboration links."

Prof. Mykhaylo Lobur from LPU wrote[23]: "No doubts that participation of Lviv National Polytechnic University in international project is a big advantage (…) Widening of international contacts with EU universities allowed to carry out productive work during the project as well as after its termination."

Dr Elena Gramatova from IISAS wrote: "Organisation of common international REASON tutorials by the project partners (TTU, BSU, TSU, TULC, WUT) has created very close and friendly contacts among people of the cooperating institutions and was beneficial in variety of aspects."

Prof. Marin Hristov from TUS wrote that one of important effects was: "Establishment of informal "society" (association) of lecturers, SME's leaders and staff, PhD students from different Bulgarian cities, who are in constant contact, exchange information and experience, participate in the preparation and carrying out of joint projects, researches and educational activities. Establishment of an educational and research laboratories "network" for education and design of systems on chip in other Bulgarian technical universities – Technical University of Gabrovo, Technical University of Varna, Botevgrad College, Plovdiv College (…)."

Prof. Vladimir Stepanets from BSU wrote[24]: "The strongest side of the project in the opinion of BSU was its global character – in the project participated practically all countries of Europe having experience and traditions in research and training of specialists for electronics. As a result, the project secured genuine integration of specialists from new EU countries into programmes and works being carried out in the EU, and solid foundations have been laid for cooperation with specialists from countries which are neighbors of new EU member states."

Dr Zdenek Pliva from TULC wrote: "Personally I was surprised that I am able to present a lecture in other than mother tongue and that the listeners are interested in it.

I hope that this experience will be used in some next cooperation. I am sure that the connections will be used in future in close cooperation among the institutions or companies."

Prof. Peteris Misans from RTU wrote: "The best event in my life to meet so much wonderful people."

<u>New links with industry and industrially oriented training</u>

Dr Jan Butas from FEISTU wrote: "During the courses, the participants met other people working in the same area (electronic system design) and exchanged their knowledge each to other and establish a new contact between. The benefit from this for us is that we

[23] Translated from Russian
[24] Translated from Russian

establish contacts with these companies and we plan to continue provide new courses for them. Also now we better know their requirements for the new courses we plane to organize in the future. In one case a company asks to us to help them during their first design by using VHDL."

Dr Zdenek Pliva wrote: "We have found that our goal is not only to teach the students, but that it is also possible to help to our local industry. In our university we realized that it is necessary (and possible) to organize the courses for industry, for continuous education and that it is necessary to ask the companies about their needs."

Prof. Raimund Ubar from TTU wrote: "Initiated by the development opportunities generated by this project as well as by other international cooperation and domestic activities, two new competence centers were established as the result of the project at the Tallinn University of Technology – Research Centre for Dependable Computing (CDD) and Development Centre of Mission Critical Embedded Systems (ELIKO) with contracts between 7 private SMEs and 2 research institutions under the leadership of TTU. Both of these centers are working on transfer of technology to the SME influencing the technology development of the local industry. Through ELIKO very tight links have been established now between the Academia and the industry of Estonia."

Prof. Rimantas Seinauskas from KTU wrote: "The Network of SME's in the field of Electronics has been established. Unfortunately, this network did not enlarge in last year. The common designer group of staff members KTU and SME " Elinta" has been established. We are feeling that SME's are more interesting on use of FPGA, especially small enterprises working on the field of design control and measure devises. Therefore, we turn special attention to the consulting SME's about FPGA design. Now we have a lot of contacts with SME's on this field and supporting them with descriptions accessible on the Internet. We are feeling, that it would be very important activities in the future of Electronics design laboratory of Kaunas University of Technology."

Prof. Vladislav Nelajev from BSUIR wrote[25]: "All that[26] was extremely useful not only for the Chair of Microelectronics at BSUIR and the whole University, but also for a number of various organizations, universities and electronic enterprises (small, medium and state-owned) of the Republic of Belarus by means of getting new information about trends of development, new methods and tools for microelectronic design; in dissemination of this information staff members of BSUIR actively participated by means of organization of local seminars and training courses. In particular, under aegis of the REASON project a Design Center at BSUIR has been organized for training and research in integrated circuit and SoC design."

For Prof. Marin Hristov from TUS an important outcome was: "Setting up informal contacts and signing research contracts between the ECAD laboratory at the Technical University of Sofia and almost all Electronics and Microelectronics SMEs in Bulgaria: Fabless, EPIQ, Melexis, IBM - Bulgaria, SMARTCOM - Bulgaria, AMIS – Bulgaria. These contracts and projects are in a process of extension. New projects are also being discussed."

[25] Translation from Russian
[26] "All that" refers here to project training actions.

Gaining experience in international cooperation, and especially in EU funded projects

> Dr Dieter Wuttke from TUI wrote: "I have learned a lot about management of a project and how to bring together partners with different fields of research and different cultures. (…) It was my first project funded by the European Commission and I had the possibility to learn a lot about the procedure of reporting and handling an international teamwork."
>
> Prof. Viera Stopjakova from FEISTU wrote: "The experience and skills gained in the frame of this project have been very valuable in establishment and managing of other local as well as international projects and co-operations currently running at FEI STU. For example, an interdisciplinary project dealing with 'Development of methodology and equipment for non-invasive biomedicine monitoring and analysis psycho-physiologic processes under stress', involving 4 different institutions from academia as well as industry (SME), has been running and managed by transferring respective experience and skills gained within the Reason project."

And, last but not least, many partners stressed that financial support for purchases of new hardware and software as well as travel grants were essential for successful participation in the project.

Many partners stressed that this project was a sort of turning point or milestone for their institutions. Prof. Vladimir Stepanets from BSU summarized this in the following way[27]: "Despite a number of problems and difficulties in our participation in the project, at this moment it is considered as a borderline, a work of great importance for BSU. In other words, its role in development of research and training of specialists for electronics is such that in many cases in the future it will be possible to speak about their state "before REASON" and "after REASON"."

Most partners didn't mention any weaknesses of the project. Dr Elena Gramatova mentioned weakness of local industries in Slovakia. Other partners who wrote about weaknesses of the project (BSU, LPU) mentioned financing and cash flow problems resulting from incompatibility of EU rules with local rules and conditions. Below is a description of the problems of financing, as seen by Prof. Vladimir Stepanets from BSU[28]:

"For BSU the main problems (…) resulted from EC rules of funding of research works. These rules are based on the following assumptions:

- salary levels and living standards in countries participating in an international project are identical or almost identical,
- in these countries government support exists; moreover, it is possible to get a low interest bank loan and/or leasing for a research project,
- all participating countries use the same currency or currencies whose exchange rates in relation to the common currency are fixed,
- in the participating countries funds for the project are considered public and free from any taxes.

[27] Translated from Russian
[28] Translated from Russian

For Belarus as well as for other non-EU countries (…) none of these assumptions was fulfilled. As a result, it was not possible to accomplish fully everything initially planned, and in particular:

- purchase the software,
- attract young Belarussian scientists to the project,
- retrain all specialists,
- take full advantage of international character of project activities,
- participate in European conferences associated with the project,
- realize other scientific contacts with specialists from other participating countries.

Lack of balance of labor costs in various countries participating in the project resulted in reallocation of the funds in the project budget. Although before termination of the project most of the participating countries became EU members, the problems mentioned above remained, being transferred into the EU. One more very serious problem was regular inexcusable delays in payment transfers."

Financial problems were the only serious problems mentioned by the partners in their assessment of the outcomes of the project.

In conclusion, the author of this report has the feeling that in the opinion of the consortium the mission of the project, defined in Annex I to the contract as follows:

> *The main goal of this project is to facilitate integration of the academic and research institutions of Central and Eastern Europe (CEE) working in the field of microelectronics into the mainstream R&D activities going on in the EU countries. To achieve this goal, the project aims at raising the level of education and research as well as the number of highly-skilled researchers and designers in the field of microelectronic design in CEE countries, in order to facilitate co-operation in research and development with European R&D institutions and industry, to reduce the microelectronic skills shortage in Europe and to minimise the consequences of this shortage.*

has been fulfilled.

