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Europe's new flagship for innovation

Jan Figél opens the doors to the EIT

Don't skimp on R&D!
A warning from Jean Philippe Courtois

The Macedonia Way
Brave ICT policy shows us all how to do it

ICT 2008 SPECIAL REPORT

British Publishers
media with influence

Aho report calls for big changes to get results

The former Finnish Prime Minister **Esko Aho** presented a thorough independent report to the European Commission in June of this year on the state and shortcomings of 'EU High-Tech Research'. It called for some fundamental changes in the way research is approached. Commissioner Reding has responded by putting her weight behind the many proposals

Whilst Esko Aho's latest report acknowledged the improvements in Europe's hi-tech R& D performance it calls for a great deal more to be accomplished particularly to capitalise on the results. Mrs Viviane Reding, European Commissioner for Information Society and Media went on to call the report a "wake-up call for all policy makers responsible for economic policy, research and budgetary rules."

The EU had invested over 4 bn Euros in Information Society research between 2003 and 2006, complementing the 100 bn Euros invested by Member States and private companies. While implementing a new research programme that will run until 2013, the Commission requested an independent panel of experts, chaired by former Finnish Prime Minister Esko Aho, to explore how the effectiveness of the EU's research spending could be improved in order to strengthen Europe's competitiveness.

> European competitiveness within a rapidly changing world economy is at stake, so we have no time to lose

Esko Aho said: "In recent years Europe's Information Society research has delivered encouraging results from mobile communications to Electronic Stability Control systems in motor cars. However, I believe a systemic change in the EU's research policy is needed to avoid that EU research spending is not more than a mere drop in the ocean. I call on the EU Member States and on the European Parliament to equip the EU with the right, flexible tools to better focus European high-tech research and to open it up to more risk and to new international partners."

Esko Aho and his panel were charged with analysing and weighing up the effectiveness of Information Society research under the EU's 6th Framework Programme for Research and Development. They concluded that the European Commission were taking a lead in boosting Micro Computer and Nano-Electronic research but it needed to do more to drive innovation to compete with the rest of the world.

Commissioner Reding, in receipt of the report concluded, "The 4 billion Euros spent on high-tech research is a considerable amount of taxpayer's money. However, Europe does not get the most out of it in terms of growth, jobs and innovation. The *Aho Report* has rightly concluded that the effectiveness of Europe's high-tech research is too often stifled by red tape, a lack of venture capital and a risk-averse mentality in both national and European administrations. I thank Esko Aho and his distinguished panel for having used plain English to highlight these shortcomings." She continued, "The consequences to be drawn from the *Aho Report* will have to be discussed intensely by the Council of Ministers, the European Parliament and also the European Commission itself as a matter of priority under the forthcoming French Presidency. In this debate, nothing should be a taboo. I will not be satisfied by empty promises when what we need is a strong shared will to reform the system of EU research. One measure for the Commission to explore is to centralise and focus EU research in one department. We should also better exploit public-private partnerships allowing for more flexibility under the EU's rules. I will address these issues in a Communication to the European Parliament and the Council in autumn this year. European competitiveness within a rapidly changing world economy is at stake, so we have no time to lose." eS

The full text of the "Aho Report" on the Effectiveness of Information Society Research in the EU's 6th Framework Programme 2003-2006 is available at: ec.europa.eu/dgs/information_society/evaluation/rtd/fp6_ist_expost/index_en.htm

Recommendations for improvement by the Aho Report

- Continue to consolidate public-private-partnerships of a more permanent nature, such as Joint Technology Initiatives (JTIs)
- Increase support of SMEs
- Create a new platform for new high-growth companies to meet investors
- Encourage support from countries outside Europe
- Internationalise the advisory system
- A more flexible approach may be needed to integrate new developments faster
- Europe should be selective and not attempt to become a world leader in every area
- The e-Infrastructures approach should be expanded to more application-oriented and user-oriented platforms in other sectors
- Accounting control in JTIs should be carried out by Member States and participating companies
- Developing a more trust-based approach towards participants at all stages, also allowing for shorter proposals
- Constructive feedback is needed to unsuccessful proposals
- Applications passing basic checks should be given a small amount of 'seed funding' for an exploratory phase
- Financing projects based on performance rather than promises and reputation
- Expand the two-step evaluation procedure from the Open part of the 'future and emerging technology' area to other parts of the programme – prospective participants first provide a broad outline of their project idea, and only provide a more refined plan once they are selected. This may increase the workload for the Commission in the early phases, and lengthen the evaluation process, but it will significantly reduce the burden on the research community of preparing proposals
- Optimise reporting and allow the participants to report when there is something to report
- Allow the refocusing of the research on different priorities if this becomes necessary during implementation
- Allow more flexibility in the composition of partnerships during the project, including the possibility of changing partners if the research takes a direction which would benefit from new partners or replacement of partners
- More strategic use of standardisation to create new EU-wide markets
- New initiatives to be taken to allow public authorities to procure the development of innovative goods and services
- The European single market needs to be made more effective for business angels and venture capitalists, and European investment funds need to be more effectively utilised to pull through innovations from the Framework Programmes
- A more strategic approach to standardisation at the European level, when this cannot be left to market forces, focused on interoperability and development of standards
- The interconnection of large regional and national eInfrastructures should be further developed. EU-wide platforms and infrastructures are needed in sectors such as eGovernment (especially procurement), eHealth (cross-border applications), logistics and transport

THE EIT

Europe's new drive for knowledge transfer

The European Institute of Innovation and Technology (EIT) is the EU's new flagship initiative for boosting innovation in Europe. After an opening ceremony on 15 September in the host city of Budapest involving the Hungarian Prime Minister Ferenc Gyurcsány, Commission President José Manuel Barroso, and Commissioner for Education, Training, Culture and Youth, Ján Figel', Richard Forsyth interviews Commissioner **Ján Figel** on the meaning of the Institute

eStrategies: Can you describe how EIT is filling a gap between higher education and R&D? And in this context can you explain the best way of nurturing the relationship between education, research and innovation?

Ján Figel: The EIT is the first European initiative to fully integrate the three sides of the knowledge triangle – innovation, education and research. Until now, higher education has constantly been the absent member of innovation partnerships. The EIT will change this fundamentally, in that it makes higher education institutions an indispensable partner in its operational base, the so-called Knowledge and Innovation Communities (KICs). One of the effects will be that the business and research partners within the KICs will be closely associated in the establishment of curricula, thereby ensuring that students will be equipped with the necessary scientific and entrepreneurial skills which are so much needed in a knowledge economy.

Regarding the best way of nurturing the relationship between education, research and innovation, there is a clear answer to me: people. Qualified and motivated people are the best asset for innovation and indeed the most effective way of sharing knowledge. The EIT will foster the interaction among partners and help to create new opportunities for students, researchers and entrepreneurs.

eS: How can the EIT make up the much needed difference to the aims of the Lisbon Agenda?

