

Project ARA: Modular Smart Phones

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Abstract: This project is named Project Ara. The point is that Project Ara could erase some of the problems we currently face when it comes to having our phones serviced. Your camera isn't working or your battery isn't holding a proper charge? there would no longer be a need to send in your device except in the most extreme cases, instead you'd simply tell them what's wrong, you'd send in the defective part and "they'd mail you a new one free of charge" — provided it was covered under warranty or insurance, of course.

This would not only lead to a better experience for the consumer, it might even reduce costs for the insurance provider, manufacturer, carrier and/or retailer. This is especially true if they could create an effective model for recycling, reusing and refurbishing existing components.

Keywords:- Project Ara

I. INTRODUCTION.

Project Ara is the codename for an initiative by Google that aims to develop a free, open hardware platform for creating highly modular smartphones. The platform will include a structural frame that holds smartphone modules of the owner's choice, such as a display, keyboard or an extra battery. It would allow users to swap out malfunctioning modules or upgrade individual modules as innovations emerge, providing longer lifetime cycles for the handset, and potentially reducing electronic waste.

The project was originally spearheaded by the Advanced Technologies And Projects team within Motorola Mobility, then a subsidiary of Google. Although Google is selling Motorola to Lenovo, it is retaining the team, who will work under the direction of the Android division.

MOTIVATIONS

Google says the phone is designed for "six billion people", including the one billion smartphone users and the five billion feature phone users. Google intends to sell a US\$50 starter pack that includes a frame, a screen, a battery, a low end CPU and WiFi.

Google wants Project Ara to lower the barrier entry for phone hardware manufacturers so there could be "hundreds of thousands of developers" instead of the current handful of big manufacturers. Anyone will be able to build a module, without requiring a licence or paying a fee.

II. MODULES AND FRAMES

Ara phones are built using modules inserted into metal endoskeleton frames. The frame will be the only component In an Ara phone made by Google. It acts as the switch to the on-device network linking all the modules

together. There will be three frame sizes available at first: "mini", which is about the size of an iPhone, "medium", which is about the size of a 4.7 inch phone, and "phablet", which is about a third larger than "medium". Frames have two slots on the front: a space for the screen and a small horizontal bar. On the back they have square and rectangular slots of various sizes. Each frame is expected to cost around US\$15.

Modules can provide common smartphone features, such as cameras and speakers, but can also provide more specialized features, like a medical device, receipt printer, laser pointer, pico projector, night vision camera, or game controller buttons. Each slot on the frame will accept any module of the correct size. Modules can be hot-swapped without switching the phone off. (The frame includes a small backup battery so the main battery can be swapped.) Modules are secured with either latches or electro permanent magnets. The enclosures of the modules are 3D printed, so customers can design their own individual look and replace them as they wish.

Modules will be available both at an official Google store, and at third party stores. Ara phones will only accept official modules by default, but users can simply change a setting to install unofficial modules. This is similar to how Android handles app installations.

III. DEVELOPMENT

Prior to its acquisition of Motorola Mobility in 2011, Google had previously acquired some patents related to modular mobile phones from Modu. Initial exploration of this concept began in 2012 and work started on April 2013. Dutch designer Dave Hakkens announced the Phonebloks modular phone concept independently in September 2013. Motorola publicly announced Project Ara on October 29, 2013 and said they will be working collaboratively with Phonebloks. Motorola went on a 5-month roadtrip throughout the USA in 2013 called "MAKEwithMOTO" to Project Ara 2 gauge consumer interest in customized phones. Interested developers, testers, or users can sign up to be Ara Scouts.

IV. PLANNED EVENTS

Google plans a series of three Developers' Conferences throughout 2014. The first of these is scheduled for April 15-16, where Google plans to release the developers' kit. Commercial release is planned for Q1 2015.

V. TECHNICAL DETAILS

The first version of the developers' kit relies on a prototype implementation of the Ara on-device network using the MIPI UniPro protocol implemented on FPGA and running over an LVDS physical layer with modules connecting via retractable pins. Subsequent versions will soon be built around a much more efficient and higher performance ASIC implementation of UniPro, running over a capacitive M-PHY physical layer.

VI. THE TEAM

Project Ara was developed and is led by Paul Eremenko. The project falls under Regina Dugan, who runs Google's Advanced Technology and Projects (ATAP) organization. Both Eremenko and Dugan come to Google from DARPA, where Eremenko originated the Fractionated Spacecraft concept and ran the Adaptive Vehicle Make program, before heading the Tactical Technology Office. The core Project Ara team at Google consists of three people, with most of the work done by outside contractors. One of the main contractor is NK Labs, a Massachusetts engineering firm. (Project Ara is named after NK Lab's co-founder Ara Knaian). Another contractor is 3D Systems.

VII. RECEPTION

Initial reception to the earlier modular Phonebloks concept was mixed, citing its infeasibility, lack of a working prototype, as well as other production and development concerns. Some production and development issues were addressed after the Project Ara announcement from Motorola as the concept now had OEM backing, but other issues were raised about the modular concept.

Potential issues with the modular concept include a tradeoff between volumetric efficiency and modularity, as the framework interface holding the device would increase overall size and weight. The current prototype is 9.7mm thick, slightly thicker than conventional smartphones. Additional issues include regulatory approval; the FCC tests single configurations for approval, not modular configurations. Google said the FCC "has been encouraging so far".

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