Chapter 3
Exploitation plan

This chapter briefly describes how the results of the project will be used after its termination.

3.1. Hardware and software

Hardware and software purchased with financial support of the project was used to organize new design labs (LPU, BSUIR, BSU) or extend and improve the existing ones. All partners declare that these labs will be maintained and used for the same purpose after termination of the project.

3.2. Teaching materials

The main project Web site will be open and maintained after termination of the project and will give access to a variety of training materials such as Power Point presentations, illustrations to lectures and courses, handouts etc. These materials are the intellectual property of their authors and the authors will decide what materials, if any, can be placed in the public domain. The intention of most partners is to give access to their materials by means of free ftp downloads.

3.3. AGBOT – the book on testing of electronic systems

As a result of cooperation of the partners of workpackage 3 together with contributions from workpackages 8 and 9 a book on testing of electronic systems has been written jointly by authors from TTU, FEISTU, TULC, IISAS, VSTU and WUT and with additional contribution of two authors from Silesian Technical University in Gliwice, Poland – see Annex 5 for the contents of the book. The book has been edited and is in printing at the moment of writing this report. It will be printed by the publishing house of the Czech Technical University in Prague in 300 copies. The price of one copy will be approx. 30 €. If there is enough interest, second edition may be printed and new distribution channels may be sought.

3.4. Materials for e-learning and distance training

These materials: Web pages, applets, software etc. will be available at the German REASON Web site and disseminated in the framework of EuroTraining "Microsystems University Service" action. Many partners declare that they will include these materials in their university courses. Some will also be included in AGBOT – on CD-ROM attached to the book.

3.5. Teenagers' microelectronic encyclopedia

The teenagers' microelectronic encyclopedia developed in workpackage 11 will be open to the public once it is transferred to its permanent Web host. Mirrors in partners' countries are planned.

3.6. Educational integrated circuits

It is the intention of the REASON consortium to make them available together with the necessary lab hardware and manuals as commercial products. The first steps to commercialization have been made in the case of "DefSim2" integrated circuit. It has been already manufactured in low volume batch and special computer controlled testing box has been designed. The box has USB interface and together with dedicated software is a "Plug and Play"-type design. This box is now available as a commercial product from VIGO S.A. – a

Polish SME. So far the chips and testers are distributed only within the REASON consortium (the chips are distributed by WUT on no-profit basis). Figures on the next two pages show the chips and the testing box.

The Hungarian MicRed company is interested in commercialization of another educational integrated circuit “AnaDig”. However, here the lab hardware is not developed yet.

The third educational integrated circuit “TestAccess” needs some improvements and second prototype must be made. However, in principle it can be commercialized as well.

Before educational chips become commercial products, a number of problems must be solved first:

1. Fabrication of the chips must be ordered and someone must invest in them at least 15 to 20 k€ (maybe much more). To avoid big financial loss, a sort of market research must be performed first in order to obtain a realistic estimate of the demand. It is planned to distribute information about the chips via EUROPRACTICE channels as well as other means (EWME and MSE conferences, IEEE “Devices and Circuits Magazine” etc.) and collect initial non-binding orders to estimate the demand and the chip price (which depends on the number of chips ordered).

2. The question of intellectual property rights must be answered. As the chips are results of joint design works of several partner teams, agreements must be worked out how the partners will participate in commercial profits, if any.

3. The chips have been designed using academic licences for CAD software used. Commercial exploitation is not allowed in such a case unless a permission from respective software vendor is obtained. This issue is now being discussed with EUROPRACTICE and software vendors. Standard EUROPRACTICE “First use by industry” agreement is probably not appropriate, but several other solutions seem possible.

4. Since the CMOS technologies used to design the existing educational chips are being phased out (or will be in the foreseeable future), sooner or later new designs will have to be made. On one hand, this can be an opportunity to avoid using CAD software with academinc licences only. WUT has its own developed in-house CAD system which can be used to design new versions. On the other hand, new designs will mean a lot of work, someone will have to invest in them.

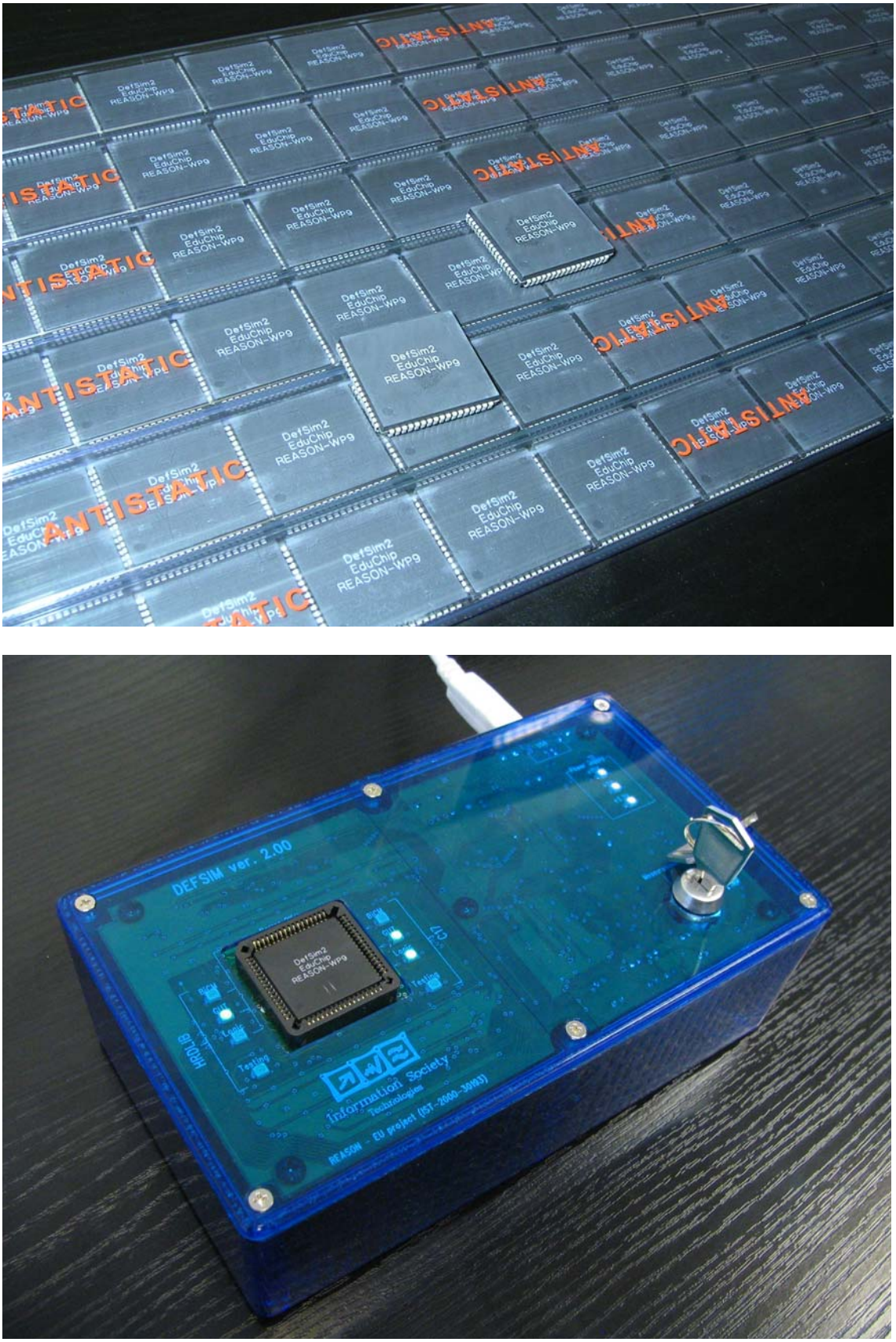


Fig. 22. DefSim2 chips on the road to commercialization: (top) manufactured in low volume batch, (bottom) in a laboratory testing box (a product of VIGO S.A.)