Figel: Here again, my first answer is: people. By making Europe a more attractive place to study and do research, we will be able to reverse the 'brain drain' into a 'brain gain'. By offering attractive jobs through the creation of new business opportunities, the EIT will be able to make its contribution to the Lisbon Strategy for Growth and Jobs. This will not happen overnight, but I am very confident that the EIT has the potential to inspire sustainable change in Europe's innovation landscape. By serving as a reference model, the EIT will help to establish a new mindset among higher education institutions, research centres and the business world.

eS: Is the EIT trying to model itself on MIT (Massachusetts Institute of Technology) in the US? Can it achieve the same status from an international perspective?

Figel: The EIT is a European answer to global challenges. When designing the EIT, we combined internationally successful elements with specific features that take into account the particular situation in Europe. The EIT is inspired by institutes like the MIT in that it fully incorporates the business component in the model. The strong link between business and education has so far been lamentably underdeveloped in Europe.

At the same time, the EIT has a unique structure that reflects the specificities of the European situation and draws upon our strongest assets. The EIT is not a green field institution. It is a model that builds upon and further invigorates all the excellent universities, research centres and companies that already exist in Europe and beyond.

And of course, we hope that the EIT will establish itself as a reference brand with international renown. The EIT is a European initiative, but with a very clear global dimension. We want to reach out to the best partners world wide; not only re-attracting European students and researchers, but also making Europe an attractive place for the best talents from all over the world.

eS: Knowledge and innovation communities or KICs – what's that about?

Figel: With the Knowledge and Innovation Communities (KICs) we are striking an entirely new path. They are the operational base of the EIT, and definitely the most innovative part of the initiative. Following a clear 'bottom-up' logic, the KICs are highly integrated, excellence-driven partnerships between universities, research organisations and businesses. They are equipped with a substantial degree of autonomy to define their vision, internal organisation, working methods and agenda. The KICs will search for innovative and global responses to complex societal challenges, such as climate change, renewable energy or the next generation of information and communication technology. This also means they will go way beyond any existing programme, both in terms of timing – with a life span of at least 7-15 years – but also in terms of pooling together top-notch knowledge from across the board through a very clear inter- and trans-disciplinary set up.

eS: How will the private sector be reeled into investing into and making connections with this institute?

Figel: My answer is simple: by the pertinence of the EIT concept. And here again, one of the most convincing arguments are the people. One of the biggest problems for innovative businesses in Europe is the skills shortage. The EIT will help to bridge this gap by making the KICs a fertile breeding ground for top-level graduates with real-world skills suited to the needs of the knowledge economy, and by promoting the free movement of students and researchers among the different partners.

And this is not the only competitive advantage for businesses. Conceived with and promoting an entrepreneurial mindset, the EIT will include business at the centre of its strategic planning in order to focus research and education activities on emerging areas that have the potential to boost innovation. This in turn will enable companies to offer new products and services and to generate high returns on investment. Moreover, the EIT will facilitate private sector investment by setting up its own Foundation, which will operate in a non-bureaucratic, business friendly manner. The feedback we are getting from business clearly confirms that we are on the right track.

eS: The EIT is still in early stages, can you explain where it is now and how it intends to develop?

Figel: With the first meeting of the Governing Board on 15 September, the EIT has now started its work, and we expect to be at cruising speed by 2010. In the coming months the Board will work very intensely to meet the January 2010 deadline for the selection of the first 2-3 KICs. Later the same year we also expect it to complete setting up the administrative support structure at the Institute's seat in Budapest.

At the same time, the success of the EIT will not grow overnight and we have deliberately chosen an incremental development path for the establishment of the KICs. There will be an independent evaluation of the initial 2-3 KICs in summer 2011. In parallel, the first long-term Strategic Innovation Agenda will be set up. And it is on this basis that further KICs will be chosen.

eS: What was decided on the 15 September regarding the Governing Board?

Figel: The meeting on 15 September marked the beginning of the Governing Board's activities.

The 18 members of the Board took some important decisions concerning their internal organisation and functioning, including the election of the Chairman, Prof. Dr. Martin Schuurmans, a Dutch citizen and former Executive Vice President, Philips Research / Philips Medical systems (PMS).

In the coming months, the Governing Board will need to take a number of fundamental decisions, notably on the governance and structure of the KICs, as well as on their themes. It has – among other things – to elect the first Executive Committee and to select the first Director of the Institute. I would also like to stress that the Governing Board has been handed an unprecedented level of autonomy. We wanted the 18 high-calibre members to be able to use their wealth of expertise and to focus on their mission without any political or bureaucratic interference.

eS: How vital is innovation to Europe's competitiveness?

Figel: Innovation is like oxygen for our economy. Only a constant flow of fresh ideas and their transformation into new commercial opportunities will allow Europe to compete in the globalised world economy. Brain power is our most valuable 'raw material' and it is high time to do everything we can to use this asset as effectively as possible. Europe could do much better in this respect. The innovation performance of our international competitors, such as the United States and Japan, is still considerably above European levels. And other countries are catching up.

We cannot afford to waste talents and creativity. The EIT is therefore a very timely initiative, since it will create an environment that is at the same time receptive and stimulating for the creation of new ideas and business opportunities. We decided to promote an innovation-friendly environment also by declaring 2009 as the European Year of Creativity and Innovation.

eS: In summary, what is the EIT expected to achieve for Europe?

Figel: The EIT will have positive effects on many levels. There is clearly an economic dimension, whereby the EIT will create new business opportunities through new research results and their better exploitation. This is a vital precondition for the creation of new jobs and for sustainable economic growth and therefore for the future well-being of Europe.

The EIT will also bring answers to large societal challenges. Through the EIT we want to find solutions to major and vital questions such as climate change and the future of our energy supplies or communication systems. These are major questions that cannot be tackled in isolation and where the EIT will provide the basis for such a joint effort.

Finally, and perhaps most importantly, the EIT is expected to bring about systemic change. The EIT model will nurture a new generation of innovators in Europe: students, researchers and entrepreneurs with a truly European, open and creative mindset who will be a driving force for change in our education and innovation systems. This way, we will make innovation an intrinsic feature of our society. eS

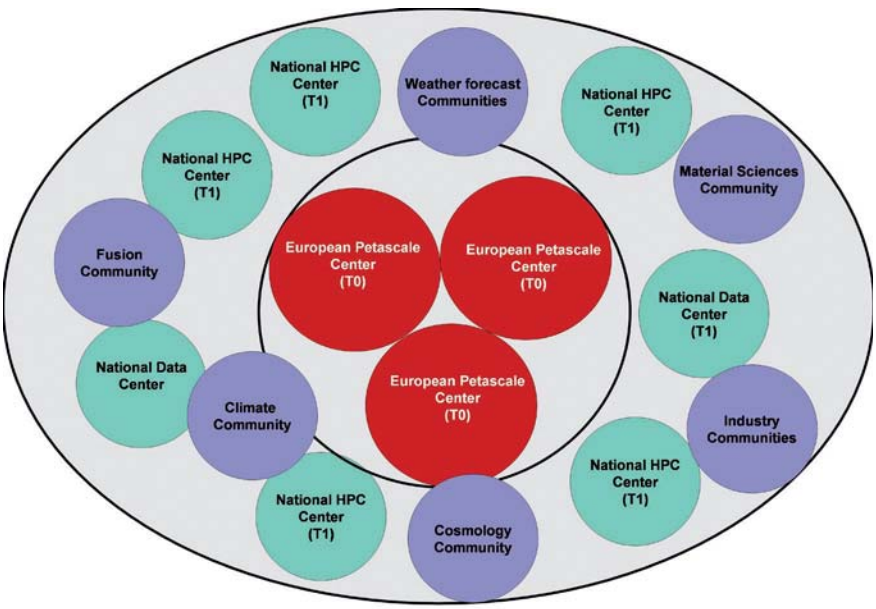
DEISA – towards a persistent European HPC Infrastructure

