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Finland, a fine land for science

The Linux philosophy is "Laugh in the face of danger". Oops. Wrong One. "Do it yourself." Yes, that's it, said Finnish-born Linus Torvalds, the acclaimed developer of the game-changing Linux kernel and open source operating system. His achievements are perhaps the most prominent example of the hands-on approach to science and technology in modern-day Finland - a country where researchers have been 'doing it themselves' and doing it well in many fields for many years.

 [1]

Over the past decade, Finland has built one of the strongest research and development sectors in Europe, and today consistently ranks among the continent's top innovators. Finnish companies such as Nokia and game developer Rovio are big names in their respective fields, while Finnish universities and research institutes regularly produce groundbreaking results: a team at the University of Eastern Finland recently announced the discovery of a vaccine that may eliminate allergies, for example, while another group at Aalto University said they have found a way to make optical displays out of water and thin air.

A solid innovation policy and public research funding through organisations such as the Finnish Funding Agency for Technology and Innovation, Tekes, and the Finnish Innovation Fund, SITRA, as well as support from the European Union, have undoubtedly contributed to making Finland a science and technology leader.

Aalto University, for example, is currently coordinating several EU-funded projects that could have far-reaching implications for the future of the internet. In the Pursuit [2] (1) project, researchers are building on an emerging concept for the future internet focused on interconnecting information rather than interconnecting machines, a paradigm in which the 'what' becomes more important than the 'who'.

They summarise their high-level vision this way: 'Imagine a system that is designed around the ability to adapt its appearance under the changing social needs and concerns of its actors. In other words, imagine a system that is designed to work in ways similar to how societies themselves work.'

Using a publish/subscribe model for interconnecting information, the aim of Pursuit is to provide dynamic access to information anywhere at any time and improve data security and safety through policy-based handling of information.

That goal ties in neatly with the focus of another EU-funded project being led by Aalto University that also involves Finnish IT company Futurice as well as partners in France, Italy and Switzerland. Called Scampi [3] (2), the initiative concentrates not on interconnecting information but on interconnecting computing resources anytime, anywhere.

With mobile devices such as smartphones, notebooks, PDAs and cameras becoming increasingly ubiquitous and often incorporating multiple means of wireless communication, the Scampi researchers are looking at ways to interconnect and effectively pool the resources of multiple devices at any time in any location. In this way, users would not only have access to the computational resources of their own devices, but could opportunistically exploit, in a trustable and secure way, the resources of other devices in the vicinity. Leveraging social awareness and social networking, a user might, for example, edit a photo on their smartphone by harnessing the superior processing power of a laptop belonging to someone else sitting in the same cafe.

The social impact of ICT

The social uses, effects and impact of ICT are at the heart of another project being coordinated in Finland. Led by the Aalto University School of Science and Technology, the ICTeCollective [4] (3) project is attempting to answer the intriguing question: 'What happens to a society when new forms of communication appear?'

Looking at everything from collaborative platforms such as Wikipedia and social networking sites like Facebook to SMS messaging, the ICTeCollective team is carrying out landmark research on the implications and consequences of modern forms of communication for social relationships. The researchers plan to use their insights to develop methods of exploring, understanding and modelling systems where ICT is entangled with social structures, focusing, for example, on behavioural patterns, and the dynamics and driving mechanisms of social structures from the level of individuals to groups and large-scale social systems.

Among other forms of communication, the internet has enabled everyone to easily share information and content, for both good and less good reasons. Peer-to-peer file sharing applications, for example, have gotten a bad name because of internet piracy. But the same technology that has long helped internet users illegally share copyrighted music, games and videos is now promising to help content providers stream video to millions of viewers simultaneously using a fraction of the bandwidth of traditional methods.

The groundwork for that transition has been laid in the P2P-Next [5] (4) project, coordinated by the VTT Technical Research Centre headquartered just outside Helsinki. Using a system initially based on the popular BitTorrent protocol, the researchers were able to demonstrate a P2P architecture for streaming video that slashes bandwidth demands by at least 65 %compared to traditional unicast streaming methods.