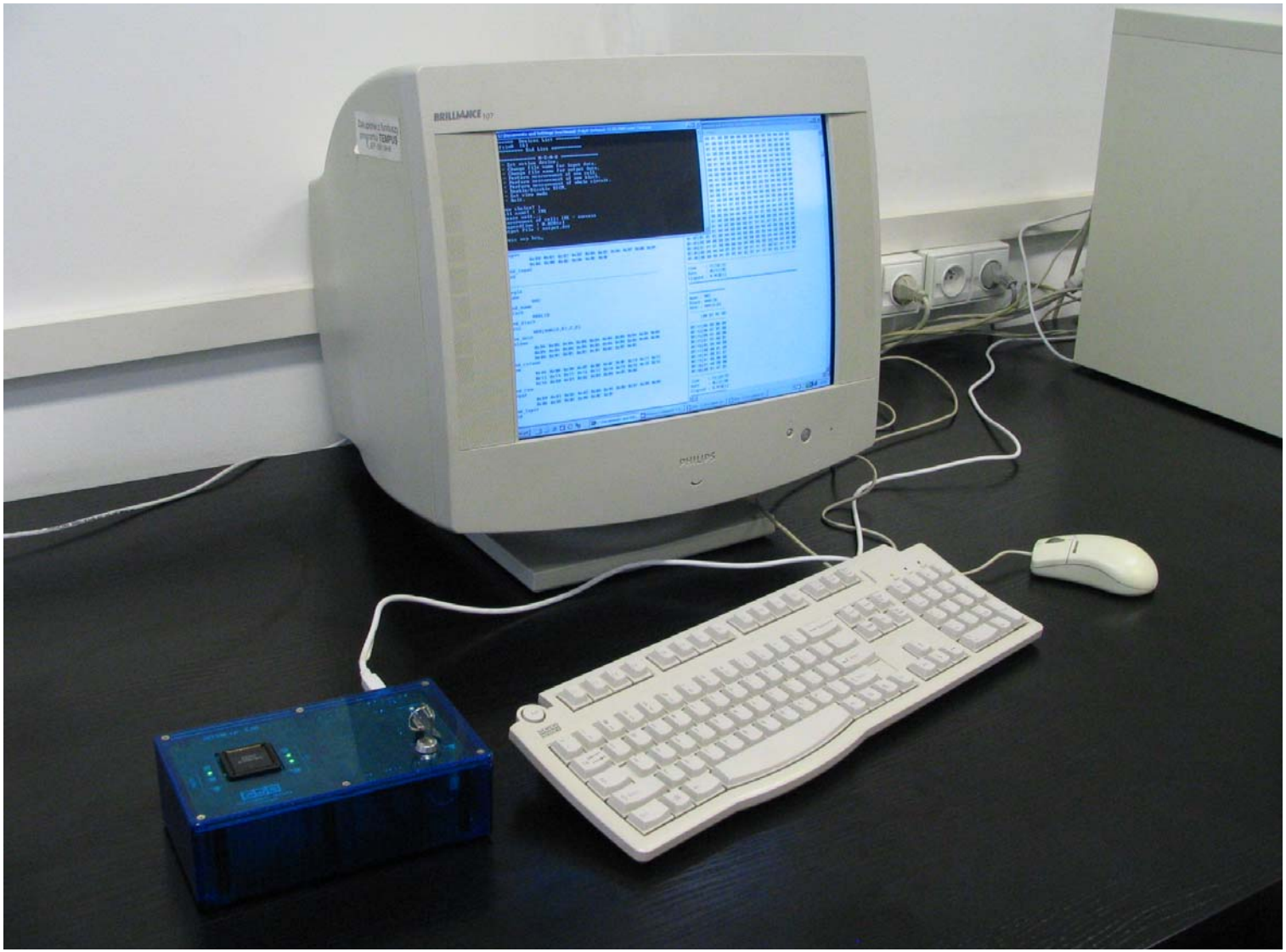


Fig. 23. DefSim2 chip in the laboratory test box connected via USB to a computer

Annex 1: List of project partner institutions

CO1 (WUT): Warsaw University of Technology, Warsaw, Poland
CR2 (IET): Institute of Electron Technology, Warsaw, Poland
CR3 (TTU): Tallinn Technical University, Tallinn, Estonia
CR4 (VSTU): Vladimir State Technical University, Vladimir, Russia
CR5 (BUTE): Budapest University of Technology and Economy, Budapest, Hungary
CR6 (FEISTU): Slovak University of Technology, Bratislava, Slovakia
CR7 (PUB): Politehnica University of Bucharest, Bucharest, Romania
CR8 (TUI): Ilmenau Technical University, Ilmenau, Germany
CR9 (TUL): Technical University of Lodz, Lodz, Poland
CR10 (IMEC): Interuniversitair Microelectronica Centrum, Leuven, Belgium
CR11 (UJF): Universite Joseph Fourier Grenoble 1, Grenoble, France
CR12 (TUE): Eindhoven University of Technology, Eindhoven, the Netherlands
CR13 (IISAS): Institute of Informatics of the Slovak Academy of Sciences, Bratislava, Slovakia
CR14 (TUS): Technical University of Sofia, Sofia, Bulgaria
CR15 (LPU): Lviv Polytechnic National University, Lviv, Ukraine
CR16 (BSUIR): Belorussian State University of Informatics and Radioelectronics, Minsk, Belarus
CR17 (TULC): Technical University of Liberec, Liberec, Czech Republic
CR18 (KTU): Kaunas University of Technology, Kaunas, Lithuania
CR19 (BSU): Belorussian State University[29], Minsk, Belarus
CR20 (UoL): University of Ljubljana, Ljubljana, Slovenia
CR21 (RTU): Riga Technical University, Riga, Latvia
CR22 (RAL): Rutherford Appleton Laboratory, Chilton, UK

[29] Not to be confused with CR16 – CR16 and CR19 are two different universities.

Annex 2: List of workpackages

WP1: Introductory actions; WP leader: WUT (Prof. W. Kuzmicz)

WP2: Methods and tools for system on chip design; WP leader: IET (Prof. A. Kobus)

WP3: Testing and design for testability of SoC; WP leader: TTU (Prof. R. Ubar)

WP4: Analog and RF design; WP leader: VSTU (Prof. V. Lantsov)

WP5: Thermal modeling, simulation and testing; WP leader: BUTE (Prof. A. Poppe)

WP6: Microsystem design: methods and tools; WP leader: FEISTU (Dr B. Weber)

WP7: Research training in new chip architectures; WP leader: PUB (Prof. D. Dascalu)

WP8: Technologies and contents for distance training; WP leader: TUI (Dr H.-D. Wuttke)

WP9: The educational chip; WP leader: WUT (Dr W. Pleskacz and Dr E. Piwowarska)

WP10: Promotion and dissemination; WP leader: TUL (Prof. A. Napieralski)

WP11: Actions adressed to high school children; WP leader: LPU (2002: Dr M. Blyzniuk, 2003-2005: Prof. M. Lobur)

WP12: Future and emerging problems in microelectronics and microsystems; WP leader: WUT (Prof. W. Kuzmicz)

WP13: Planning, management, assessment and evaluation; WP leader: WUT (Prof. W. Kuzmicz)

Annex 3: REASON event evaluation forms

REASON event evaluation form (version 2002)
<Name of the event>
<Place and date>

We greatly appreciate your participation in this event and we would like to get your feedback. Please provide brief answers to the following questions. Please be frank, your answers will help to make next events better.