Creation of the Distributed European Infrastructure for Supercomputing Applications was a milestone to establish Europe-wide supercomputing resources and to contribute to advancing computational sciences in Europe, explains **Dr. Hermann Lederer**

Supercomputing has become a key technology and an indispensable tool in all natural sciences. It is now accepted that processing power of the very highest level is needed to perform cutting-edge research. This fact has been recognised by the European Strategy Forum on Research Infrastructures (ESFRI, www.cordis.europa.eu/esfri) in its Report 2006, which stated: "capability computing refers to provision of large low latency machines capable of tackling large scale and closely coupled problems which can not be solved in any other way".

ESFRI recommended a European strategic approach to high-performance computing, "concentrating the resources in a limited number of world top-tier centres in an overall infrastructure connected with associated national, regional and local centres, forming a scientific computing network to utilise the top-level machines".

The same year that ESFRI was launched, back in 2002, the establishment of a Distributed European Infrastructure for Supercomputing Applications (DEISA, see www.deisa.eu) was proposed in an Expression of Interest to the European Commission, to overcome the fragmentation of supercomputing resources in Europe. The FP6 DEISA proposal was submitted in May 2003. In December of 2003 the e-Infrastructure Reflection Group (e-IRG, see www.e-irg.eu) was established by member states to coordinate the introduction of a Grid-based infrastructure for e-Science at European-high level. In May 2004 the Integrated Infrastructure Initiative FP6 DEISA project was started by eight leading European supercomputing centres, joined in 2005 by three more leading centres. DEISA reached production quality soon after and started to support leading edge European capability computing projects as of 2005 through the DEISA Extreme Computing Initiative (DECI).

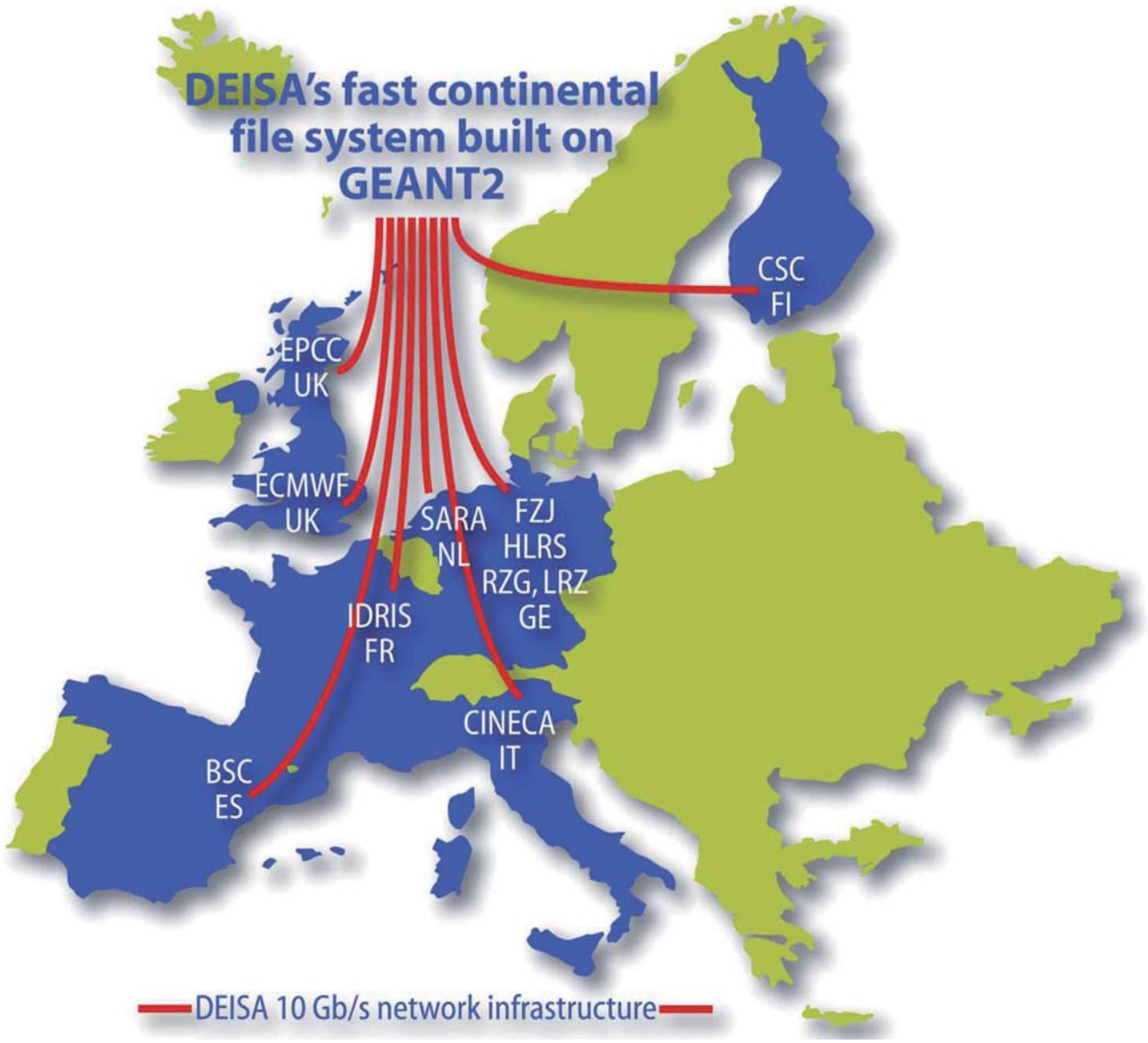


Schematic illustration of the HPC ecosystem integrating national HPC centres, future European Petaflop centres and science communities Deisa©

In 2006 the ESFRI recommendations for the enforcement of High Performance Computing in Europe appeared, based on results of the e-IRG and the High-Performance Computing In Europe Taskforce (HET, see www.hpcineuropetaskforce.eu), which was established in June 2006 by 11 European countries. In May 2007 14 member states signed a Memorandum of Understanding (MoU) for a Partnership for Advanced Computing in Europe (PrACE, see www.prace-project.eu) which started in January 2008 also as a two year FP7 Design Study, aiming for the installation of a limited number of European leadership-class (Tier-0) supercomputers. After four years of support through EU FP6 funding until April 2008, the DEISA Consortium succeeded to continue its engagement for a persistent integrated European HPC infrastructure for another three years through EU FP7 support for the DEISA2 project.

