Smartphone grids – the future for distributed computing?

With the popularity of smartphones soaring, it's time grid computing projects tapped into this valuable resource, say researchers from Germany.

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The modest beginnings of a distributed-computing revolution? Image courtesy Felix Büsching, Sebastian Schildt, and Lars Wolf.

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Could you have a virtual supercomputer in your pocket? Or at least part of one? Researchers from

the University of Braunschweig in Germany are carrying out tests to combine the computing power of smartphones into distributed computing networks. So far, the tests have been limited to creating small grids using just a handful of Android phones, but Felix Büsching- one of the computer scientists who carried out this research - argues that smartphone grids could be of vital importance in the future: "We have all this computational power going to waste in our pockets; it's easily as much as a desktop computer from just 10 years ago." And, he says, with smartphones now shipping globally at a faster rate than PCs, it's time that distributed computer projects started to take advantage of this processing power.

In a paper presented at a workshop held as part of the 32nd International Conference on Distributed Computing Systems in Macau, China, Büsching and his colleagues outlined how they connected six low-end Android phones to create a mini-grid, or cluster. "We had a bunch of identical smartphones which we had used for a project designed to help students learn how to program on Android. We had the devices lying around in our office and we were wondering what we could do with them. So, we decided to do a typical nerdy thing and see if we could create a cluster out of them," explains Büsching. Together these smartphones, each individually capable of carrying out 5.8 megaflops, were able to carry out 26.2 megaflops when connected by Wi-Fi. While this may not seem all that impressive, given that modern desktop computers are able to process at speeds thousands

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of times faster than this, current top-of-the-range smartphones are capable of carrying out 100 megaflops, which means that connecting these together could make a smartphone grid which is significantly faster than the test system created by the researchers. As Büsching points out, the mini-grid created by him and his colleagues was very much "a proof-of-concept". What the research shows, he says, is that "you don't need to develop lots of crazy software to do this - it's really very easy to connect these smartphones."

New grid, new possibilities

Yet, if smartphone-based grid computing is really to take off, it must be much more than merely easy to set up, it must also be highly useful. Despite the relatively low computing power of the individual smartphone devices, Sebastian Schildt, another computer scientist who worked on the research, says: "Volunteer computing in particular could really be boosted by the development of smartphone grids because of the immense number of devices involved. Projects such as SETI@home - which no institution wants to pay for, but which lots of people are interested in - could see major benefits from this technology."

But as well as expanding upon existing distributed computing projects, smartphone grids pose some unique opportunities thanks to their flexible, highly mobile nature. The researchers have suggested that combining the computation power of mobile devices could be useful for cooperative cracking.

For example, groups of people who have gathered in one place could use the technology to crack the encryption codes on local wireless networks, thus allowing them access to the internet.

A less legally-dubious suggestion from the researchers is that smartphones could be used to create rolling clouds in long-distance trains. While devices are plugged into charging sockets, they could connect via the in-train Wi-Fi to form a closely coupled computing cloud. This could then, for example, be used to calculate extremely fine-grained weather forecasts for passengers at their destination. Oncoming trains would transmit environmental data from public sensing systems installed at destination stations further down the line and this would allow the ad-hoc cloud to carry out calculations which would tell passengers whether or not to put on their raincoat before disembarking the train. While this may seem like a somewhat trivial use for smartphone grids, the researchers stress that once the idea is out there, it is only a matter of time before people begin to come up with thousands of exciting ways to use the new technology.

In a recent report entitled "Middleware for Grid computing on Mobile Phones", a team of researchers from Kenya and South Africa argue that the technology could be particularly useful in Africa where desktop computers are rare in many areas, but phone uptake is high. They believe that by using smartphone grids, "computer-based applications that are currently a reserve for the

developed countries and for resource-endowed cities of Africa can become a reality for all." Consequently, they add: " Much needed custom applications, such as e-health, e-education, e-farming, e-weather forecast and so on, can then be implemented as mobile phone applications for use in the remote villages where they are needed the most."

Making the switch

Kevin Reed, an IBM computing architect who has spent several years working on the World Community Grid, is another researcher who spotted the potential smartphones hold for distributed computing early on. He highlighted the opportunity smartphones pose in a blog post last year: "Tablets and smartphones are starting to reach the point where they can do significant computations," he said. "In two to three years these devices could become powerful contributors to the grid." Reed has suggested that smartphones could be of particular use for grid computing purposes when they are plugged into a socket for charging overnight. Büsching also thinks that this is a good idea, given that power usage will be high when smartphones are carrying out computationally heavy tasks. He and his colleagues argue that using smartphones as part of a grid computing network while they charge at night is actually - perhaps counter-intuitively - an environmentally friendly option. While running computations does use extra energy, it also means that smartphones which are

on, but which are otherwise not being used, can at least be doing something productive. Plus, the team point out in their paper: "The amount of energy a device consumes during its lifetime is negligible compared to the energy put into it for production." Of course, the real environmental gain would come if smartphone grids could be used to replace traditional stationary servers. And, with the "computation per watt" that can be harvested from smartphones set to soon be as high as that for stationary computers, such a point could not be all that far off in the future, argue the researchers.

Büsching and his colleagues have also suggested that large companies could ask their staff to donate computing time on their smartphones as part of a grid network, possibly as a trade-off for allowing them to charge their smartphones while they're at work. Employees' smartphones could thus contribute back to the company's computing cloud, thereby offsetting the additional costs of the electricity used to charge their phones. However, getting employees to agree to such a deal might not be all that easy. In fact, some researchers have suggested that people may generally be much less willing to donate computing time from their smartphones than from desktop computers to grid projects, because of the highly personalized nature of these devices. This, they argue, is one of the main challenges which must be overcome if smartphone-based grid computing is really to take off. However, Schildt disagrees. "It's simply a matter of trust", he says. "There's no reason people should be any less willing to donate computing time on their

smartphones than they are with their desktop computers." If he's right, smartphone grids could be set to revolutionise the way we think about grid computing.

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