1. Did you find the event at the right level for you ?
(*Please check one*) o Too advanced o Not advanced enough o Just right
Comments:

2. Were the topics well selected ?
(*Please check one*) o No, not at all o Some, but not all o Yes
Comments:

3. How do you rate the quality of lectures/talks/presentations ?
(*Please check one*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

4. How do you rate the handouts or other materials distributed ?
(*Please check one*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

5. Could you give your opinion regarding the practical exercises ? Did they help you reinforce understanding the basic concepts? Were they at the right level ?
(*Please check one*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

6. Will this event help in your future work/learning/research ?
(*Please check one*) o Not at all o Maybe? o I hope so o I am sure it will
Comments:

7. How would you rate the organization (information, registration, managing payments etc.) ?
(*Please check one*) o Very poor o Poor o Acceptable o Good
Comments:

8. How would you rate the conditions (accommodation, meals, conditions in the lecture room etc.) ?
(*Please check one*) o Very poor o Poor o Acceptable o Good
Comments:

9. If you were to give this event an overall grade, what it would be ? Circle one (A is highest)

A B C D E F

Any other comments or suggestions ? Please write them here. Use reverse side of this sheet for longer comments.
Thank you !

REASON event evaluation form (version 2003 – 2005)
<Name of the event>
<Place and date>

We greatly appreciate your participation in this event and we would like to get your feedback. Please provide brief answers to the following questions. Please be frank, your answers will help to make next events better.

1. Did you find the event at the right level for you ?
(*Please check one*) o Too advanced o Not advanced enough o Just right
Comments:

2. Were the topics well selected ?
(*Please check one*) o No, not at all o Some, but not all o Yes
Comments:

3. How do you rate the quality of lectures/talks/presentations ?
(*Please check one*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

4. How do you rate the handouts or other materials distributed ?
(*Please check one*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

5. Could you give your opinion regarding the practical exercises ? Did they help you reinforce understanding the basic concepts? Were they at the right level ? o Not applicable, there were no practical exercises
(*Please check one if applicable*) o Poor o Not uniform, some good, other poor o All rather good o Excellent
Comments:

6. Will this event help in your future work/learning/research ?
(*Please check one*) o Not at all o Maybe? o I hope so o I am sure it will
Comments:

7. How would you rate the organization (information, registration, managing payments etc.) ?
(*Please check one*) o Very poor o Poor o Acceptable o Good
Comments:

8. How would you rate the conditions (accommodation, meals, conditions in the lecture room etc.) ?
(*Please check one*) o Very poor o Poor o Acceptable o Good
Comments:

9. If you were to give this event an overall grade, what it would be ? Circle one (A is highest)

A B C D E F

10. Please tell us about yourself:

Your education (*Please check one*): o Student o BSc o MSc o PhD o Other: please explain:_____
Your employer (*Please check one*): o University o Research institute o Big enterprise o Small enterprise o Not employed yet o Retired o Other: please explain:_____
Your job (e.g. academic teacher, researcher, engineer, company manager): _____

Any other comments or suggestions ? Please write them here or use reverse side of this sheet for longer comments. **Thank you !**

Annex 4: Web-based reporting system

Introduction

During the first project year preparation of progress reports was a nightmare. 22 contractors, 13 workpackages, dozens of project events and actions resulted in submission of hundreds of files with materials for reports and hundreds of megabytes of deliverables in electronic form to the workpackage leaders and the coordinator. Even introduction of standard templates for preparation of partners' reports didn't help much. Tracking what was submitted, what was missing, which version was the most recent etc. and presentation of all information in a uniform and well structured form proved to be extremely difficult and time consuming. The first annual report contained 5 main files (in PDF format) and 13 long Word files – a total of more than 300 printed pages. Despite all efforts it was difficult to get a clear image of the whole project and even more difficult to find a particular information in these 300 pages. To streamline the reporting process, simplify collection of information from partners and enforce completeness and uniformity special Web-based reporting system has been developed. It was used for the first time in summer 2003 for preparation of semi-annual progress report. In December 2003 and July 2004 its functionality has been enhanced, bugs fixed and the system became the main tool for delivery of reports and collection of data for the second annual report.

Functionality

The Web reporting system allows to submit four kinds of reports:

- event reports (reports about courses, seminars, tutorials etc.),
- free form (text) reports (reports about activities such as design of educational ICs, development of Web-based teaching materials etc.),
- workpackage overviews (summaries of activities in workpackages),
- partner reports (summaries of activities of project partners).

From the viewpoint of the user the system is visible as a set of Web pages (HTML files) compatible with all commonly used Web browsers. There are three main forms: for submission of event reports, for submission of free form reports and workpackage overviews (the same form) and for submission of partner reports. These forms are shown in Fig. 2, 3 and 4. In addition, there are forms that allow to retrieve an already submitted report, edit and resubmit it or delete it.

To submit a report, the author has to fill all fields in an appropriate form and submit it. A page is returned which displays all submitted information for review. If some information is missing or seems inconsistent, fields that need correction are indicated. At this point it is possible to get back the submitted form for editing (even if it is complete and correct), and the process of edition and resubmission can be repeated as many times as necessary. Once the report is complete and accepted by the author, it is permanently added to the database. A unique ID number is assigned to every report and communicated

to the author of the report when the report is added to the database. This ID number serves as a password if the author decides later to correct or update the report or delete it. This ID number is never visible to other users of the system. This protects the reports against unauthorized changes.

The database can be searched using several criteria: kind of report, workpackage and task, reporting partner and submission/modification dates (see Fig. 5). The results are presented in form of list of reports meeting the criteria, with links that allow to access and read every report found.

For every set of reports found by the search engine an additional page with statistical data is generated. If the set consists of event reports only, full statistical data related to these events is available. For sets mixing various kinds of reports only the basic information is given. Fig. 5 shows an example of the statistical page.

Off-line processing of statistical data is also possible. The search engine can produce files readable by Excel and FileMaker.

The reporting system is not generally accessible. It is in the “private” part of the project Web site, and a user name and password is necessary to get access to it.

Technical background

The system consists of Apache Web server and four CGI applications developed especially for processing of the submitted reports. These applications extract information from the forms, perform simple checks for completeness and consistency and create records for the database. Each record is stored as a separate file. One of the CGI applications serves as the search engine. It can be also used in special “admin” mode for maintenance purposes such as retrieval of ID numbers, formatting the records for Excel or FileMaker, purging of auxiliary files produced by other CGI applications etc.