DEISA in EU FP7

Through the FP7 DEISA2 project the DEISA Consortium continues to support, consolidate and further develop the DEISA HPC infrastructure which is unmatched world-wide in heterogeneity and complexity. Services of the European supercomputing infrastructure, which is built and operated on top of national services, are extended for capability computing and data management. Activities and services relevant for Applications Enabling, Operations, and Technologies



Facilitation of data management through a continental global file system, based on the dedicated high speed network provided by GEANT2 and the National Research and Education Networks Deisa©

are continued and further enhanced. The service provisioning model is extended from single project support to one supporting Virtual European Communities and EU projects in computational sciences. Collaborative activities will be carried out with new European and other international initiatives.

DEISA Services

Taking care of the operation of the infrastructure and the support of its efficient usage is the task of the service activities named Operations, Technologies and Applications. Operations refers to operating the HPC infrastructure and advancing it to a turnkey solution for the future European HPC ecosystem. Technology covers monitoring of existing technologies in use and taking care of new emerging technologies with relevance for the infrastructure. Applications addresses the 'areas applications enabling' for the DECI, Virtual Communities and EU projects, environment and user related application support, and benchmarking for the provision and maintenance of a European Benchmark Suite for supercomputers. In addition, Joint Research Activities aim at an integrated environment for scientific application development, and at the enabling of applications for the efficient exploitation of current and future supercomputers characterised by an aggressive parallelism.

A focus of DEISA is on the provisioning and operation of those infrastructure services which allow its users to efficiently work within a distributed high performance computing environment. These are:

- Dedicated high speed network
- Common AAA (Authentication, Authorisation, Accounting) with "single sign on" and accounting/ budgeting
- Global data management with high performance remote I/O and data sharing with global file systems,

and high performance transfers of large data sets

- User operational infrastructure with a DEISA Common Production Environment (DCPE), a job management service and a common user support and help desk

- System Operational infrastructure with common monitoring and information systems and common system operation

- Global Application Support

DEISA Extreme Computing Projects and Virtual Communities

The DEISA Extreme Computing Initiative (DECI), launched in 2005, continues to support the most challenging supercomputing projects in Europe which require the special resources and skills of DEISA. A European Call for Extreme Computing Proposals is published annually.

By selecting the most appropriate supercomputer architectures for each project, DEISA is opening up the most powerful HPC architectures currently available in Europe for the most challenging projects. This strongly mitigates the rapid performance decay of a single national supercomputer within its short life cycle of typically about five years, as implied by Moore's law. DEISA, started with an aggregated computing peak performance of 30 TeraFlop/s in 2004, and has reached about one PetaFlop/s in 2008. Over 100 challenging projects have already been performed or are still ongoing in all major areas of science, and scientists from over 160 different universities and research institutes from 15 different European countries with collaborators from North and South America, Asia and Australia have already benefited.

This successful service provisioning model for single projects has now been extended to persistently supporting Virtual European Communities and EU projects in computational sciences. First communities supported already in 2008 are from Fusion Research and Life Sciences.

International activities and collaborations

Collaborative activities will be carried out with new European and other international initiatives. Emphasis is put on contacts to research infrastructure projects established by the ESFRI, and the European HPC and Grid projects such as PRACE and EGEE, respectively. The activity reinforces the relations to other European and international leading HPC centres and initiatives, e.g. in the United States, Japan, Australia, Russia and China. For supporting international science communities DEISA participates in the evaluation and implementation of standards for interoperation. Within OGF DEISA is active at several levels and especially supports the GIN activity. Of accentuated importance are the activities of the Infrastructure Policy Group, aiming at achieving the seamless interoperation of leading Grid Infrastructures worldwide. Current members are DEISA, EGEE, TeraGrid, OSG, and Naregi. The initial focus is on Authentication, Authorisation and Accounting. DEISA and EGEE, Europe's representatives, are very closely cooperating.

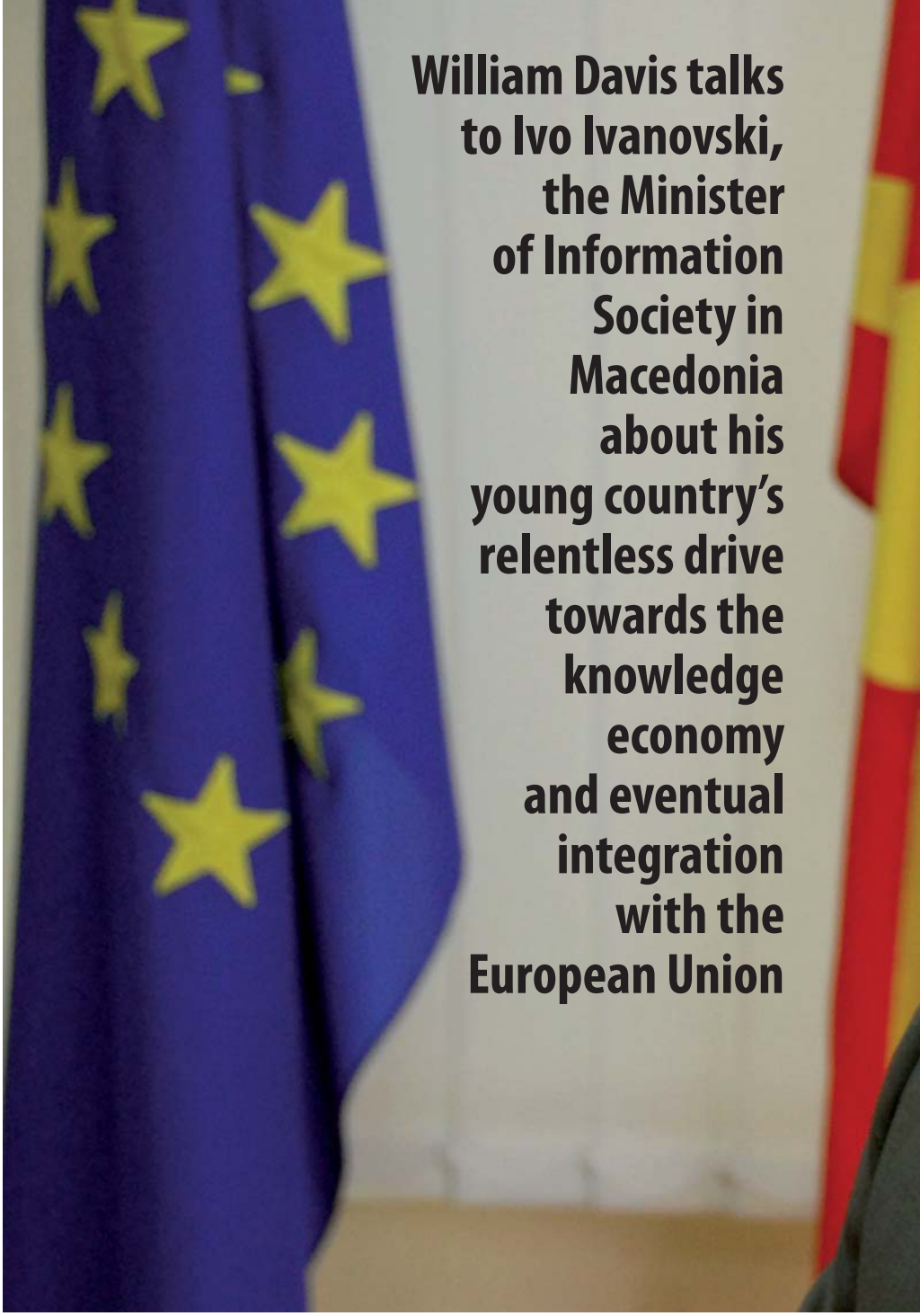
The Vision

The key role and aim of DEISA will be to deliver a turnkey operational solution for a future persistent European HPC service, integrating national HPC centres (Tier-1) and the new European Petascale centres (Tier-0), to be established by PRACE, as illustrated in the following sketch.

