CASE STUDY

The Value of SoC Collaboration: How Arm, MediaTek and vivo are Redefining Flagship Smartphone Experiences

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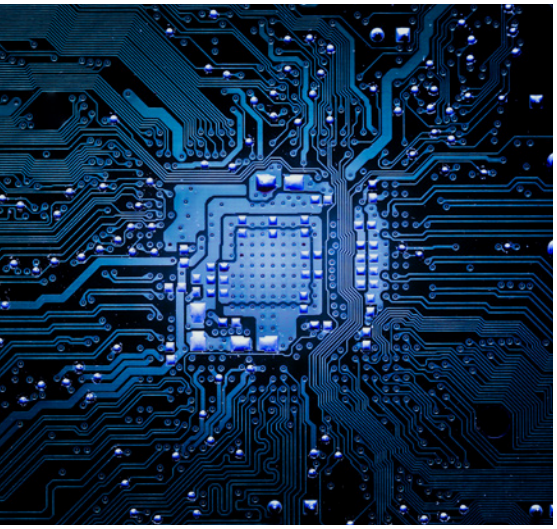

Enabling the Best Flagship Smartphone Experiences

Bringing Arm's leading-edge IP and solutions to life requires close collaboration with a range of partners across our industry-leading ecosystem. This is especially true on mobile where Arm works closely with MediaTek (the silicon vendor), vivo (the device manufacturer) and other ecosystem partners, like Android and our community of 15 million application developers, to deliver flagship handsets and user experiences to market.

From CPU to GPU to software, Arm, MediaTek and vivo worked together to ensure the highest quality implementation of the Arm Cortex-X4 and Cortex-A720 CPUs, and Immortalis-G720 for MediaTek's Dimensity 9300 system-on-chip (SoC) and then selected as the chipset for vivo's X100 and X100 Pro flagship smartphones. This was built around vivo's demands for optimum user experiences on flagship smartphones based on the following requirements:

- Longer battery life
- More immersive mobile gaming
- Faster application launches
- Better web browsing
- A more fluid UI
- Advanced security

Throughout the system-on-chip (SoC) development process, vivo provided feedback to Arm and MediaTek's engineering teams based on these requirements. This allowed Arm and MediaTek to keep making performance improvements across the SoC during the development process.

Addressing the Key Challenges and Requirements

On the CPU, Arm worked extensively with MediaTek from the early prototype stage right through to silicon development and tapeout, with vivo's ongoing feedback via silicon testing supporting this process. Arm's engineering teams also worked with vivo and MediaTek to perform deep dive CPU modelling tasks exploring system performance and power consumption on the Dimensity 9300 to see how any SoC thermal and power challenges could be addressed.

On the GPU, Arm and MediaTek spoke extensively with vivo about their expectations around performance and what they wanted to achieve through the key mobile gaming use case. It was clear that GPU performance was about sustained performance, rather than just peak performance alone. Both MediaTek and vivo wanted to "supercharge" mobile gaming with immersive visual experiences combined with long battery life for untethered gaming 'on-the-go'. For vivo, it was also important to look ahead to future mobile use cases, with Arm's engineering teams working closely with the device manufacturer to prepare its smartphones for the next generation of gaming and graphics features through Arm's extensive GPU roadmap.

The collaboration between Arm, MediaTek and vivo aimed to bring better security and software across the mobile ecosystem. On security, this required close engineering collaboration between Arm, MediaTek, vivo and Google on Android to facilitate the implementation and adoption of Arm's leading security technologies to benefit developers and end-users, like Memory Tagging Extension (MTE). On software, the Arm engineering teams wanted to identify any bottlenecks in applications that would affect performance on the X100 and X100 Pro smartphones, so worked closely with vivo through sharing optimizations based on Arm's long-term collaboration with Google on the Android operating system.

Optimizations Through Collaboration

MediaTek decided upon a highly optimized CPU design of using only Arm "big" cores (four Arm Cortex-X4 CPU cores and four Cortex-A720 CPU cores) in the Dimensity 9300 SoC. This led to leading-edge performance improvements across the board compared to the previous generation Dimensity 9200 SoC, including.

- 33 percent less power consumption at the same performance level
- 40 percent higher peak performance

For the end-user, this means faster web browsing, quicker app loading, longer battery life, and faster, cooler AAA mobile gaming experiences — all of which matched the key requirements from vivo.

On the GPU, MediaTek's Dimensity 9300 adopted Arm's latest flagship GPU, Immortalis-G720. The graphics and computing capabilities of Immortalis-G720 fed into a range of performance improvements compared to the previous generation Dimensity 9200 SoC, including:

- 46 percent GPU performance boost while remaining at the same level of power consumption
- 40 percent reduction in GPU power consumption

For the end-user, this means they get a big performance upgrade without sacrificing battery life for longer gameplay on mobile. Moreover, the focus on sustained performance supports seamless multi-tasking on smartphones, like gaming and video streaming at the same time. These core features supported MediaTek and vivo's desire to "supercharge" the mobile gaming experience.

Arm's MTE was seen as an important security technology and developer feature to bring better, more secure developer experiences through making it easier to find memory safety bugs that account for 70 percent of all software vulnerabilities. Arm worked closely with MediaTek to implement MTE on Dimensity 9300, with Google already enabling the technology on Android 14. Vivo then announced a new memory safety developer program, which makes MTE available to its developer community. All of this work provides improved code robustness, safety and security for the vivo application ecosystem, which ultimately delivers better software and user experiences on the X100 and X100 Pro smartphones.

Arm, MediaTek and vivo worked together on a software collaboration to deliver CPU and GPU optimizations that resulted in higher frame rates alongside significant performance gains in vivo's Chromium-based browser. When 'pinch points' in applications on the X100 and X100 Pro smartphones were identified, Arm engaged with Google on best practice guidance that would help developers improve application performance in response to these bottlenecks. These will feed through to the entire Android mobile ecosystem for improved application experiences.

True Collaborative Mobile Innovation

The engineering capabilities of Arm and MediaTek alongside the strong collaboration with vivo, which reflects the company's core requirements, has resulted in leading-edge mobile performance that brings faster, longer running handsets and better overall user experiences.

> "Arm is a longstanding and trusted partner of MediaTek, and we have worked together for many years to deliver on innovations that give way to unmatched optimization and acceleration for each new generation of SoCs. Our collaborative efforts with Arm in the development of the MediaTek Dimensity 9300 have helped ensure supercharged performance, improved power efficiency and better security."
>
> — JC Hsu, Corporate Vice President and General Manager, Wireless Communications Unit, MediaTek

Arm's work with the ecosystem is then helping to provide improved developer experiences that are translating to better, more secure software on vivo's X100 and X100 Pro smartphones.

All these collaboration efforts combined create true mobile innovation. From faster web browsing to more immersive AAA mobile gaming, the collaboration to integrate TCS23 successfully is delivering improvements that continue to push the boundaries of performance and efficiency on the SoC and satisfy vivo's mission to deliver better, longer device experiences via its flagship handsets.

> **"Collaborating with our partners on the vivo X100 has allowed us to push the boundaries of what is possible in the smartphone industry. By leveraging Arm's technology and our mutual expertise, we were able to deliver a truly innovative product to the market."**
>
> — Yujian Shi, Senior Vice President & CTO at vivo