

# Case Study: Virtualization for Mobile Devices with ETRI (South Korea)

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## The Situation:

### ETRI: Client Profile

Electronics and Telecommunications Research Institute (ETRI) is Korea's largest government-funded research institute, focused on developing talent, techniques, and innovative ideas in the field of Information Telecommunications.

The ultimate goal of ETRI is enhancing social and economic aspects of modern society.

Founded in 1976 with headquarters in Daejeon, ETRI employs 1736 professionals and has produced some of the most significant technological advances in Korean history.

ETRI is currently in progress on project ViMo (Virtualization for Mobile) developing a micro VMM (Virtual Machine Monitor) for mobile systems designed to enable devices to run multiple operating systems (RTOS + GPOS) concurrently.

The underlying idea driving this project is the widespread trend of consumerization of corporate devices and data; this is evidenced by increasing numbers of employees installing business applications on their smartphones and other mobile devices in order to gain access to corporate information on-the-go. Following this trend, the thought emerged that mobile devices should include some sort of protected environment for business information and programs isolated from personal user data.

One method of creating such an environment is mobile device virtualization, though no ready-to-use products exist for this purpose.

## The Problem:

When taking into regard the hardware limitations of mobile devices, full mobile virtualization is problematic because each hosted virtual system would run at less than optimal performance levels. One solution to the issues created by full virtualization is OS switching. Under this scheme, multiple operating systems can be loaded on a single device but only one will be running actively at any time. This allows system performance to remain optimal. With this notion ETRI set out to implement the ability to switch between two separate instances of Android OS running simultaneously on a single device.

Certain requirements existed which complicated this task:

- ◆ A user-friendly OS switching interface needed to be created
- ◆ Switching time was to be less than one second

- ◆ After switching the user must be returned to the exact same place in the same task as before (i.e. in the middle of editing a document, searching an address, browsing a gallery, etc.)
- ◆ The solution must work on a specific platform: a device based on the Cortex A8 (S5PC100; ARMv7 architecture) provided by the Institute.

Before this project, ETRI had never outsourced research or development. This is due to the highly specific area of expertise required and competitive rates for labor in Korea to offshore outsourcing services. When ViMo was proposed, though, the highly skilled in-house staff of ETRI was occupied by other tasks, leaving the Institute lacking the resources necessary to research the problem and develop a working solution. Other outsourcing firms which were considered for the job either lacked the technical skills necessary or were wary of undertaking the job on a fixed-price model due to the high risks involved with exploring new technological territory.

ETRI contacted Apriorit, who had already prepared to be assigned to the project. After an on-site meeting, the project was approved to begin. This was the pilot project for Apriorit and ETRI and was quite challenging in many aspects.

In the work on project ViMo, Apriorit needed to apply a number of skills:

- ◆ Linux kernel development
- ◆ Vast knowledge of ACPI and ARM architecture
- ◆ Development in Assembler
- ◆ Thorough understanding of Android OS internals
- ◆ Reverse Engineering (mainly for hardware drivers)

## The Solution:

The main challenge of the project was that it did not have any analogues. So, after the first requirements were approved, we needed to perform feasibility research as well as produce the solution concepts from scratch.

Key competence of Apriorit, which is well-established research process, was of primary importance in this project. Team applied several approaches, which form the company's "know-how", using advanced toolbox:

This approach was absolutely unexplored and required deep investigation. No analogues, no research documents – we needed an exclusive solution.

*Dr. Ahn, Chang-Won,  
Electronics and Telecommunications Research Institute*

- ◆ Disassemblers,
- ◆ Debuggers,
- ◆ Reverse Engineering for hardware drivers,
- ◆ Virtualization platforms.

Having the general feasibility research finished after the first month, team started to develop and improve prototypes. Then, development and research processes were conducted simultaneously providing solution with new features and implementing tricky requirements while keeping the prototype stable.

Thanks to the expertise in R&D projects, our team created a fully-working solution in just six person-months breaking even the boldest plans.

When Apriorit team arrived to Korea, to our laboratory, and presented the working solution, we were happy and at the same time astonished: it was very hard to imagine that this task could be finished just in 6 person-months!

*Dr. Ahn, Chang-Won,  
Electronics and Telecommunications Research Institute*

## The Impact:

Due to the solution developed by our project team, the client was able to greatly broaden ViMo functionality and significantly increase the number of user scenarios for the new technology. In its turn, this broadened the solution market segment adding those numerous hardware vendors, who were not ready to use full virtualization for their devices. OS switching – just as it was supposed to be – discovered to be more tolerable and attractive approach that has made ViMo target audience about five time greater.

Quick project development allowed ETRI to be the first on this market and enjoy the benefits of the exclusive product. Solution immediately stirred the interest of major market players upon release. ETRI is currently in contact with top manufacturers such as Samsung, LG, etc. to commercialize the groundbreaking technology.

While preparing this case study we faced with the fundamental problem of impact estimation: as Apriorit discovered to be the only one partner who took on the project with all its challenges and requirements. If ETRI had been forced to choose an alternative, it would have had to revise some project aspects (functionality, terms, deadlines, business model, etc.), that means it would not have been the same solution.

[See the ETRI video of Android OS switching.](#)

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## What's next?

Get the **free estimation** of time and effort for your project! After initial research, we'll provide you with the basic task dropdown and estimates indicating approaches and tools we can use to save your budget.

All we need is a brief project description sent to the [info@apriorit.com](mailto:info@apriorit.com) with "RFP" mentioned in the subject.

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The logo for Apriorit Inc. features the word "apriorit" in a lowercase, italicized sans-serif font. The letters "a", "p", "i", "o", and "r" are green, while the letters "i", "o", "r", "i", and "t" are orange. The "i" and "o" in the second half of the word are slightly taller than the others.