> A focus of DEISA is on the provisioning and operation of those infrastructure services which allow its users to efficiently work within a distributed high performance computing environment

Dr Hermann Lederer is head of application support at Garching Computing Centre of the Max Planck Society (RZG). He received a diploma in physics from the University of Munich (LMU) and a PhD in Natural Sciences from the Technical University of Munich (TUM). After leading the European Applications Task Force and Joint Research Activities in Plasma Physics and Materials Science in the FP6 DEISA project, he became work package leader for external relations and dissemination in the FP7 DEISA2 project.

Interview



William Davis talks to Ivo Ivanovski, the Minister of Information Society in Macedonia about his young country's relentless drive towards the knowledge economy and eventual integration with the European Union

It became clear soon after the formation of the Former Yugolsalv Republic of Macedonia in 1991 that despite historical disputes with the young country's neighbours as well as the difficulties inherent in creating a successful democracy from the remnants of a crumbling communist state, there was a clear understanding of the value of ICT in creating the economic bedrock that would form the foundations of the country's successful future.

Following the lead of other former communist states like Estonia, the formation of a true knowledge economy was quickly seen as a priority and, as early as 2002, the country made a decisive e-Declaration to speed up the development of the information society and digital economy and made this a national priority.

"Those countries that fail in the articulation of resources needed for development by using modern Information Communication Technology will remain in stagnation, and fail to keep up with the modern world," warned the declaration.

Momentum

Just five years on from this statement and with Prime Minister Nikola Gruevski and his team maintaining the momentum, Macedonia is moving ahead with these goals firmly in sight, with a dexterity that evades many larger, richer countries in the European Union. The structure has been clearly defined, while there is little legacy to untangle and the national policies and initiatives are being implemented without the need to battle with bureaucrats, Eurocrats and red tape – all with the understanding that public, private partnerships are essential for successful growth.

And the results are clear for all to see – from being known as one of the poorest nations in Europe, it is now one of the most technologically advanced. Using foreign aid, commercial sponsors and government funding, the country has installed a computer laboratory in each of its 430 schools and has a nationwide broadband network that wirelessly covers 95 per cent of the land. The network, which uses Motorola technology, uses WiFi hotspots to bring high-speed Internet access to remote rural areas, while mesh technology is used to blanket cover urban areas.

While the initial impetus for the school computer project and blanket internet access was provided by former president Boris Trajkovski, who died in 2003, it has been implemented by Gruevski and his team, and in particular the young and dynamic minister for the Information Society in Macedonia Ivo Ivanovski. The former director of an IT company was brought up and educated in America, but has been advising the Prime Minister on technology since he was in opposition.

When Gruevski was elected Prime Minister, Ivanovski was immediately brought in to fill his first political role in the Macedonian Government, taking the prized position of Minister for the Information Society. When he arrived, however, although the vision for the knowledge economy was there, little was being implemented.

"When I arrived there were no projects having any impact on the government or the citizen in Macedonia," he said. "We inherited an

administration where there were paper documents and, while the strategies indicated where the government would like Macedonia to be in the next five or 10 years, nothing was being implemented."

Immediately, Ivanovski began changing this with a clear programme designed to fully utilise the country's connectivity but also invest in the future, for he was clearly thinking in the long term.

"We came in with a rich programme and strategy outlining exactly where Macedonia should be by 2012 – and we began implementing straight away," he said.

And one of these programmes has been the most ambitious ICT project in Macedonia's short history – a computer for every child in the country.

"This is going very well," claims Ivanovski. "We have finished installing all the computer equipment in all the 93 high schools, which is approximately 55,000 stations, all using advanced technology with both thin and full client capabilities."

As with the wireless development, an international tender procedure was used for the one PC for every child project with the government looking for the best value for both full and thin client capabilities. Ivanovski explains the process:

"In choosing the hardware and software we used and international tender and eventually went with the best deal for full client capabilities from Chinese company Haier, while the thin client came from US company NComputing. Under this deal there are now seven children to one computer – each with their own computer screen and using the same desktop.

"We are currently in the process of equipping all of our 365 primary schools, and by the end of this year all of them will have computers installed in five to 10 classrooms. We then aim to purchase a further 35,000 stations through tender and procedure by the end of the school year; this will mean that children from fourth grade to senior high-school will each have access to a computer."

Globilised market

Of course, equipping the children with the hardware is only half the story and, again, Macedonia is looking far into the future with an ambitious plan for eLearning software that will utilise both local and English-speaking content, preparing the Macedonian scientists, technologists, researchers and business people of the future for the globilised market.

"Our strategy for the next five years is that we are to develop the digital content for the children to use. The operating system we are using is Edge Ubuntu – which is open source and comes with a collection of tools for basic subjects. We are also, however, downloading many tools from the internet and we are currently working out how we can incorporate them into our curriculum in our primary, secondary and high-schools.

"The software used on the computers is international," he continued. "The only exception to this will be with Macedonian literature, Macedonian history and Macedonian geography – all of which will be developed in house. We are, however, localising and translating into Macedonian the international software and are undergoing teacher training, equipping them with the knowledge and skills

Defending our Cyberspace

The Executive Director of ENISA (European Network and Information Security Agency), **Andrea Pirotti**, reveals the many security threats that are rife in our online society and how Europe intends to systematically tackle them, in this interview conducted by Richard Forsyth

eStrategies: What sort of network abuses and dangers have come to your attention this year as a serious threat?

Andrea Pirotti: The biggest threat to large network structures like national public communication infrastructures in the EU Member States are still massive Distributed Denial of Service Attacks, committed by cyber criminals, using so called botnets, networks of infected systems, mainly in use by end users. The biggest threat to the citizens is identity thefts in coincidence with cyber robberies of private bank accounts. This goes together with leakage of theft of confidential data, for example by infection of private PCs with Trojans and key loggers, or very sophisticated social engineering. Considering these threats in conjunction with the importance of vital information infrastructures (e.g. e-communication infrastructure, transportation, banking, health etc.) gives a clear picture about the effects of such abuses/risks. Member States have already recognised this: ENISA has launched a multiannual programme to take care about the availability of e-communication networks that will influence future security measures and eventually relevant European legislation in this vital field.

es: Is the law keeping pace with new threats in networking and cyber space? Also are prosecutions high, or do many criminals get away with it, can you speculate?

