New 'GreenWeb' tools aim to create an energy-efficient web

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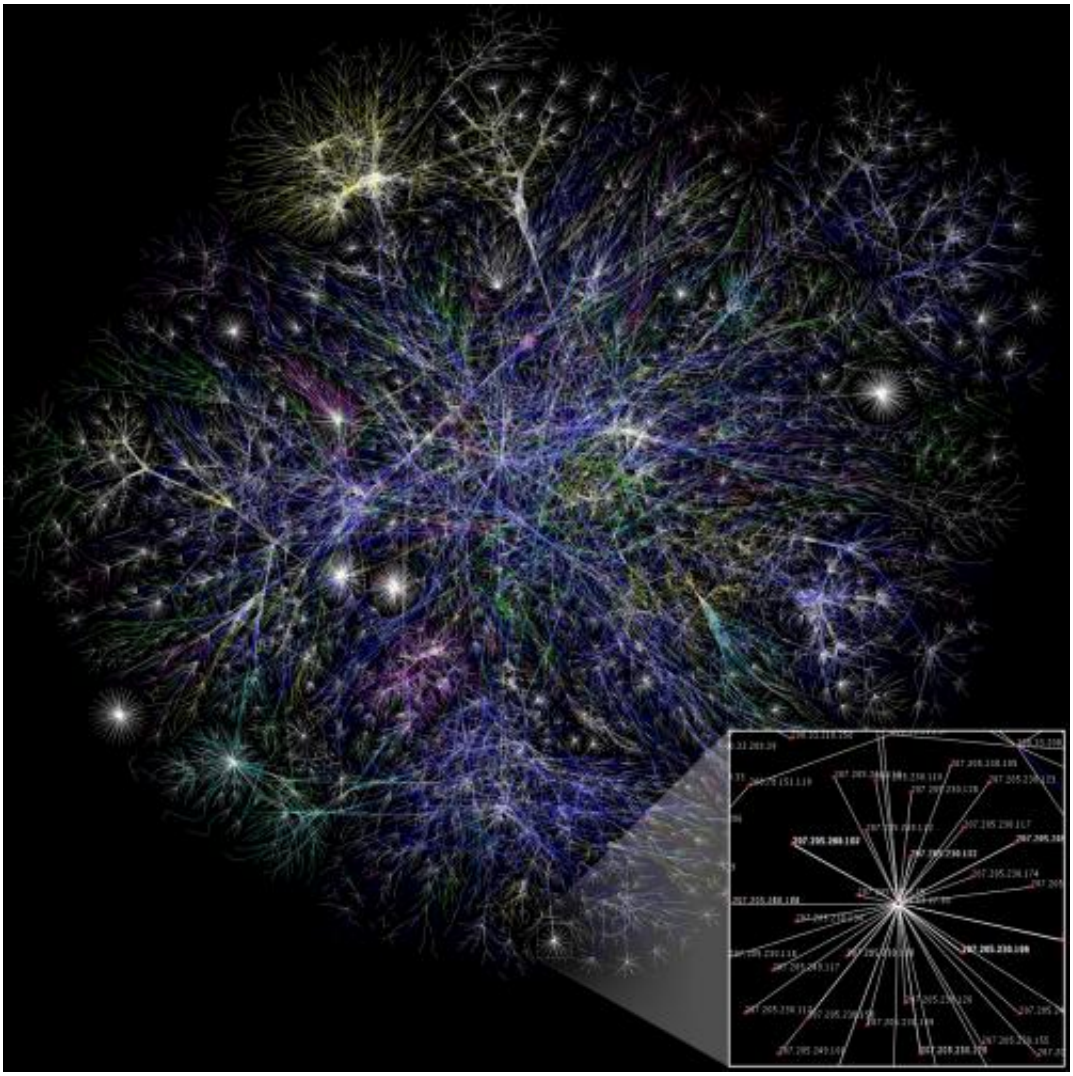

Partial map of the Internet based on the January 15, 2005 data found on opte.org. Each line is drawn between two nodes, representing two IP addresses. Credit: Wikimedia Commons

Researchers in the Cockrell School of Engineering at The University of Texas at Austin have developed a new, open-source computer programming framework that could make the web significantly more energy efficient, allowing people to save more battery power while browsing on mobile devices.

To help mobile device users maximize their limited battery storage, electrical and computer engineering professor Vijay Janapa Reddi and graduate student Yuhao Zhu have developed what they are calling "GreenWeb," a set of web programming language extensions that enable web developers to have more flexibility and control than ever before over the energy consumption of a website.

The researchers have made the framework available to the public at WattWiseWeb.org, and they are presenting it at the ACM SIGPLAN Conference on Programming Language Design and Implementation (PLDI) on June 15 in Santa Barbara, California. Their peer-reviewed paper on GreenWeb is also published in the PLDI 2016 journal.

"Because user awareness is constantly increasing, web developers today must be conscious of energy efficiency," Janapa Reddi said. "However, current web language standards provide developers little to no control over device energy use. We've taken an important step toward language-level research to enable energy-efficient mobile web computing."

The researchers integrated GreenWeb into Google Chrome and reported energy savings of 30 to 66 percent over Android's default mode. Mobile device users spend nearly two-thirds of their time browsing the web, so that amount of energy savings could result in a 20 to 40 percent battery life extension.

GreenWeb more efficiently guides the web browser engine to save processor energy without sacrificing user experience. The language

extensions, implemented as CSS style rules, allow developers to express hints to the browser, which in turn conserves power when excessive computational horsepower is not necessary.

The researchers also developed AutoGreen, an automatic tool within the GreenWeb framework to assist developers in automatically making webpages energy-friendly. The system continuously monitors hardware and browser execution behavior to better understand how to maximize energy efficiency during interactive usage.

The web's energy demands have big implications in the digital economy. Poor energy behavior is a top reason that mobile users give negative app reviews, and 55 percent of mobile users say they would delete an app for heavy battery usage, according to an independent survey by market research company Instantly. Additionally, high energy requirements of a website or app could lead to processor performance throttling, which in turn leads to slower webpage load times, resulting in lost traffic or consumers and lost revenue.

Janapa Reddi believes there is a need for greater emphasis on improving web technology standards, making energy efficiency a priority for optimization.

"Cavalierly sacrificing energy for performance is no longer an option. Webpages and apps are getting larger and increasing in complexity, putting more pressure on CPU and network resources for performance that draws power," he said.

The foremost challenge for systems such as GreenWeb is for them to be embraced by developers, according to the researchers, adding that GreenWeb is a starting point, but that they want to encourage other web programmers to improve the tools and techniques.

"We want WattWiseWeb.org to be a portal for discussions about energy and the web," Janapa Reddi said. "We have developed a set of techniques as architects, but it is actually the community that will come up with the ultimate right set of solutions."

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Provided by University of Texas at Austin