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Google project ara

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ABSTRACT

The project Ara is an initiative of Google in the field of smart phones. The main focus of Project Ara is to bring the revolution of modular concept in smart phones. The platform will include a structural frame or endoskeleton that holds smart phone modules of the owner's choice, such as a display, camera or an extra battery. The project will focus on to reduce the yearly generated e-waste which is contributed by electronic industry especially mobile phones. This page aims to review the project's goals, challenges, implementation and its scope in the near future.

Keywords: *Project Ara, Modularity, Endoskeleton, E-waste, Modules and Smart Phones.*

1. INTRODUCTION

Smart phones are an essential part of human life today. This became the basic need for each and every person. With the advancement of technology, every day brings us a new feature. So every person wants the latest technology due to which with the advent of a new feature one has to buy a new phone and the old phone is now a waste which is either kept aside or sold at lower prices. Studies show that most fortune 500 companies assign, on an average 3.5 devices per employee. This wastage leads to the generation of a lot of electronic waste every year, most of whose part is contributed by the smart phone industry. Electronic devices produce 50 million tons of waste each year and the electronic waste stream increases 5% every year. This lead to the wastage of a lot of hard-earned money. The money which could be utilized in many other ways. In order to save the money and the generation of the electronic waste every year Google took an initiative to start modular concept in smart phones. This revolution in smart phones aims at reducing the waste of mobile phones as with the advent of any new feature, now we do not have to replace the whole smart phone rather just have to replace the module. This will save our time, money and environment too. 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. This initiative will expand the life span of components.

2. ORIGIN

The project Ara was originally started under Advanced Technology and Projects team of Motorola Mobility which was then a subsidiary of Google. Motorola was sold to Lenovo while keeping the ATAP section along with Google itself, which later became an independent operation. In 2011 Google acquired modular smart phone patent. In 2012 initial exploration started and Phonebloks started in December month of the same year. In 2013 Partnership between Phonebloks and Motorola was announced, Project ARA. "MAKEwithMOTO" tour took off. In 2014 Motorola was sold to Lenovo. ATAP team conducting Project ARA was integrated into Google. First Project ARA Developers Conference took place. In 2016 the concept has been revised again as it was going to launch the phones the same year. But due to top some challenges, the modular phone failed the drop test in September 2017, so the project is still under some research and development.

3. GOALS

- Designed to be utilized by around 6 billion people.
- The basic model would cost around US$50.
- There will be thousands of developers instead of hundreds of current phone companies.
- It would be an open source project, so no licensing is required.

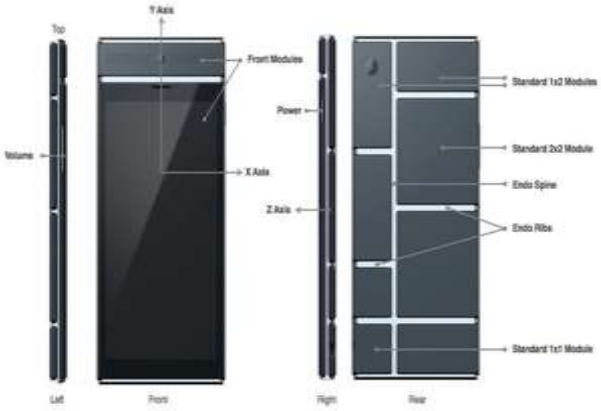
- We could be able to parcel out the pieces.
- It will bring openness to the hardware.
- 3-D image viewing system.

4. CONCEPTS USED

The project Ara basically aims at providing such a smart phone in which a user could be able to replace any of specific part without replacing the whole set. If there is an improved version of any of the module such as a camera, battery, CPU, display, speaker etc. To achieve this kind of flexibility few basic and important concepts are being used. These two concepts are not literally simply concepts but are the building blocks of the project Ara.

1) Endoskeleton:

Also recognized as Endo. Endoskeleton is used as the backbone of the platform of the project. It is defined as the internal framework of a system. In human beings and other vertebras, their bones decide the outer structure. Therefore bones are considered to be as an endoskeleton. An endoskeleton is simply a platform or we can say that an area on which different modules are to be implemented. The modules could be attached by just sliding them into the endoskeleton of the system. Endoskeleton of a system describes the characteristics and structure of a system. The life span of an endo is 5-6 years. The front side of an endoskeleton consists of latches and back side consists of EPMs.