Pirotti: There are auspicious examples of successful inquiries by law enforcing agencies in the Member States, but still the dark figures are tremendous and the number of successful detentions and prosecutions far from being satisfactory. Especially in the area of privacy – including data protection, electronic identity and context information allowing for personal profiling – it seems that significant needs for regulatory intervention still exist.

Crimes in the aforementioned areas are difficult to track and clear up. This is mainly due to the inability of law enforcement agencies to detect and analyse potential threats and threat agents. International cooperation in the area of law enforcement for cyber-crimes does not effectively protect consumers from misuse (e.g. for Internet transactions involving international parties).

es: Mobile phones, especially in developing countries are becoming more and more the choice of ICT devices. They are also becoming more complicated, replicating many of the functions that computers have, including Internet access. Will mobile phones and mobile devices have an additional impact on networking challenges for security?

Pirotti: Mobile devices are both a security tool and a security risk. On the one hand, they can provide us with an extremely convenient way of identifying ourselves – a powerful computer everyone already owns and carries with them all the time, and which they tend to notice and take action if stolen or lost. This makes a compelling case for their use as identification tokens and personal information managers – even in e-Government applications.

On the other hand, mobile devices have their own set of security problems – and the risks that come with this opportunity need to be carefully managed. A mobile user continuously leaves traces of their identity and transactions, often just by carrying around the device in their pocket. Statistics show that there is an increase of stolen mobile devices which nowadays store more and more personal information about their users. New weaknesses in the secure elements like smartcards are in

the popular and technical press on a daily basis. ENISA is conducting a study on mobile devices as a tool for identification which will be published in Q4 this year.

es: Cyber wars / or massive attacks the like that Estonia suffered which crippled the electronic infrastructure temporarily are a serious threat to economies, let alone security, so how prepared is Europe for this sort of scenario happening again?

Pirotti: The open structure of the Internet does not provide any means of prevention of massive Distributed Denial of Service Attacks like those against Estonia in 2007 that temporarily brought down their public communication infrastructure. The only protection against those attacks is mitigation, and here the Computer Emergency Response Teams (CERTs) in the European Member States and beyond play a key role. Only by coordinated Incident Response, where attacking systems around the globe are identified and neutralised, massive cyber attacks can be mitigated. It is one of ENISAs key tasks to help the EU Member States to set up Computer Emergency Response Teams by providing expertise and material, in order to clear out "white spots" in the Incident Response landscape in Europe, and to foster CERT cooperation wherever needed.

es: Social networking invites sharing of personal information. How dangerous is this – have there been many cases to your knowledge where social networking has led to fraudulent activity or criminal elements taking advantage? Also, have there been many prosecutions to your knowledge?

Pirotti: Social networking has been a breeding ground for some of the fastest spreading viruses we have seen. It is by nature an extremely viral medium –information spreads fast from person to person, which makes it fertile ground for a new breed of spammers and scammers, who misuse the sense of trust people feel in communicating within an "intimate" circle of friends. Rather than the criminal abuses however, I would emphasise the potential damage to European citizens due to voluntary disclosure of personal information. Many innocent users do not realise the size of their audience and the potential consequences to their career. I am happy to report, however, that we are seeing an improvement in security on social networks since the publication of ENISA's report last year. For example many providers are now offering open formats which allow users to export their data in a more secure way so that they not locked into a single provider.

es: With the advent of e-Passports there have been many who doubt they are very secure at all and early attempts to hack them have succeeded – we recently interviewed Lukas Grunwald (who works for dn-systems) who famously cloned an e-Passport and he is adamant that even with Extended Access Control they are not secure. My question is – should we be looking into these sort of electronic solutions for passport ID at all when the hackers and fraudsters are so clever at undermining every attempt at these security solutions. There are other ways to make important documents secure – including reading the unique physical texture of the document at a highly magnified level – PIN numbers etc as with bank cards. Are sophisticated new solutions often an unknown variable with possible flaws that will not be known until they are operational?

Pirotti: Cloning a first-generation electronic passport is not a hack and certainly not a magic trick. The aim of the electronic chip is to prevent criminals from modifying the passport, for example replacing the photo or changing the serial number. Therefore, a digital image of the passport holder is stored on the chip, together with personal information like name and date of birth. This data is digitally signed by the issuing authorities and can be verified at the border using the government's public key. The simple copying of data onto another chip does not pose a threat to the system. Of course, new security mechanisms sometimes come with flaws and sometimes can be broken and it is certainly true that no system is 100 per cent secure. Nevertheless, electronic security elements, combined with classical printing technologies, constitute a powerful way to fight against document fraud.

es: Enterprise level security is usually good but SMEs make up the bulk of business in Europe – how high is network security on their agendas and how concerned should they be about networking security threats?

Pirotti: SMEs are a major economic factor in the European economy and for most SMEs information technology forms an indispensable part of their business. However, there are clear indications that NIS is not high on SMEs agendas.

Whereas it is true that SME risk exposure is generally lower than the one of large enterprises, SMEs should still be concerned about NIS threats. Every enterprise is exposed to security risks in proportion to their reliance on information technology. Therefore, increasing implementation of information technology in SMEs will result in increasing risk exposure and an increasing necessity to react.

In order to tackle this issue, ENISA has implemented an ad-hoc Working Group which will assess SMEs' information security needs and point out good practices and solutions implemented in EU Member States. The Working Group will deliver at the end of 2008.

es: Do you think ENISA is going to face some innovative criminal activity in the coming years and with ICTs developing at such a fast pace can security measures and regulation be aligned with this pace of development (including cultural changes in approach to, and usage of ICTs) or will this be difficult?

Pirotti: The criminals have become very professional in committing all sorts of crime online in an increasingly complex Information Society. We are facing an arms race to keep up with a fast developing 'sector' in our society. This will never change. We therefore have to be committed to protect ourselves best against the risk of being online. It requires a continuous development and nurturing of a culture of security, starting with raising awareness to make people vigilant. es

Wearable computing pioneered by the wearIT@work project

As the largest project world-wide in 'wearable computing', which incorporates computer technology into clothing, wearIT@work is setting new standards of applicability and integration in this field – with a goal of improving productivity, efficiency and safety in the workplace. Professor **Otthein Herzog**, coordinator of the project, explains some of the applications to date

Set-up by the European Commission under the Sixth Framework Programme and consisting of forty-two partners with a project volume of €23 mn and EU funding of €14.6 mn, the wearIT@work campaign is making strides towards its goal of computer system integration in wearables. In addition, its applications of these new technologies are diverse and, while developing for the industrial workplace, are also pushing the technology into innovative new areas.

The main goal of the wearIT@work project is to 'investigate the user acceptance of wearables'. This is being achieved, as well as methods for user interaction and the identification of successful wearable processes, through the project's four industrial pilot applications and three take-up schemes. The basis for the pilot schemes is focused on four areas: variant production, clinical pathway, maintenance and emergency. The take-up schemes on the other hand, focus on fire prevention in rural areas, cultural heritage and e-Inclusion.

