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●スマートフォンのバッテリー駆動時間 2 倍に伸ばすETAdvanced技術

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電力を大きく消費する機能が増えていることで、スマートフォンのバッテリー駆動時間を延長できる技術の開発に注目が集まっているが、マサチューセッツ工科大学（MIT）から派生した Eta デバイセズの新技术は、バッテリー駆動時間を従来の 2 倍に伸ばすとともに、セルラー通信塔の省エネ化も後押しできるという。

スマートフォン・バッテリーの電力を消費する主な原因の 1 つは、無線信号を発信するためのパワーアンプの効率が悪いこと。

原理的には、基地局で使われているパワーアンプにも同様のことがいえる。パワーアンプは、いつでも相当量のデータを発信できるよう最大電圧で待機しており、これにより電力が消費される。その消費量は、スマートフォン内のどの部品よりも大きく、基地局では消費電力の約 75%を占めるが、実際には消費した電力の半分以上は熱として浪費される。

しかし、今回 Eta デバイセズが開発したスマートフォン向けチップ、基地局向けモジュールは、必要に応じて電圧を調整することで電力の浪費を抑えることが可能。

昨年基地局を使って行ったテストでは、4G LTE 向けトランスミッタとして初めて平均 70%超の電力変換効率を実現した。この数字は、これまで高く見積もっても最大 45%程度だった。

同社は、この技術を 2015 年中に基地局に導入できるようにしたいとのことで、これにより大規模な移動通信事業者の場合、年 1 億ドルのコストを削減できるようになるとしている。

また、同社は、LTE 対応スマートフォンを製造する大手メーカーとも、同社チップを来年中に搭載する方向で交渉を行っている。同社の「ETAdvanced」技術は、「Asymmetrical Multilevel Outphasing (AMO)」と呼ばれていたものが基盤。

AMO のコンセプトは 2008 年、商用製品開発を目的に MIT の学生が集まる「Innovation Teams (i-Teams)」クラスで初めて提出された後、2009 年にはデシユパンデ・センター・フォー・テクノロジカル・イノベーションの補助金を獲得。これにより、従来システムより 77%効率のよりハードウェアの初めてのデモが行われた。ETAdvanced は、この AMO に大幅な改良を加えている。

いくつかの大手スマートフォン・メーカーは、パワーアンプの電圧をその場その場で調節するエンベロップ・トラッキング (ET) を使っているが、対応できる帯域幅は 20MHz で、LTE、802.11ac (Wi-Fi) では効率性を上げることが難しい。

一方、ETAdvanced は既に、LTE Advanced (最大帯域幅 80MHz)、次世代 Wi-Fi (同 160MHz) にも対応している。

(参考) 本件報道記事

Beating battery drain

Startup's power-conserving chip may increase smartphone battery life, save energy in cell towers.

Rob Matheson | MIT News Office

October 28, 2014

Stream video on your smartphone, or use its GPS for an hour or two, and you'll probably see the battery drain significantly. As data rates climb and smartphones adopt more power-hungry features, battery life has become a concern. Now a technology developed by MIT spinout Eta Devices could help a phone's battery last perhaps twice as long, and help to conserve energy in cell towers.

The primary culprit in smartphone battery drain is an inefficient power amplifier, a component that is designed to push the radio signal out through the phones' antennas. Similar larger modules are found in wireless base stations, where they might use 10 or even 100 times the power.

Prepared to send sizeable chunks of data at any given time, the amplifiers stay at maximum voltage, eating away power — more than any other smartphone component, and about 75 percent of electricity consumption in base stations — and wasting more than half of that power as heat. This means smartphone batteries lose longevity, and base stations waste energy and lose money.

But Eta Devices has developed a chip (for smartphones) and a shoebox-size module (for base stations) — based on nearly a decade of MIT research — to essentially “switch gears” to adjust voltage supply to power amplifiers as needed, cutting the waste.

“You can look at our technology as a high-speed gearbox that, every few nanoseconds, modulates the amount of power that the power amplifier draws

from the battery,” explains Joel Dawson, Eta Devices’ chief technology officer and a former associate professor of electrical engineering and computer science who co-invented the technology. “That turns out to be the key to keeping the efficiency very high.”

When trialed in a base station last year, Eta Devices’ module became the first transmitter for 4G LTE networks to achieve an average efficiency greater than 70 percent, Dawson says. “The highest number we’ve heard before that was 45 percent — and that’s probably being generous,” he says.