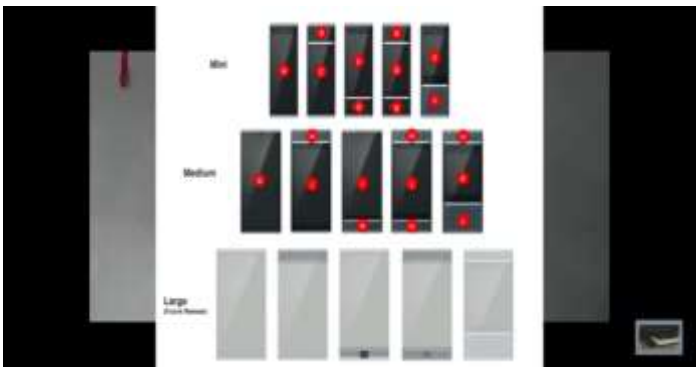


a) Structural differentiation: This gives us three types of structural specifications from mini phones to tablets. It provides three standard module sizes differing from

- 2x5
- 3x6
- 4x7

Frame	Size	Module Slots
Mini	(4.65x1.77x0.33)inch	2x5
Medium	(5.55x2.68x0.38)inch	3x6
Large	(6.46x3.58x0.38)inch	4x7

The smallest version would cost around US$50, the medium version would cost US$100 and the large version would cost US$150. These variations would be available according to size and cost of the device.



b) Endoskeleton issues:

- It has a universal electronic bus.
- Modules can not jump ribs or spines of the endoskeleton.

2) Modularity:

Modularity is the degree to which a component could be separated or recombined. In industrial designing, modularity refers to an engineering technique that builds larger systems by combining smaller subsystems. It is basically compartmentalization and inter-relation of the parts of a software package. It is the ability to alter the work by reconfiguring, adding to and/or removing its parts. It allows the logical partitioning of the "software design" that allows complex software to be manageable for the purpose of implementation and maintenance. The logic of partitioning may be based on related functions, implementation considerations, data links, or other criteria. The concept[t of modularity is also used in robotics for reconfiguring the robots. Modularity is used to automatically achieve different morphologies to execute the task at hand.

Modules are the building blocks of the modular smart phones. These modules are hot-swappable i.e. the modules can be easily inserted and removed from the endoskeleton of the mobile phone. Modularity defines a constant module ecosystem. In the modular smart phones, we have various modules of the camera, processor, speaker, display, battery etc. which could be replaced whenever a new invention is introduced in the market.

Modules issues:

- Cost of production is high.
- Can only expand the y-axis (top/bottom) or z-axis.
- Connectors
- P2P module communication.
- Device driver requirements (new drivers, different kernels, security).
- Size and weight overhead.
- 40% of PCB for component developers have their own hardware.
- The CPU module with holds SD card slot, memory, and other cores together but cannot be separated.
- Security of data.

5. NEW TECHNOLOGIES IN ARA

The project Ara indulges few new technologies which are emerged in order to fulfill the modularity concept of the smart phones. These technologies provide a higher order of efficiency and effectiveness of the modular smart phones.

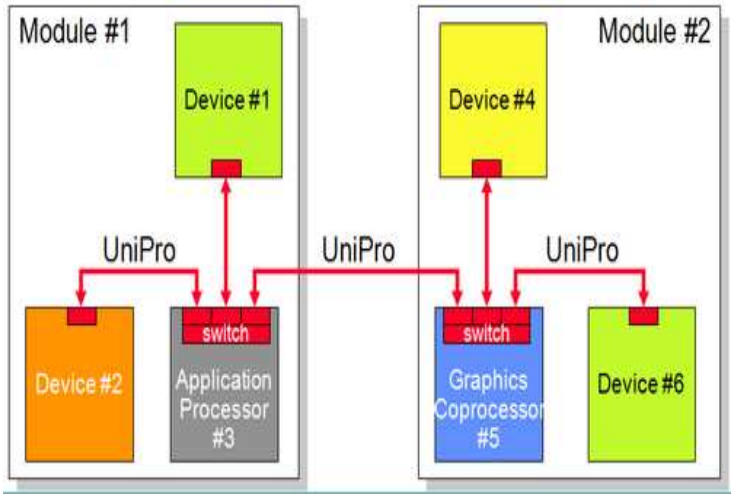
1) UniPro 1.6:

UniPro is Unified Protocol that provides a high-speed interface for connecting integrated circuits in mobile electronics. It performs following functions:

- Provides high-speed data communication i.e. gigabytes/second.
- Low power operation.
- Low pin count.
- Serial signaling and multiplexing.
- Small silicon area.
- Small packet sizes.
- Data reliability.
- Error recovery and robustness.
- Proven networking concepts, including congestion management.