However, despite the high level of research activity and practical application through trials, the apparent benefits of wearable computing, at first, remain unclear. This is something the wearIT@work project wishes to address. The benefits of wearable computing are two-fold: firstly, the technology leads to an increase in productivity, thus allowing simplified access to enterprise information and therefore to faster group decisions, and secondly, increased safety at work and decreased pressure towards automation. In addition to this, it is important to note that the world-wide market for wearable computers generated over $600 mn in 2006, a figure that will increase to over $1.7 bn by 2011.

Wearable computing is not overly intrusive and very effective for information

So how has the project progressed since initialisation? Run in 18-month cycles, the project has developed from early 'Show Cases', through 'System Prototypes' and finally into 'Industrial Pilots' in all four dedicated scenarios and the three take-up applications. Indeed, as the project stands now – underway in all Industrial Pilots and take-up applications – the integration of wearable computing seems inevitable.

Industrial Pilots

By wearing computer-integrated clothing many industries and enterprises, not necessarily office based, can reap the benefits of the wearIT@work project. The wearIT@work: Ward Round Support is a good example as one of the projects' Industrial Pilots, and demonstrates the benefits to healthcare that wearable computing can offer. By equipping physicians and nurses with wearable devices and software systems, wearable computing allows them to access all available patient information at any time and any place in the hospital. This provides them usable, ubiquitous access to information through connections to the clinical server and audio and visual functions, greater data retrieval, an

improved quality of information and prevention of patient mix-up through context awareness.

Another Industrial Pilot, Emergency Response: a wearIT@work application field, further demonstrates the benefits wearable computing has to offer. Created to 'push wearable computing to its limits', here the wearIT@work project has worked in co-operation with the Paris Fire Brigade (BSPP) to provide – through wearable computing – Localisation and Navigational Support, Context-Sensitive Information Services and Enhanced Communication systems. These developments have in turn led to improvements in safety, communication and rescue rates.

devices – with the former reporting from the field to the latter at a 'situation room' in direct contact with local fire brigades.

The wearIT@work concept

The wearIT@work wearable computing concept differs from that of conventional mobile systems. Instead of basing interaction on a modified version of a desktop human computer interface (HCI), the wearIT@work concept focuses on the interaction between the user, the system and the environment. Instead of forcing the user to choose between interacting with either the device on one hand, or the environment on the other (but never

The main goal of the wearIT@work project is to 'investigate the user acceptance of wearables'. This is being achieved through the project's four industrial pilot applications and three take-up schemes

Take-up projects

Of course it's not just in the health and emergency domains where wearable computing has a future, nor indeed merely in the Industrial Pilots. WearIT@work has seen significant developments in all three of its take-up projects too, particularly in rural fire prevention. 'Farmers Rangers' in Lunigiana: a wearIT@work take-up action, aims to counteract the effects of climate change and arson by protecting fire-prone ecosystems. The project works by creating a 'living-lab', constituting a collection of producers and officials who act as 'Farmers-Rangers', protecting a large area through integrated mobile

both), the wearable system pioneered by the wearIT@work project allows the user to interact with the system and the environment simultaneously. Further, 'there is direct interaction between the system and the environment as well as the possibility of the system mediating the interaction between the user and the environment.'

This synergy of user, device and environment underpins the entire wearIT@work project. The 'always-on' nature of the wearables accompanied by this focus, provide a fluid cross-pollination of enterprise, user and computer system – in turn allowing greater productivity, communication, safety and efficiency.

Industrial applications and emergency service applications are currently in use

Otthein Herzog is the head of the Artificial Intelligence Research Group at the Computer Science Department of the University of Bremen since 1993. Before he joined academia, he worked in industrial software development and research with IBM for 16 years. working in many international software product development and research projects.

The AI Research Group is fully integrated in the "TZI - Center for Computing Technologies" of the University of Bremen, which was founded by him in 1995 devoted to the technology development and transfer in the areas of Mobile Computing, Intelligent Systems, and Digital Media.

For further information on the project, including a full list of 42 partners and an overview of the Technology Repository, the collection of available wearable technologies:

W: www.wearitatwork.com

e-Infrastructures designed for demanding science

As scientific research advances, so the lines between what were once viewed as separate subjects become increasingly blurred. Against this backdrop Virtual Research Environments take on enormous importance, says **Donatella Castelli** of the D4Science project

In the current climate of scientific endeavours, creating an effective means of collaboration between partners is crucial to furthering the collective research agenda. However, such partners are often widely dispersed, autonomous entities, and thus enabling collaboration between them is a far more complex matter than it may at first appear, one in which there is a significant role for innovative new technologies.

"Scientific collaborations are often cross-disciplinary, and as such may need to rely on Virtual Research Environments that provide data and processing capabilities, as well as interaction intensive workflows," acknowledges Donatella Castelli of D4Science - a project funded under the EU FP7 'e-Infrastructure Capacity Programme' working to enhance European e-Infrastructures and Virtual Research Environments. This is work of enormous importance, particularly given the backdrop of scientific research growing ever-more dependent on the availability of relevant information, as well as analytical and processing tools. "The relevant information and tools often come from many diverse scientific disciplines through proprietary heterogeneous systems," says Castelli. "Meanwhile, the nature of the information required varies widely, from the more traditional scientific literature to audio-visual material, 3D models and large experimental data sets."

Conceived as an instrument to reduce the complexity and cost of exploiting these resources, and also of simplifying the controlled sharing of them, the D4Science approach has developed in direct response to the shortcomings of existing methods. Indeed, Castelli says that the ongoing development of e-Infrastructures is being driven, in large part, by practical concerns. "Across the whole cycle, the functional and non-functional requirements that characterise collaborative workflows – particularly cost-effectiveness, security, and autonomic adaptation to highly dynamic environments – exceed the capacity of commodity technologies and ad-hoc developments alike," she explains. "The D4Science e-Infrastructure implements mediation services between resource providers –

organisations that decide to share their resources under certain policies – and resource consumers, as well as virtual research organisations which need applications capable of supporting their activities. Virtual Research Environments translate instrument observations into information, and then information into knowledge, which in turn makes it apparent that further observations are needed."

However, not enough worldwide research and development over the past decade has concentrated on the deployment of e-Infrastructures of human, hardware, software, and data resources for the support of innovative research environments - the D4Science project addresses this.