Illustrations

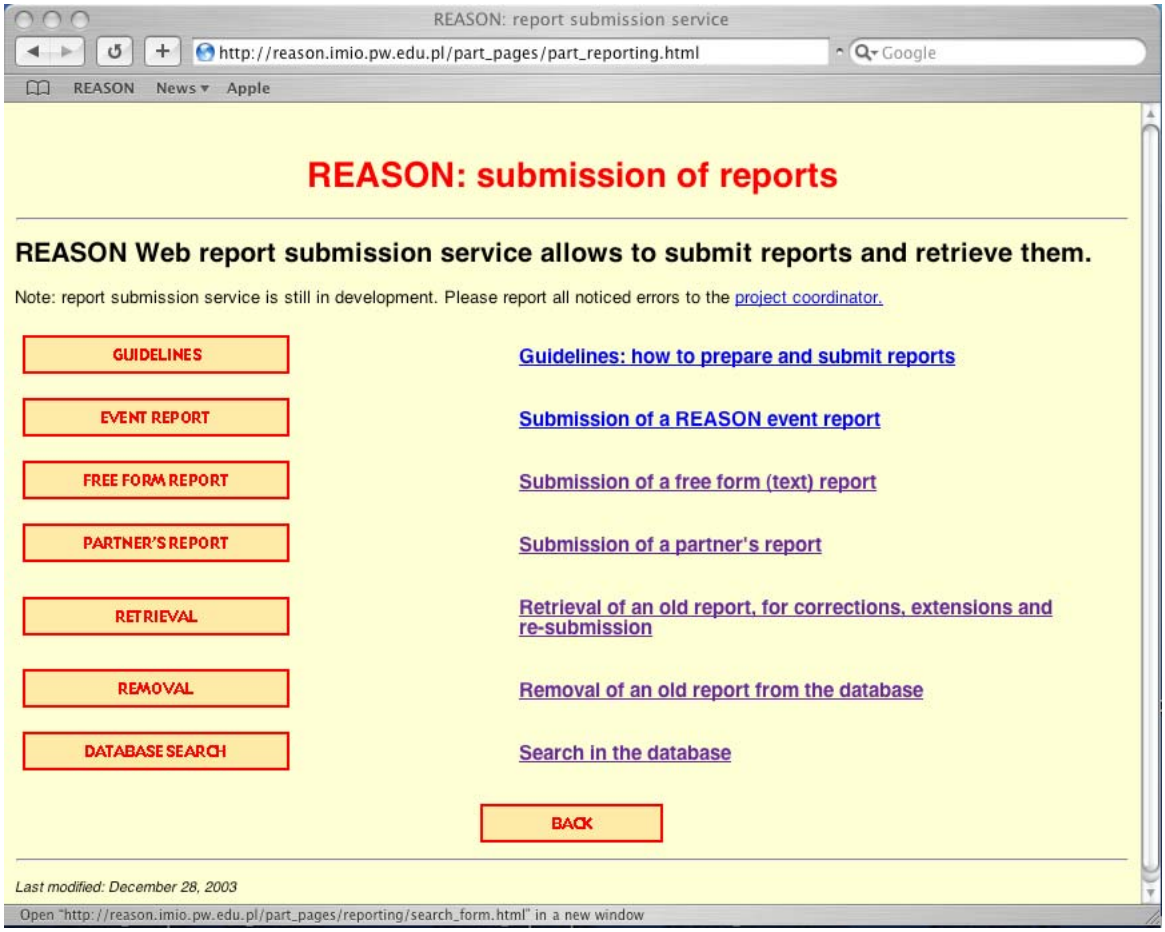


Fig. 1. Web-based reporting main page

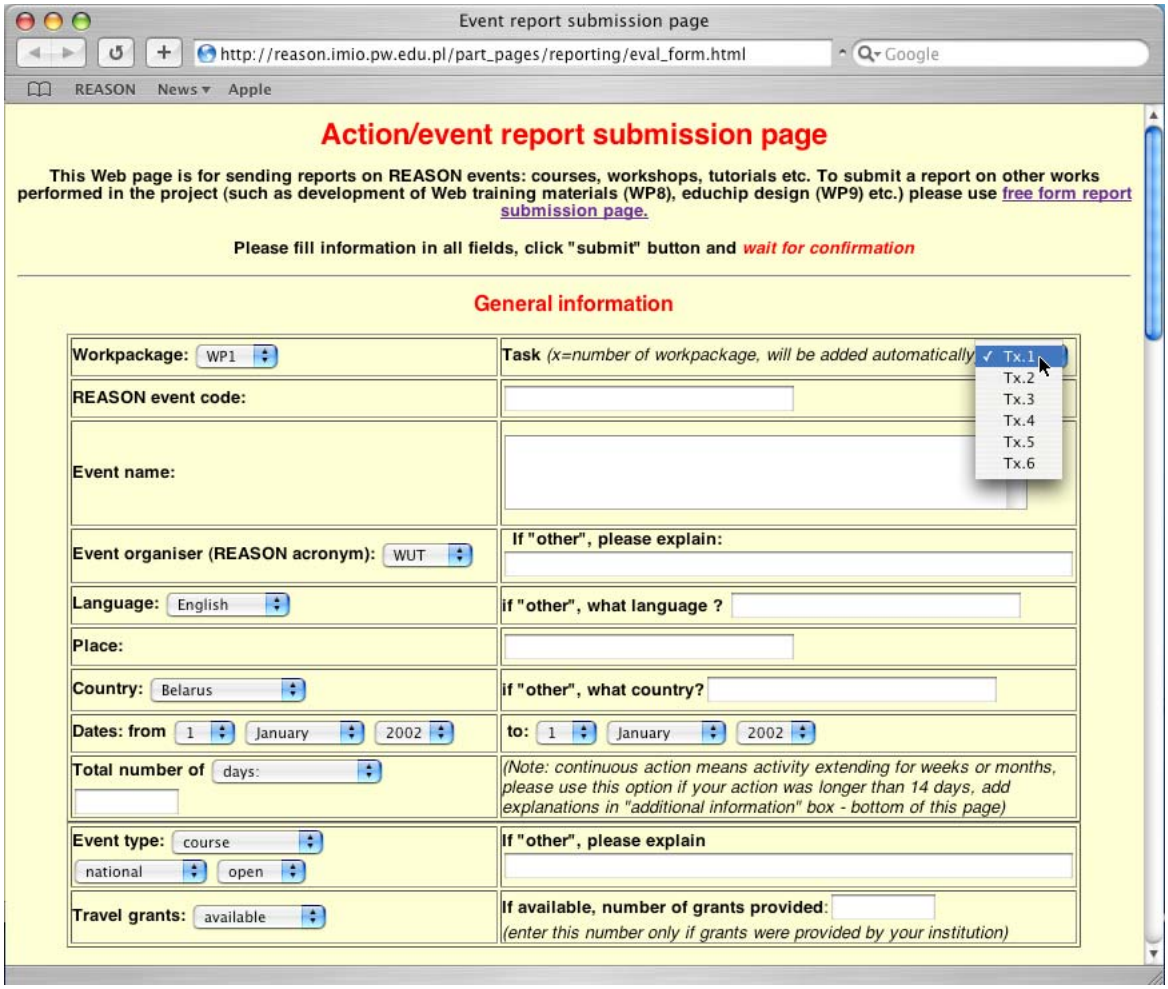


Fig. 2. Event report submission page (upper part)