Backed by millions in funding, Eta Devices — co-founded by David Perreault, an MIT professor of electrical engineering, and former MIT Sloan fellow Mattias Astrom — has partnered with a large base-station manufacturer. The goal is to deploy the technology in live base stations by the end of 2015. The savings could be substantial, Dawson says, noting that a large carrier could save \$100 million in annual electricity costs.

Eta Devices has also entered conversations with major manufacturers of LTE-enabled smartphones to incorporate their chips by the end of next year. Dawson says this could potentially double current smartphone battery life.

Besides battery life, Dawson adds, there are many ways the telecommunications industry can take advantage of improved efficiency. Eta Devices’ approach could lead to smaller handset batteries, for example, and even smaller handsets, since there would be less dissipating heat. The technology could also drive down operating costs for base stations in the developing world, where these stations rely on expensive diesel fuel for power.

And ultimately, it could impact the environment: If all midsized carrier networks were to replace current radio amplifiers with Eta Devices’ technology, he says, the reduction in greenhouse gases would be equivalent to taking about 5 million cars off the road. “There are so many ways to leverage high efficiency if you have it,” Dawson says.

In August, the World Economic Forum named Eta Devices the 2015 Technology Pioneer, a designation awarded previously to Dropbox, Spotify, and Twitter, to name a few.

In the mobile market

Eta Devices' commercial success is, in part, a product of engineering ingenuity intersecting with business acumen at MIT.

In 2008, Dawson and Perreault, who directs the Power Electronics Research Group, submitted an early concept of the Eta technology — then called asymmetrical multilevel outphasing (AMO) — to an Innovation Teams (i-Teams) class that brought together MIT students from across disciplines to develop commercial products.

The AMO technology was a new transmitter architecture, where algorithms could choose from different voltages needed to transmit data in each power amplifier, and select the optimal choice for power conservation — and do so roughly 20 million times per second. This could be done on the transmitting and receiving end of data transfers.

This caught the eye of Astrom, who had come to MIT after working in the mobile industry for 10 years, “looking for the next big thing.” With help from Astrom, the professors started designing the technology for the mobile market — initially leaning toward base stations.

“At the time, I was suffering, as everyone else was, from my iPhone running out of battery at lunchtime,” Astrom says. “The iPhone was only a year old, but you could see how much data traffic would explode.”

Fleshing out a business plan from an i-Teams draft, the two professors earned a Deshpande Center for Technological Innovation grant in 2009, allowing for the first demonstration of the hardware, showing a 77 percent gain in efficiency over standard systems. (A paper detailing the technology was presented at that year's IEEE Radio Frequency Integrated Circuits Symposium.)

“That Deshpande Center grant was big in terms of the funding and connecting us with local venture capitalists, and really helping with being in that business mindset,” Dawson says.

Eta Devices launched in 2010, with Astrom as its CEO. From there, it's been all rapid prototyping at Eta Devices' Cambridge and Stockholm offices, as well as gathering customer feedback.

Spinning out a company has been the best way to validate the technology — especially with novel power-electronics hardware, Dawson says. “People in our industry take ideas a lot more seriously when there's a company behind it,” he says. “We had impressive performance at MIT, but now we have a team of professionals working on the technology full-time. The resulting performance numbers are jaw-dropping. Now people are going back and frantically studying the original MIT research papers.”

Luckily, Dawson says, several significant changes were made to those old research projects in order to develop today's ETAdvanced — so the secret ingredients of the technology are safe. “The joke I like to tell is: When I was a professor, I was going around the world trying to give the technology away,” Dawson says, laughing. “If I had succeeded, then there'd be no business.”

Future-proofing technology

Today, Eta Devices' major advantage is that its technology is able to handle ever-increasing data bandwidths.

A few major smartphone manufacturers are now using envelope tracking (ET), which adjusts voltage to power amplifiers on the fly. But by adjusting that voltage continuously, ET efficiency falls apart for 4G/LTE and 802.11ac (WiFi) wireless standards, even up to 20 MHz bandwidth. ETAdvanced, in contrast, already accommodates ultrahigh bandwidths used by newer communication standards, such as LTE Advanced (up to 80 megahertz), and the next-generation WiFi standard (up to 160 megahertz).

Prepping for future communication standards is one thing that's helped the company thrive, Dawson says. “As a small company, you'll lose a fair fight with another technology — you have to have some overpowering advantage that they can't match you on,” he says. “In introducing new hardware, you not only have to be better than the product of today, but also have to make compelling case for being future-proof.”

Source :

<http://newsoffice.mit.edu/2014/chip-increases-smartphone-battery-life-1028>

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