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## France ICT: Plugging into a networked world

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With a demanding consumer market, France is a tech-savvy, tech-consuming nation, and it is hardly surprising to find that French ICT and R&D organisations are involved in almost half of all FP7 ICT projects.

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Long before the World Wide Web, France had Minitel. In the 1980s, other European countries could only look in awe at how the French could buy train tickets or check their bank account 'online'. The French loved it, and it set them up to embrace the World Wide Web, mobile phones and all things techy whenever they came along.

The latest figures compiled by the European Commission for its Digital Agenda Scoreboard show France ranked as the third country in the EU in terms of fixed broadband penetration and second in penetration growth. Well over half of the population regularly shop online. This is a country that knows about the power and convenience of ICT.

So with such a healthy consumer market, it is hardly surprising to find R&D organisations striving to deliver innovative systems and services that will stimulate the ICT market. France has always participated in EU-funded projects and initiatives and the Seventh Framework Programme (FP7) is no exception. Over 150 projects, out of the 1500 or more funded so far under the FP7 theme ICT, are coordinated by French organisations. French organisations - from government-funded research organisations through large corporations to SMEs - participate in just under half of all FP7 ICT projects. This impressive level of involvement is helping France to develop important knowledge transfer links and gain insights into external ICT markets.

Medicine to microelectronics

It is unsurprising that the publically funded National Centre for Scientific Research (CNRS) is heavily involved in FP7. It has coordinated eight ICT projects in total (of which seven are still in execution), in a diversity of topics ranging from medicine to microelectronics.

The Thrombus (1) project, for example, is part of the wide-ranging European initiative to create a 'virtual physiological human'. The idea is to combine the huge wealth of data generated by

pharmaceutical companies, medical device manufacturers and healthcare providers with powerful ICT tools and techniques to model complex human biochemical and physiological processes. The computer models will help healthcare providers predict the response of individuals to medical interventions.

Thrombus will develop and test a biological model of spontaneous or stent-induced thrombosis in intracranial aneurysms. The model will be used by doctors to assess the likelihood of stent-induced thrombosis in their patients; they will be able to select appropriate stents on evidence rather than intuition.

CNRS is also involved in several projects that will support Europe's competitive position in micro- and nanoelectronics design and fabrication. E-LIFT (2) is currently piloting a new method, based on the same technology as inkjet printers, to deposit a wide variety of materials with a spatial resolution of just a few micrometres. The project brings together experts in laser physics, chemistry and microelectronics - from both academia and industry - who are collaborating to see how this new fabrication method can be scaled up from its current laboratory-scale applications to an efficient industrial process.

New fabrication techniques are essential if France's microelectronics industry is to remain competitive. Participation in FP7 is helping the country's industry to develop new expertise and forge links with partners elsewhere in the EU.

The ATMOL (3) project, for example, is working to create a critical mass in Europe for a promising and highly specialist approach to atomic-scale manufacturing methods. Atomic manipulation could be used to 'manufacture' specially-designed molecules that function like electronic components such as logic gates.

ATMOL project partners are improving the precision of methods such as atom-by-atom manipulation, on-surface chemistry and unique 'Ultra-high vacuum' (UHV) transfer printing technology. UHV printing requires a set of extremely specialised devices; only three such systems exist worldwide and they are each housed within the laboratories of ATMOL consortium members.

If ATMOL is successful in building electronic logic gates at the scale of a single molecule then it will be an important step on the road to ever smaller, ever more powerful electronic devices. ATMOL is funded from the 'Future and emerging technologies' budget line of the FP7 ICT programme, a budget line targeted at just these types of groundbreaking technologies.

The focus of CNRS on more fundamental science is perfectly complemented by the involvement of the National Institute on Computer Science and Automation (INRIA), which manages and participates in another substantial portfolio of FP7 ICT projects totalling some 34 million euros. This organisation has coordinated nine FP7 ICT projects and participated in many more. It has particular expertise in infrastructure and IT architecture issues, for example the design of feedback for wireless networked systems (Feednetback (4)) and the development of open computing infrastructures (e.g. Contrail (5)).

Fancy 3D?

As avid consumers of networked media, it is unsurprising to find many French companies contribute a wealth of project partners to projects building the next generation of networked media, virtual reality applications and 3D graphics. For example, France Telecom and the French firm Technicolor R&D were both involved in 3D4YOU (6), a project that touched on every aspect of 3D television, including the definition of a 3D delivery format and guidelines for a 3D content creation process.

3D4YOU partners helped to push advances in 3D capture techniques and methods for converting captured content into broadcast-friendly formats. The work of the project is making an important contribution to the capabilities of broadcasters and producers to deliver 3D TV.

3D TV is just one area where French participants are demonstrating their creative streak as well as technical flare. The country enjoys a strong presence in many projects looking at the production and delivery of visual content over networks.

The Reverie (7) project, for example wants to change the face of how we interact with others. Why spend time watching TV or catching up on Facebook on a screen when you could immerse yourself into a 3D online environment which lets you interact with friends and share common experiences together, in real time, without having to leave home?