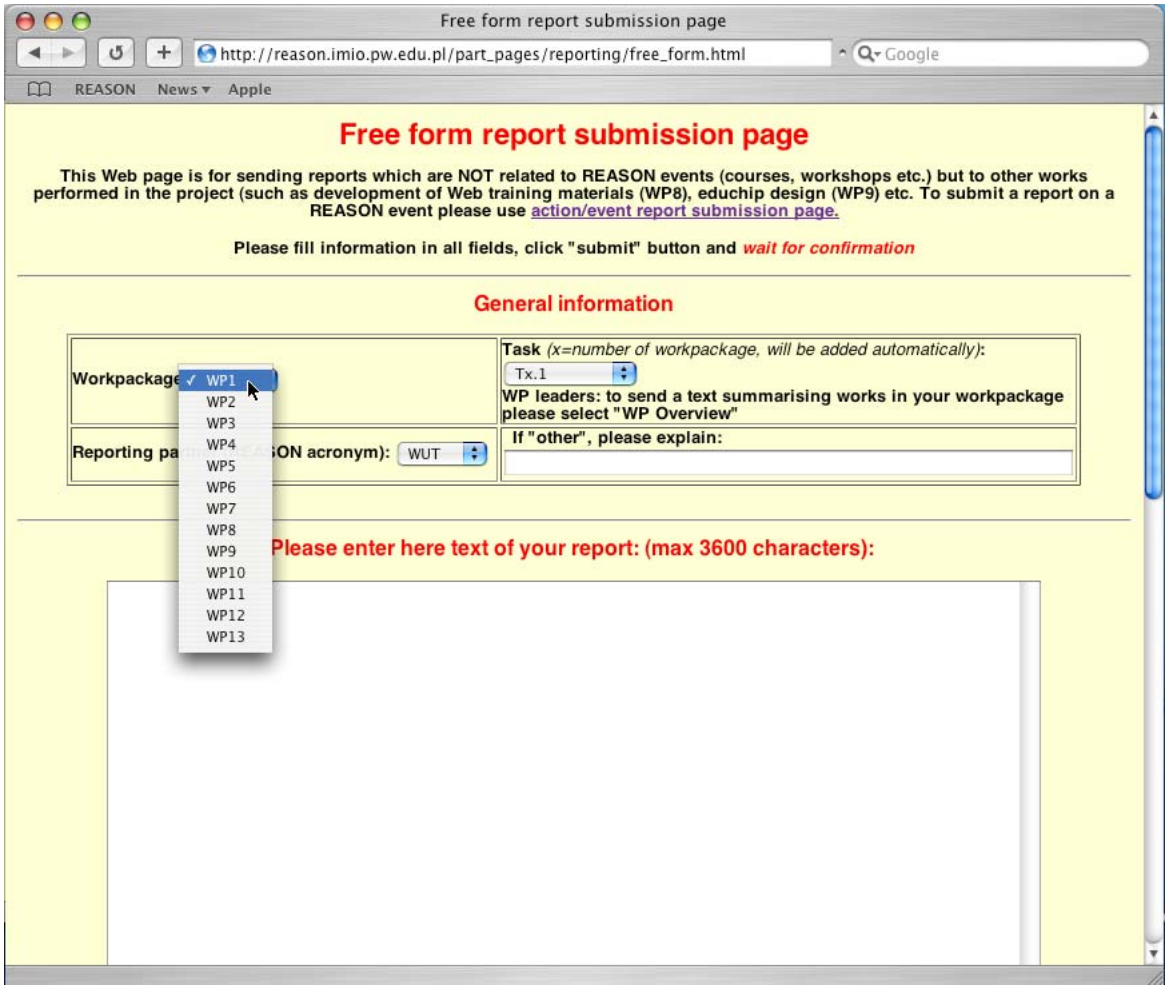


Fig. 3. Free form (text) report submission page (upper part)

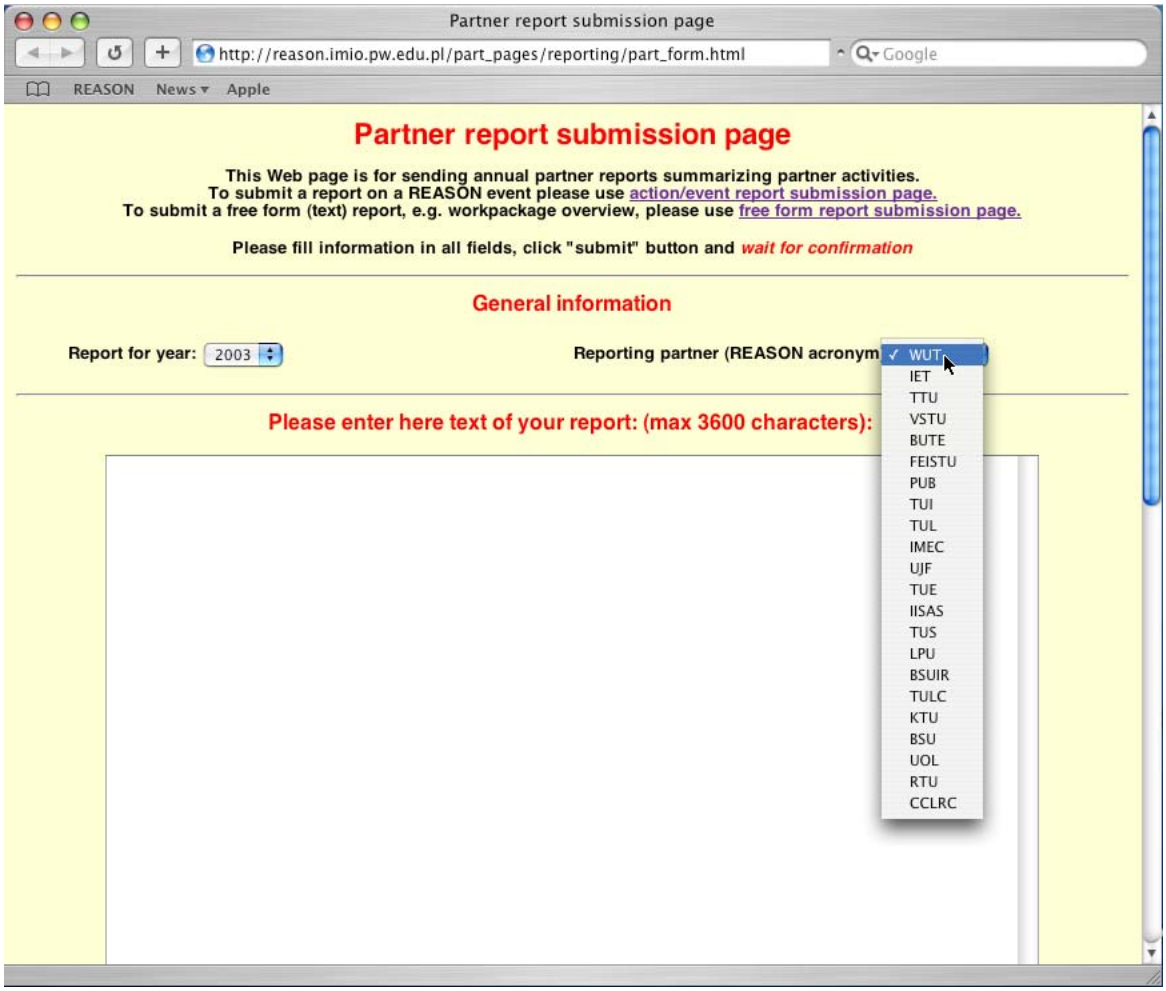
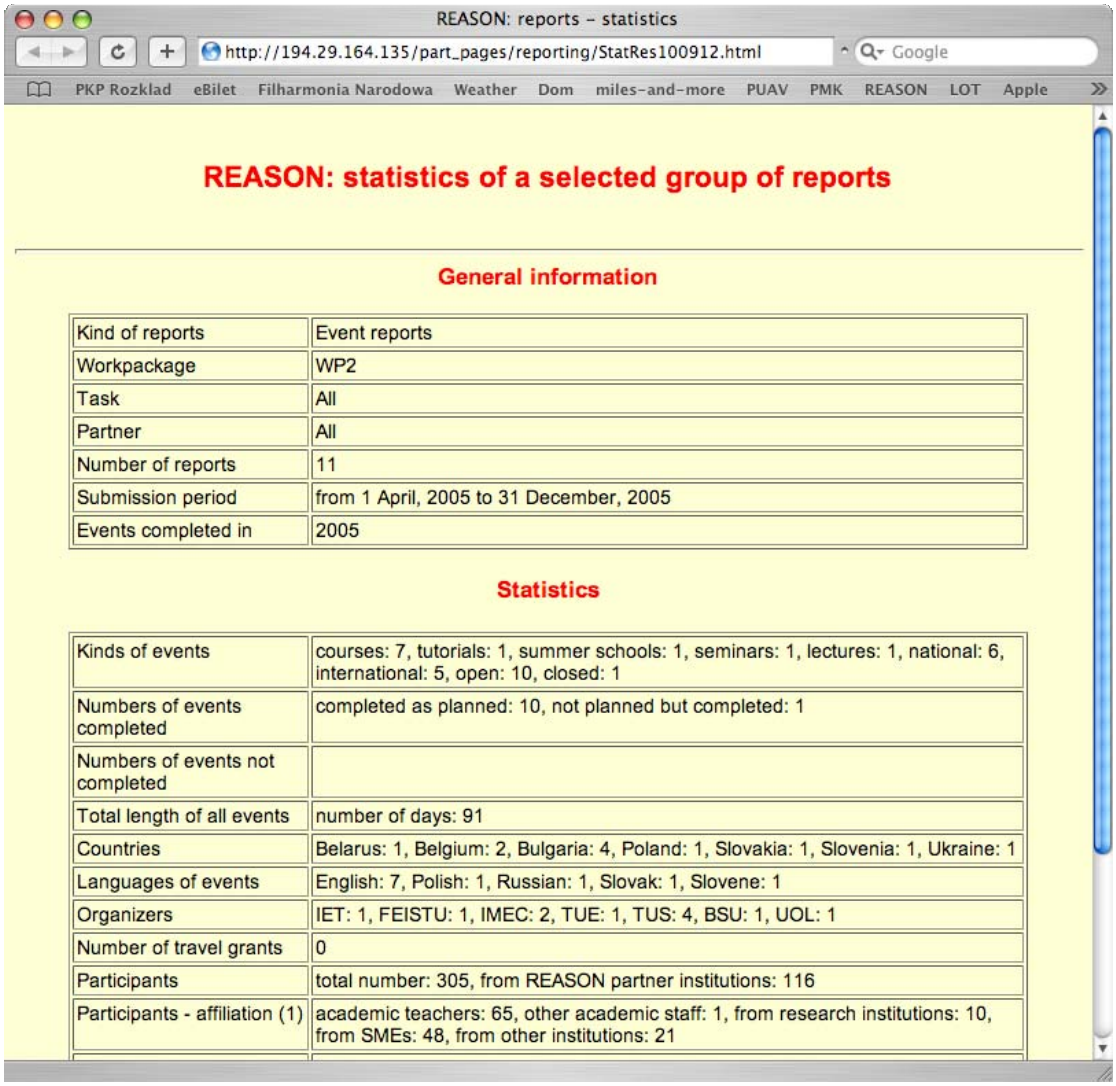


