Can smartphones use less energy to browse the web?

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Web browsing is one of the core applications on smartphones. After all, who hasn't checked Facebook or watched the latest news—or amusing cat videos—on their mobile phone? However, mobile browsers on smartphones are primarily optimized for performance, not energy efficiency, so web browsing—especially the loading of web pages—tends to drain batteries and frustrate users.

Recognizing this problem, Yunxin Liu, a researcher at Microsoft Research Asia, and a team from the Korea Advanced Institute of Science and Technology (KAIST) have collaborated to reduce the energy needed to load web pages without increasing page load time or compromising the user experience. In a recent research paper, they present three techniques to reduce the energy consumption of web page loading on smartphones. Two of these, network-aware resource processing and adaptive content painting, address energy inefficiencies in smartphones' content processing and graphic processing pipelines. The third, application assisted scheduling, takes advantage of ARM's big.LITTLE architecture to save energy.

The researchers have implemented the proposed techniques on Chromium and Firefox mobile browsers and have conducted comprehensive evaluations using real-world websites and the latest-generation smartphones. Experimental results and user studies indicate that the techniques significantly reduce the energy cost of web page loading while introducing only barely perceivable increases in page load

time. When tested for browsing with Chromium on a latest-generation big.LITTLE smartphone, the techniques achieved a 24.4% average system energy saving using Wi-Fi and a 22.5% saving when using 3G, with no discernable impact on average page load time.

The collaboration between Liu and the team at KAIST resulted from one of those fortuitous encounters that happen at scientific conferences. During the annual International Conference on Mobile Systems, Applications, and Services, Liu struck up an acquaintanceship with Duc Hoang Bui, a Vietnamese PhD student from KAIST. They had a good conversation, which resulted in Bui becoming an intern at Microsoft Research Asia and joining Liu's project.

After the first period of research, Bui returned to KAIST to continue his doctoral studies, under the supervision of Prof. Insik Shin. Liu and Shin knew one another already, and, now, with Bui as the link, they readily saw the advantages of working together on the second stage of the research. Focusing on their strengths, Shin's team contributed largely to the big.LITTLE technique, while Liu focused on the energy-saving work.

"Prof. Shin was very supportive during the research. We had a very nice cooperation together," said Liu.

The research paper was presented at MobiCom 2015. One of the top international conferences on mobile computing and networking, MobiCom is an annual event sponsored ACM SIGMOBILE (the Association for Computing Machinery Special Interest Group on Mobility of Systems, Users, Data, and Computing).

"I'm really flattered to publish the paper at this top conference," said Liu. "It's big news for our project and the whole research team." The researchers now plan to apply their application, which is still a prototype,

in additional browsers. Their ultimate goal, of course, is to get it into real-world use, where it just might save your battery long enough for one final download of cat videos for the day.

More information: "Rethinking Energy-Performance Trade-Off in Mobile Web Page Loading." cps.kaist.ac.kr/papers/com073-buiA.pdf

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