'For network operators, P2P offers a big advantage in terms of bandwidth demands and cost. Content

providers are also interested in this technology as a low-cost alternative for their content delivery networks,' Jari Ahola, the P2P-Next coordinator, says.

When it comes to storing, accessing and managing content, services and applications online, however, no technology currently holds more promise than cloud computing. By providing computing resources as an on-demand and scalable service rather than a product, cloud computing is revolutionising access to software, processing power and storage. But as the cloud grows some of the costs of cloud computing are becoming clear - particularly in terms of the energy consumption of the thousands of power-hungry servers in data centres around the world that store and serve all that data.

Researchers working in the EuroCloud [6] (5) project are targeting a 10-fold improvement in the cost and energy efficiency of current state-of-the-art servers by using many ARM microprocessor cores and 3D DRAM memory to create very dense, lowpower 3D server-on-chip systems. With the potential to make a one-million core data centre feasible in the future, these so called 'green' cloud servers will initially be used to support mobile cloud services offered by project partner Nokia.

"The ARM design philosophy has focused on optimising energy efficiency to enable mobile platforms for 20 years," says Dr Mika Kuulusa, a research manager at Nokia. "We probably have the best expertise in low-power gadgets in the industry."

Printed circuits and solar cells

Energy, both saving it and producing it, is the focus of two other projects coordinated by the VTT Technical Research Centre.

In Polaric [7] (6), researchers are working on large-area organic integrated circuit technology, developing a roll-to-roll manufacturing process using flexible plastic polymer substrates for high-performance, low-power consumption integrated circuits. The energy efficient circuits can be printed in large volumes, potentially lowering the manufacturing and operating costs while improving the performance of a wide range of devices, from LCD displays and radio frequency identification tags to sensors and lighting fixtures.

Meanwhile, in the Facess [8] (7) initiative, another team has been using similar roll-to-roll printing technology to develop organic solar cells and thin film batteries. By printing the circuits on thin foil, the researchers were able to integrate the different components to create a flexible, fully autonomous power source with the organic solar cells harvesting solar energy and charging the batteries that can then power a wide range of devices.

The Facess project also involves Suntrica, a Finnish manufacturer of flexible and high-efficiency portable solar chargers, as well as public- and private-sector partners in four other European countries. The project, like many others in Finland in many different fields, is an example of the Finnish knack of combining private- and public-sector expertise for science and technology innovation.

Indeed, the idea of Living Labs, a collaboration of Public-Private Partnerships focused on user-centric innovation that is now popular across Europe, was first launched under the Finish presidency of the EU in 2006. As Finnish Prime Minister Matti Vanhanen said at the time: 'New concrete measures are needed to make Europe more competitive and innovative in a human-centric way, a way that focuses on people's real needs.'

Finnish research, and its influence elsewhere in Europe, is certainly doing just that.

The projects featured in this article have been supported by the Seventh Framework Programme (FP7) for research.

(1) Pursuit: Publish Subscribe Internet Technology
(2) Scampi: Service platform for social Aware Mobile and Pervasive computing
(3) ICTeCollective: Harnessing ICT-enabled collective social behaviour
(4) P2P-Next: Next generation peer-to-peer content delivery platform
(5) EuroCloud: Energy-conscious 3D Server-on-Chip for Green Cloud Services
(6) Polaric: Printable, organic and large-area realisation of integrated circuits
(7) Facess: Flexible autonomous cost efficient energy source and storage

Useful links

- FP7 on CORDIS [9]
- Pursuit on CORDIS [10]
- Scampi on CORDIS [11]
- ICTeCollective on CORDIS [12]
- P2P-Next on CORDIS [13]
- EuroCloud on CORDIS [14]
- Polaric on CORDIS [15]
- Facess on CORDIS [16]

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