Fig. 4. Form for partner reports (upper part)

Fig. 5. Search page (version 2005)



REASON: statistics of a selected group of reports

General information

Kind of reports	Event reports
Workpackage	WP2
Task	All
Partner	All
Number of reports	11
Submission period	from 1 April, 2005 to 31 December, 2005
Events completed in	2005

Statistics

Kinds of events	courses: 7, tutorials: 1, summer schools: 1, seminars: 1, lectures: 1, national: 6, international: 5, open: 10, closed: 1
Numbers of events completed	completed as planned: 10, not planned but completed: 1
Numbers of events not completed	
Total length of all events	number of days: 91
Countries	Belarus: 1, Belgium: 2, Bulgaria: 4, Poland: 1, Slovakia: 1, Slovenia: 1, Ukraine: 1
Languages of events	English: 7, Polish: 1, Russian: 1, Slovak: 1, Slovene: 1
Organizers	IET: 1, FEISTU: 1, IMEC: 2, TUE: 1, TUS: 4, BSU: 1, UOL: 1
Number of travel grants	0
Participants	total number: 305, from REASON partner institutions: 116
Participants - affiliation (1)	academic teachers: 65, other academic staff: 1, from research institutions: 10, from SMEs: 48, from other institutions: 21

Fig. 6. Statistical page (version 2005)

Annex 5: Contents of AGBOT (Handbook of testing electronics systems)

Annex 6: Tables of efforts in person-months declared by the project partners

Table 1: Efforts in 2002

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	WP13	Total
WUT	0.63	0	0.17	0	0	0	0	0	1.943	0.286	0.086	0	4.74	7.855
IET	0	6.7	0	0	0	3.2	0	0	0	0	0	0	0	9.9
TTU	0.75	0	17.35	0	0	0	2.6	4.75	0.75	2	0.75	0	0.6	29.55
VSTU	8.5	0.5	1.1	3	0	0	0	3	0.17	6.3	2.63	0.1	1.2	26.5
BUTE	0.5	0	0	0	1.5	0	0	0	1	0	0	0	0	3
FEISTU	0.14	1.2	0.2	0	0	1.15	0.52	0	0.54	0.27	0.23	0.07	0.3	4.62
PUB	5.85	0	0	0	0	1.5	7.5	5.35	0	4.1	5	3.7	2	35
TUI	0	0	2	0	0	0	0	8.5	1	0	0	0	0.5	12
TUL	0.84	0	0	0	0.42	0.42	0	0	0	3.28	0	2.52	0.42	7.9
IMEC	1.15	1.15	0	0	0	0	0	0	0	1.15	0	0	1.15	4.6
UJF	0	4.28	0	0	0	0	0	0	0	0	0	0	0	4.28
TUE	0	0.57	0	0	0	0	2.6	0	0	0.1	0	0	0.6	3.87
IISAS	0	0.25	4.25	0	0	0	0	3	0.3	1	0.25	0.55	0.5	10.1
TUS	5.25	4	3.75	4.5	0	0	0	7.2	2.5	5.1	0.5	0.6	1	34.4
LPU	0	0	0	0	0	0	0	0	0	0	0	0	0	0
BSUIR	1	0	0	2	0	0	0	6	2	1	2	1	0	15
TULC	1.2	0.2	4.8	0	0	0	0	0	0.4	0.1	0	0	0.2	6.9
KTU	2	0	8	0	0	0	0	1	0	0.5	0.5	0	0	12
BSU	3	3.4	4.4	1	0	0	3.6	1	0.3	1.15	1.3	0.1	0	19.25
UOL	0	1.6	0	0	0	0	0	0	0	0	0	0	0	1.6
RTU	1	0	0	0	0	0	0	0.6	10.5	2.1	0	0	0	14.2
CCLRC	3.25	0.5	0	0	0	0	0	0	0	0.25	0	0	0.3	4.3
Total	35.06	24.35	46.02	10.5	1.92	6.27	16.82	40.4	21.403	28.686	13.246	8.64	13.51	266.825

Table 2: Efforts in 2003

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	WP13	Total
WUT	2.93	0	0	1.36	0	0	0.14	0	11.86	0	0	0	2.79	19.08
IET	0.71	1.29	0	0	0	5.01	0	0	3.41	0	0	0	0.41	10.83
TTU	0	0	9.5	0	0	0	2	6.25	0.75	2	0.75	0	0	21.25
VSTU	5.5	2.29	4.25	0.4	0	0	7.7	2.5	0	3.8	0.5	0	1.2	28.14
BUTE	0.1	0	0	0	3	0	0	0	0.6	0.3	0	0	0	4
FEISTU	0.18	2.83	1.2	0.4	0	0.47	0.33	0	2	3.97	0.83	0	0.61	12.82
PUB	2.98	0	0	1.85	0	9.63	7	8	0	3	1.69	0	2.38	36.53
TUI	0	0	2	0	0	0	0	6.5	0	0	0	3	0.5	12
TUL	0.39	0	0	0	2.72	2.04	0	0	1.39	5.94	0	1.88	2.33	16.69
IMEC	1.55	7.5	0	0	0	0	0	0.54	0	0.97	0	0	0	10.56
UJF	0	2.9	0	0	0	0	0	0	0	0	0	0	0	2.9
TUE	0	3.8	0	0	0	0	3.9	0	0	0.2	0	0	1.1	9
IISAS	0	0.25	4.84	0	0	0	0	6.45	0.7	2.5	1.55	0	0.5	16.79
TUS	4.84	8	3	6.5	0	0	0	9	7.3	5.09	0.5	1	0.75	45.98
LPU	1	0	0	2	2	0	0	0	0	1	1	0	0	7
BSUIR	2.8	1	0	4	0	0	0	7.71	2	2.5	3.5	12	0	35.51
TULC	0.7	0.3	5.09	0	0	0.3	0	0	0.8	0.6	0	0.4	0.2	8.39
KTU	0	0	8	0	0	0	0	3	1	0	1.5	0	0	13.5
BSU	1.2	10.8	13.3	4.9	0	0	7.2	4	0	0.9	3.4	0.1	0	45.8
UOL	0	0.98	0	0	0	0	0	0	0	0	0	0	0	0.98
RTU	0	0	0	0	0	0	0	0.94	0.43	0.46	0.96	0	0	2.79
CCLRC	0.5	0	0	0	0	0	0	0	0	0	0.15	0	0	0.65
Total	25.38	41.94	51.18	21.41	7.72	17.45	28.27	54.89	32.24	33.23	16.33	18.38	12.77	361.19

