DECONSTRUCTING THE SMARTPHONE

HOW FEDERALLY-FUNDED R&D ENABLES BILLION DOLLAR INDUSTRIES

Adam Porter
UMD/Fraunhofer USA
aporter@cs.umd.edu

A few years ago I accepted an invitation to teach a course on programming mobile applications in China. I also decided to take my wife and two young daughters with me. We went to China and I gave the class and after the class was over we stayed in in China to do some sightseeing.

Everything was going great, but near the end of our trip we were sightseeing on our own in Shanghai when all of sudden my daughter started to complain about a severe earache. I wasn't sure what to do or how to get help. I don't read or speak Chinese and the people around me didn't seem to speak English. All the while my daughter's earache is getting worse. She's upset and crying and I was anxious wondering, "what do I do now?" In the end I did what many of us do when we don't know the answer to some question.

I used technology to tap into a vast network of knowledge and experience, products and services, spread out across and around our entire world. In English, that means that I took out my smartphone, opened up my web browser, connected to the Internet, and searched for information on how to treat an earache. Based on that search I found a CDC website that told me to give my daughter a dose of ibuprofen. Ok. Great. I know what I need to do. But how do I say ibuprofen in Chinese? I don't know.

So next I searched for "ibuprofen in Chinese" on google.com. That service first figured out that ibuprofen was an English term. It then translated ibuprofen into Chinese, "Bu lo fen," gave me its spelling in Chinese and also provided an audio track speaking the Chinese word. So now I know I need Ibuprofen and I know how to say it in Chinese. All I have to do now is say this to a Chinese. But where am I going to find a Chinese pharmacist? I don't know.

So I opened a mapping app and I searched for a "Pharmacy near me". This program figured out where I was in Shanghai, found pharmacies near where I was, showed me the area on a map, and then directed me with turn by turn directions to one of the pharmacies. I followed those directions, bought the medicine, and soon my daughter felt better. Disaster averted.

Of course, people do this and more with their smartphones every day now, so maybe my story's not so amazing. But if we went back in time only 10 years, I guarantee you that this story wouldn't have unfolded this way and this easily. If I could go back 35 years and talk to my college student self, he would have told me to stop watching so many Star Trek reruns, because that story wouldn't be possible in his lifetime. He would have been wrong, of course, because the story's true and today smartphones are part of a multi-billion dollar per year industry.

So how did come so far in so short a time? I often hear people talk about this person or that company as having invented smartphones. True visionaries working in a garage who saw the future and made it happen. I don't want to take anything away from those people and those companies. They've done amazing things - but that's not the entire story. The truth is that smartphones aren't simply the result of one person or one company's grand vision. Smartphones and the smartphone industry couldn't exist without decades of research and development done by armies of scientists and engineers in the US and around the world. In fact, a great many of the technologies embodied in today's smartphones got their starts in Universities, National Laboratories and Applied Research Centers funded by the US government.

Let's go back to my example. That Internet search I conducted depended on software and systems innovations developed with federal funds. For instance, some of the first modern web browsers were built at the University of Illinois in the early 1990's with NSF funding. Today's popular search engines use techniques developed at Stanford University in the early 1990's, again using NSF funding. The Internet itself was initially funded by the Department of Defense starting in the late 1960's. And that's just what you see on the surface. None of this would be possible without lots of software underneath all this. Again, federal funding has paid much of the research on programming languages, software engineering, operating systems and more.

Similarly, language processing tasks such as translation, speech recognition and text to speech synthesizers has made tremendous strides in the last decade. When you look into where these breakthroughs came from, it you find a chain of research starting in the 1980's, that was supported largely by the DoD, that has lead up to commercial products we see today.

Finally, my ability to instantly find myself on the globe and get directions to the places I needed to go would be completely impossible without the federal funding that created the Global Positioning System and that built up massive databases of satellite imagery starting back in the 1970's though NASA and the USGS. For many years this information was only usable by scientists, but later it was paired with other federally-funded innovations in graphical user interfaces and touch processing making it easy for almost anyone to interact with this specialized data in order to address their own needs. And again, all of this was initially driven by federally-funded R&D.

 Of course, deconstructing smartphones is just one example of the impact of federal R&D funding. But there are literally dozens of other examples I could have chosen- deconstructing this or deconstructing that - in which federally-funded R&D has demonstrably improved lives and transformed our economy by creating billion dollar per year industries. Over and over again, federally-funded R&D has led to transformational technologies, improved quality of life for our citizens, created new business and millions of new jobs, and a trained a cutting edge, highly productive workforce.

In closing, I don't think it's a stretch to say that the US government has been the most successful innovation engine in the history of the world and our country is unquestionably the better for it. Other countries, however, want to emulate our past successes and are investing heavily in hopes of out innovating us. Now more than ever, therefore, we must continue to invest in American ingenuity.