Future computing in the ether

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(PhysOrg.com) -- As computer networks become more complex and pervasive, and their development is in a state of constant flux, leaving their design and management to human intervention is becoming increasingly unfeasible. An EU-funded project has come up with an innovative, self-adaptive architecture to enable future ubiquitous networks to deal automatically with changing circumstances.

The ancient Greeks believed that, above the terrestrial sphere, the universe was filled with a mysterious element called ether or aether (also known as the 'fifth element'). In early modern physics, ether was believed to be the substance that filled all of space.

Although we now know better, the word lives on in the language and is used to refer to things that are ubiquitous. It is thus no accident that an European project focusing on ubiquitous or pervasive computing should

call itself AETHER.

And as Web 2.0 technology is already demonstrating to us, the future internet will not just be confined to our desktop and laptop computers but will quite likely fill the ether, as computer processors not only find their way into most everyday objects in our physical environment - at home, at work, on the road, or at play - but all these objects will communicate with one another. This is a far cry from how computing was once perceived.

“Only a matter of a few decades ago, a computer was a very big, expensive and intriguing machine for most people,” explains Christian Gamrat, the coordinator of AETHER. “Nowadays, of course, the picture has completely changed and we find people surrounded by dozens of computers, many of them sitting hidden in the most unlikely places.”

He goes on to say that: “We have witnessed a silent change in the way most computing resources are being used, gradually shifting from a few big mainframe computers to millions of small embedded micro-processors that run most of our everyday applications.”

But this growth in embedded computers and their interconnectedness raises major challenges. The pervasive computing networks of tomorrow will be rapidly evolving meshes of different processors and other hardware, not to mention software and operating platforms, which will make it costly and perhaps impossible to rely on human programmers to build and manage these diverse systems.

“In this context, the problem of programming and managing applications running on such complex, highly heterogeneous and potentially volatile computing resources is a key issue,” notes Gamrat.

Computer adapt thyself

With 14 partners from nine countries, the AETHER project has come up with an innovative solution to the challenge of building and managing complex, organic, ever-evolving ubiquitous networks. Known as 'self-adaptive computing', the framework is designed around the idea that the platform or system must be able to react by itself to changes in the environment, such as the optimal execution of a wide range of applications on a variety of different platforms using a wide spectrum of dispersed computing resources.

"The AETHER project ranges from the topmost layer of programming and setting the goals and objectives of the application, down to the design of computing resources with adequate properties," points out Gamrat.

At AETHER's core is a descriptive language known as S-NET which enables several levels of static and dynamic adaptivity. S-NET maximises the use of computing resources by minimising the amount of computing power required for execution. There is also a clear separation between the world of the application designer and that of the computing environment.

The system uses two protocols to support the self-adaptive virtual processor (SVP) and the system environment place (SEP) in delegating tasks to vastly different resources in the pervasive network.

The SANE choice

For the S-NET model of self-adaptive computing to work requires it to be integrated into the system architecture at the processor level. This is what the AETHER project calls SANE, or self-adaptive networking elements. "By designing each computing element along the SANE design pattern, we guarantee its seamless integration within the AETHER

framework," says Gamrat.

He adds that SANE ensures that "each and every bit of computing resources has a level of autonomy that makes it suitable to accept jobs delegated by the run-time systems and returns reports indicating the actual cost of execution".

As AETHER is about the principles and the protocols needed to implement 'self-adaptivity' in heterogeneous networks, it is a very versatile technology. It can be applied both to standard or reconfigurable processors and future bio- or nano-based architectures, as well as contemporary mobile technology and futuristic pervasive computing. It can also be used to develop complex systems that are not only self-adapting but self-healing and self-repairing.

Spin-off projects seeking to harness AETHER's full potential have started or are already in the pipeline. One example is the EU-funded Apple-CORE project which seeks to mainstream multi-core processors and to integrate many-core chips into the PCs of the future.

More information: AETHER project - www.aether-ist.org/

Provided by ICT Results

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