Mediterranean fisheries – collecting data at sea
©FAO/Roberto Faidutti

Focus on research

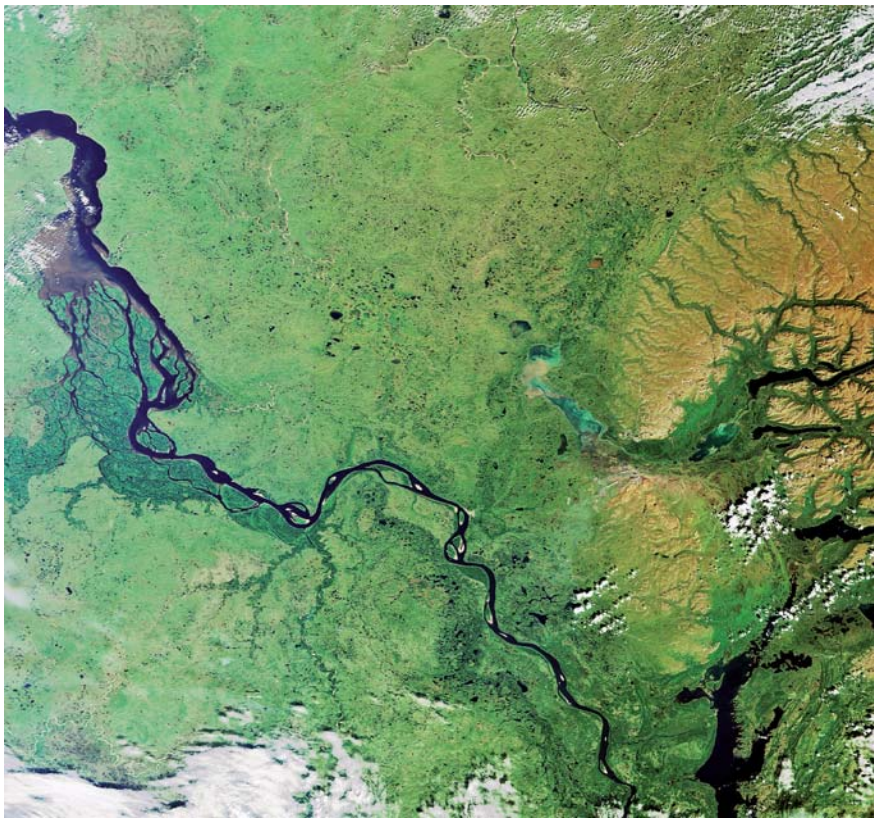
This focus on research into e-Infrastructures gives some idea as to the importance widely attached to their ongoing development, and indeed the resources that have been directed towards the area over recent years have enabled a number of projects, including GÉANT, EGEE, and DILIGENT, to make significant advances. D4Science is the follow-up to DILIGENT, and it consolidates and expands on its outcomes. "Among application-level infrastructures, the case of D4Science is unique rather than prototypical," stresses Castelli.

"Its control-oriented and cross-domain, content-oriented services – which allow users to store, describe, annotate, search, select, merge, and transform information – leverage the functionality of the gLite middleware in order to virtualise the computational and storage resources of the pan-European EGEE infrastructure and, in turn, the connectivity fabric of the underlying GÉANT infrastructure. The infrastructural services are organised into a distributed software system, gCube, the development of which was initiated by the predecessor of the D4Science project, DILIGENT. The D4Science project aims to progressively consolidate gCube and to offer a production quality e-Infrastructure that will initially serve those Virtual Organisations affiliated to the fields of Environmental Monitoring and Fisheries and Aquaculture Resource Management."

This of course is a broad discipline, and with research continuing to advance it is likely to become broader still as new synergies are established. Indeed, while the main scientific communities currently being targeted by the D4Science project are those operating on socio-ecosystem modelling, the project already has its eyes on further innovation, and Castelli anticipates that increased inter-community collaboration will lead to some significant developments. "Collaboration between the Fisheries and Aquaculture Resources Management and Environmental Monitoring communities, is enabled through the D4Science e-infrastructure and is expected to act as a catalyst leading to the further enlargement of the community base by other groups such as oceanographers and economists," she explains. "More generally, cooperation between these communities is expected to provide a springboard for the use of data streams by diverse scientific communities to perform socio-ecosystem modelling. The work undertaken by the two communities can be applied to the whole biodiversity management domain, including both biodiversity conservation and biodiversity exploitation – such as fish catching and farming. Therefore, the project will not only bring together the currently separate communities of fisheries/aquaculture and environmental monitoring, but will also create a framework and a process to establish further collaborations of this type between related communities."

> The next step will be to move to e-Infrastructure ecosystems, where e-Infrastructures are interoperable and can collaborate by sharing resources and capabilities

By providing these kinds of much-needed synergies across currently fragmented scientific communities, the D4Science project is making a significant contribution to the wider goal of speeding up the process of scientific research and development. This is work with global implications – and while the project has been engaged in developing a new system to create consolidated country profiles for fishery data, it by no means implies that the project neglects the wider agenda. "The communities with which we work all require numerous data sources such as satellite (ocean colour



Earth from Space: A green Siberia ESA© ESA contributes satellite information

and reef maps), climate, hydrographic and trade data," says Castelli. "This data is often produced separately by the different communities. In the project these communities are led by three major project participants: Food and Agriculture Organization of the United Nations (FAO), WorldFish Centre and European Space Agency (ESA). The first two in particular are actively involved in addressing scientific challenges related to Fisheries and Aquaculture Resources Management while the last one operates in the Environmental Monitoring sector."

Wider potential

This international dimension is an important element in the project, particularly in terms of its future development. Already Virtual Organisations can dynamically register new resources, new content resources can be shared, any external Web Service can be accessed and service resources can be deployed on available hosting nodes, and with the D4Science e-Infrastructure being open and dynamically extensible, these attributes can be built on further. "There are many possibilities in terms of exploiting the D4Science e-Infrastructure more widely," enthuses Castelli. "It can be enriched with additional resources, support many other Virtual Organisations and, for each Virtual Organisation, many other Virtual Research Environments can be created to serve specific applications. Virtual Organisations in Biodiversity, Health, and Humanities have already approached the project to exploit its resources and capabilities. The next step will be to move from the current model, which is characterised by the existence of autonomous, independently-operated heterogeneous e-Infrastructures to e-Infrastructure ecosystems, where e-Infrastructures are interoperable and can collaborate by sharing resources and capabilities. These Ecosystems will serve a significantly expanded set of communities dealing with multidisciplinary challenges, the solution of which is beyond the reach of existing resources. In its new role, D4Science would build bridges across multi-disciplinary communities, thus enhancing the cross-fertilisation of scientific results and encouraging innovation." eS

D4Science Details

Title: DIstributed colLaboratories Infrastructure on Grid ENabled Technology 4 Science (D4Science).

Objectives: Deploy the e-Infrastructures built so far by the EGEE and DILIGENT projects so that they address the needs of several new scientific communities.

Project participants: GEIE ERCIM (ERCIM), France (Coordinator)/ Consiglio Nazionale delle Ricerche (ISTI-CNR), Italy/ Engineering - Ingegneria Informatica - SpA (ENG), Italy/ European Organisation for Nuclear Research (CERN), Switzerland/ European Space Agency (ESA), France/ Food and Agriculture Organization of the United Nations (FAO), Italy/ International Center for Living Aquatic Resources Management (WorldFish Center), Malaysia/ National and Kapodistrian University of Athens (NKUA), Greece/ Universität Basel (UNIBASEL), Switzerland/ University of Strathclyde (BDM-USTRATH), United Kingdom/ 4D SOFT Számítástechnikai Kft (4D SOFT), Hungary.

W: www.d4science.eu

Donatella Castelli is a senior researcher at Consiglio Nazionale delle Ricerche (ISTI-CNR). She graduated in Computer Science at the University of Pisa and joined CNR-ISTI in 1987. Since then she has participated actively in several EU and nationally funded projects on Digital Libraries and Research Infrastructures. She is currently the scientific coordinator of the D4Science project. She also leads the activities dedicated to the definition of the DELOS Digital Library Reference Model.