Reverie hopes to develop new ways for users to meet, socialise and share experiences using equipment they already have at home, such as 3D TV and the Microsoft 3D Kinect, along with a range of content creation tools built for the new platform. The project will focus on the integration of cutting-edge technologies related to 3D data acquisition and processing, sound processing, autonomous avatars, networking, real-time rendering, and physical interaction and emotional engagement in virtual worlds.

French participation in Venturi (8) is helping this project to develop clever ways of providing users with 'augmented' reality too. ST Microelectronics, INRIA and French joint venture firm ST Ericsson are working with other partners to improve the context awareness of mobile technologies, for example differentiating between home and 'on the move'; user type and level of activity; noisy urban versus quiet countryside surroundings; smart object or other user proximity. This information will help devices to deliver appropriate data and experiences to the user, where access to relevant information becomes part of their reality.

The importance of contextual awareness is also the key focus of Concerto (9), in which partners are working to deliver 3D images and health information over wireless and mobile networks to doctors and paramedics. The project will demonstrate how high-quality images, video and other relevant information can be fused, adapted and delivered in an appropriate format for the device and location of the user. The project will focus on adaptive compression algorithms for medical images; near-instantaneous adaptation will be then used for coping with variable bandwidth availability. The project will design adaptive solutions that also consider the specific context of the delivery, such as patient-specific data and status.

## Size matters

While national research organisations dominate the landscape, French universities tend to act as players rather than leaders; only 12 FP7-ICT projects are coordinated by universities.

Indeed, large corporations (including France Telecom, members of the Thales Group, Technicolor and Alcatel) seem to be more involved in FP7 ICT projects than universities. These big players in networking infrastructure and telecommunications really add clout to several key areas of EU interest, especially Future Internet and 'Networked electronic media' (NEM). French project participants have won well over the EU average for funding in these areas.

The Thales group, for example, coordinates more than 25 FP7 ICT projects and is involved in over 100 projects overall, mainly in the areas of microelectronics and telecommunications.

The Optimix (10) project is trying to tackle the problem of video streaming which even today tends to be slow, jumpy and unreliable for most users, especially on mobile devices. The Optimix researchers have developed new ways to enhance video streaming; tests have shown that the improvements in video quality are substantial, to the point where, in many cases, viewers were unable to differentiate between the streamed video and the original video source.

'Any user should benefit from a seamless experience of multimedia applications and services. The integrity of the transmitted media should be maintained anywhere and anytime,' explains Roberta Fracchia of the Optimix project, a program manager at Thales Communications and Security. 'Connected consumers will also expect to move content freely and easily between their devices and share content with friends. They will require that content can be controlled and played-back in a future-proof format on any device, regardless of the device used to capture, store or edit the content.'

Other Thales projects include Nanopack (11), a quite different project to develop a range of greases, adhesives, polymer fibres and carbon nanotubes to conduct heat away from electronic components and make devices smaller and more powerful.

France Telecom is another big player in FP7; the telecoms firm has coordinated or participated in more than 50 projects, typically in the areas of networking and Future Internet. Notably, the company plays a key role in FI-WARE (12), the flagship project to agree and promote a core platform architecture for the Future Internet.

France Telecom has also provided expertise in Internet and network security through projects like Wombat (13). This project developed and tested a system for gathering security-related data across an infrastructure. This data is then enriched (for example by looking at the context of data, not just the raw numbers) and analysed to assess security threats in real time.

With such advanced applications under development it is hardly surprising that France's Minitel service was finally closed in June 2012, made redundant by the internet and World Wide Web. But thanks to France's strong participation in FP7 ICT projects, it is perfectly poised to take a leading role in the ICT developments of the future.

The projects featured in this article have been supported by the Competitive and Innovation Programme's (CIP) ICT-Policy Support scheme or the Seventh Framework Programme (FP7) for research.

- (1) Thrombus: 'A quantitative model of thrombosis in intracranial aneurysms'.
- (2) E-LIFT: 'Laser printing of organic/inorganic material for the fabrication of electronic devices'.
- (3) ATMOL: 'Atomic scale and single-molecule logic gate technologies'.
- (4) Feednetback: 'Feedback design for wireless networked systems'.
- (5) Contrail: 'Open computing infrastructures for elastic services'.
- (6) 3D4YOU: 'Content generation and delivery for 3D television'.
- (7) Reverie: 'Real and virtual engagement in realistic immersive environments'.
- (8) Venturi: 'Immersive enhancement of user-world interactions'.
- (9) Concerto: 'Content and context aware delivery for interactivemicro-multimedia healthcare applications'.
- (10) Optimix: 'Optimisation of multimedia over wireless Ip links via X-layer design'.
- (11) Nanopack: 'Nano-packaging technology for interconnect and heat dissipation'.
- (12) FI-WARE: 'Future Internet core platform'.
- (13) Wombat: 'Worldwide observatory of malicious behaviours and attack threats'.

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