- Works on the physical layer.

UniPro 1.6 aims at providing high-speed P2P communication between the mobile ICs. It can support up to 128 devices. In this network environment, the devices are connected through some links and data packets are routed through switches. These switches are connected through LAN and gigabyte Ethernet. The basic need of UniPro is to connect chips within the mobile terminals rather than connecting different computers in a specific area.

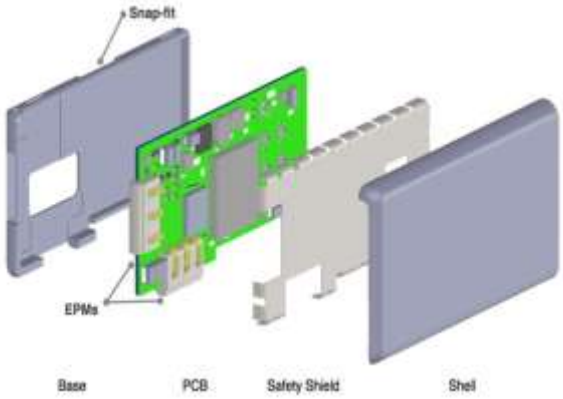


2) Capacitive M-PHY:

It Is a high-speed physical layer to serve essential interconnection needs in a device. The PHY stands for the Physical layer which is an important part of any device. MIPI alliance provides three cost-optimized specifications: MIPI D-PHY, MIPIM-PHY, and MIPI C-PHY.

MIPI M-PHY is used for multimedia and chip-to-chip or inter processor communication. It aims to provide:

- Connection points with longer life-spans.
- High bandwidth capabilities.
- Good power efficiency.



It meets the requirements of high performance, low power consumption, and low EMI effects.

3) Electro Permanent Magnets:

Electro-permanent magnets are used to attach a module on the endoskeleton or the frame of the device. It enables the module to get stick to its frame. The module could be inserted or removed though just sliding it over the frame only by using the electro permanent magnetic effect.

- The magnetic effect can be acquired without any continuous supply of energy.
- Operations could be performed by switching the magnetism between on and off.

6. FUTURE SCOPE

The Project Ara aims to replace the regular smart phones with the modular ones. This emerging technology which will change the future of smart phones.

- Reduction of electronic waste.
- Customer will not face any loss by selling his old smart phone and buying the new one with some enhanced features.
- A rapid growth in the electronic industry which will bring a new era of electronics.
- User-friendly as he has to replace just the required module whose feature is enhanced.
- This technology will bring in the feature of 3D image viewing on the display of the phone itself.
- These phones will provide a facility of high-speed data transfer i.e. up to 20 gigabytes/second.
- Specialized modules could be added to the mobile phone itself such as medical devices, receipt printers, laser pointers, pico projectors, night vision sensors, or game controller buttons.
- Modules would be available both at an official Google store and at third-party retailers.
- The user could only indulge only 40% of the hardware as per choice and rest will be implemented by the Ara specifications itself.
- Once an endoskeleton is bought it will last for about 5-6 years. So a yearly estimate of electronic waste would be reduced.

7. CHALLENGES TO PROJECT ARA

There are always two faces of a coin so if we have advantages of a thing, there are some drawbacks also. Pros and cons always come with a new technology. Two challenges to Project Ara are:

- Use of Electro Permanent Magnets: The modules are inserted or we can say implemented on endoskeleton frame with the help of electro-permanent magnet. During 2017 drop test when the phone was dropped on the floor, it completely got disassembled. Due to this, the project failed in the drop test. Therefore, goggle is now working to replace the magnets.
- Designing issues: Another challenge to the upcoming technology is its designing issues because every PCB is manufactured accordingly to the modules. But this phone would have a separate frame and modules have to be inserted as per user's need. So there should be a synchronization between the frame and module manufacturers.
- This project will not run completely on Android. As androids do not support dynamic hardware configurations yet. These phones will work on partially android functionality.
- Project Ara does not support the Internet of Things as these phones could not be attached to refrigerators or any other house hold device.

8. CONCLUSION

The Project Ara's development will decide the future of smart phones and the electronic industry. It only depends upon the time that how much the project would be successful and it could be used for the welfare of mankind. It will give rise to 3D printing and few new technologies such as UniPro and M-PHY. These technologies can also be used in other fields of science. The modular market has not been set yet but with the arrival of the prototype, the setup would achieve a faster pace. The platform that allows the user to manage all its modules should be intuitive enough for new smart phone users. The success is tightly connected to the variety of modules and brands that the user might be able to acquire.

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