Table 3: Efforts in 2004

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	WP13	Total
WUT	0.71	0	1.3	0.68	0	0	0	0	4.57	0	0	0	4.14	11.4
IET	0	5.5	0	0	0	0	0.75	0	0	0	0	0	1.7	7.95
TTU	0.25	0	4	0	0	0	3	3	3	2	0.75	0	1	17
VSTU	0.65	1	4	4.6	0	0	0	3	0	5.95	1.1	0	1.6	21.9
BUTE	0	0	0	0	3	0	0	0	0.3	0.7	0	0	0	4
FEISTU	0.09	1.92	1.73	0.29	0	0.21	15.33	0	0.51	1.17	3.1	0	0.17	24.52
PUB	3.65	0.93	0	0	0	14.86	0	0	0	0	2.78	0	1	23.22
TUI	0	0	1.5	0	0	0	0	5.5	0	1	0	0	0.5	8.5
TUL	0	0	0	0.54	1.88	1.57	0	0	1.9	2.01	0	1.34	0	9.24
IMEC	0	3.2	0	0	0	0	0	2.44	0	0.3	0	0	0	5.94
UJF	0	4.33	0	0	0	0	0.6	0	0	0	0	0	0	4.93
TUE	0	1.3	0	0	0	0	0	0	0	0.2	0	0	0.8	2.3
IISAS	0	2.43	3.8	0	0	0	0	3.7	0	3.5	1	0	0.5	14.93
TUS	0	5.4	7.2	9.6	0	0	0	10.2	1.5	5.8	0.5	0.5	1	41.7
LPU	1	0	0	2	0.7	0	0	0	0	2	2	0	0	7.7
BSUIR	2	2	0	1.5	0	0	0	2	0.5	2	3.5	7	0	20.5
TULC	0.1	0	8.4	0	0	0.3	0	0	3	0.5	0	0.3	0.3	12.9
KTU	0	0	8	0	0	0	3.9	1	2.9	0.5	0	1	0	17.3
BSU	1.2	7.48	0.8	5.95	0	0	0	6.8	0	2.5	6.36	1.7	0	32.79
UOL	0	1.06	0	0	0	0	0	0	0	0	0	0	0	1.06
RTU	0	0	0	0	0	0	0	1.26	0	1.38	0.98	0	0	3.62
CCLRC	0.5	0	0	0	0	0	0	0	0	0	0.15	0	0	0.65
Total	10.15	36.55	40.73	25.16	5.58	16.94	23.58	38.9	18.18	31.51	22.22	11.84	12.71	294.05

Table 4: Efforts in 2005

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	WP13	Total
WUT	0	0	0	0	0	0	0	0	5.03	0	0	0	1.82	6.85
IET	0	4	0	0	0	0	0	0	0.9	0	0	0	0	4.9
TTU	0	0	1.5	0	0	0	0	0	2.25	2.9	0	0.5	0.6	7.75
VSTU	3.65	0	1.05	0	0	0	0	1.5	0	2.7	0.5	0	1.6	11
BUTE	0	0	0	0	1	0	0	0	1	1	0	0	0	3
FEISTU	0	0.96	0.77	1.95	0	0.74	0	0	0.64	0	0	0	0.09	5.15
PUB	0	0	0	0	0	0	6	0	0	0	0	0	1	7
TUI	0	0	0.5	0	0	0	0	1	0	0	0	0	2	3.5
TUL	0	0	0	0	0	1.74	0	0	1.71	1.28	0	1.81	0	6.54
IMEC	0	0.19	0	0	0	0	0	0	0	0	0	0	0.19	0.38
UJF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TUE	0	1.2	0	0	0	0	0	0	0	0.14	0	0	0.46	1.8
IISAS	0	0	3.3	0	0	0	0	3.5	0.55	0.3	0	0	0.65	8.3
TUS	0	2.5	0	1.5	0	0	0	0	3.5	0.5	0	0	0	8
LPU	0	1	0	0	0	0	0	0	0	2	4	0	0	7
BSUIR	0.5	0.5	0	0.5	0	0	0	0.7	0	0.5	0.5	3	0	6.2
TULC	0.1	0	4.2	0	0	0	0	0	2.3	0.3	0	0.2	0.2	7.3
KTU	0	0	4	0	0	0	0	0	0	0	0	0	0	4
BSU	1	4.8	0	2.2	0	0	0	6.4	0	0.25	3.5	0	0	18.15
UOL	0	0.8	0	0	0	0	0	0	0	0	0	0	0	0.8
RTU	0	0	0	0	0	0	0.54	0.8	0	0	0.86	0	0	2.2
CCLRC	0.5	0.15	0	0	0	0	0	0	0	0	0	0	0	0.65
Total	5.75	16.1	15.32	6.15	1	2.48	6.54	13.9	17.88	11.87	9.36	5.51	8.61	120.47

Table 5: Total efforts 2002 – 2005

	WP1	WP2	WP3	WP4	WP5	WP6	WP7	WP8	WP9	WP10	WP11	WP12	WP13	Total
WUT	4.27	0	1.47	2.04	0	0	0.14	0	23.403	0.286	0.086	0	13.49	45.185
IET	0.71	17.49	0	0	0	8.21	0.75	0	4.31	0	0	0	2.11	33.58
TTU	1	0	32.35	0	0	0	7.6	14	6.75	8.9	2.25	0.5	2.2	75.55
VSTU	18.3	3.79	10.4	8	0	0	7.7	10	0.17	18.75	4.73	0.1	5.6	87.54
BUTE	0.6	0	0	0	8.5	0	0	0	2.9	2	0	0	0	14
FEISTU	0.41	6.91	3.9	2.64	0	2.57	16.18	0	3.69	5.41	4.16	0.07	1.17	47.11
PUB	12.48	0.93	0	1.85	0	25.99	20.5	13.35	0	7.1	9.47	3.7	6.38	101.75
TUI	0	0	6	0	0	0	0	21.5	1	1	0	3	3.5	36
TUL	1.23	0	0	0.54	5.02	5.77	0	0	5	12.51	0	7.55	2.75	40.37
IMEC	2.7	12.04	0	0	0	0	0	2.98	0	2.42	0	0	1.34	21.48
UJF	0	11.51	0	0	0	0	0.6	0	0	0	0	0	0	12.11
TUE	0	6.87	0	0	0	0	6.5	0	0	0.64	0	0	2.96	16.97
IISAS	0	2.93	16.19	0	0	0	0	16.65	1.55	7.3	2.8	0.55	2.15	50.12
TUS	10.09	19.9	13.95	22.1	0	0	0	26.4	14.8	16.49	1.5	2.1	2.75	130.08
LPU	2	1	0	4	2.7	0	0	0	0	5	7	0	0	21.7
BSUIR	6.3	3.5	0	8	0	0	0	16.41	4.5	6	9.5	23	0	77.21
TULC	2.1	0.5	22.49	0	0	0.6	0	0	6.5	1.5	0	0.9	0.9	35.49
KTU	2	0	28	0	0	0	3.9	5	3.9	1	2	1	0	46.8
BSU	6.4	26.48	18.5	14.05	0	0	10.8	18.2	0.3	4.8	14.56	1.9	0	115.99
UOL	0	4.44	0	0	0	0	0	0	0	0	0	0	0	4.44
RTU	1	0	0	0	0	0	0.54	3.6	10.93	3.94	2.8	0	0	22.81
CCLRC	4.75	0.65	0	0	0	0	0	0	0	0.25	0.3	0	0.3	6.25
Total	76.34	118.94	153.25	63.22	16.22	43.14	75.21	148.09	89.703	105.296	61.156	44.37	47.6	1042.535