A Qualcomm® Application Processor Case Study
Featuring HumanWare and Mistral Solutions

Boosting Performance in a Braille Tablet

HumanWare
BrailleNote Touch 32 Plus

Case Study Highlights

- **Background:** HumanWare designs and commercializes assistive technology products for people with blindness, low vision and learning disabilities. They looked for a processor that could meet their engineering requirements for a new, more powerful tablet for taking notes and using the web in braille.
- **Solution:** Mistral proposed the 820 Nano SoM, a system on module it had built around the Qualcomm® APQ8096SG processor. The SoM includes a 64-bit quad-core CPU, the Qualcomm® Adreno™ 530 3D graphics accelerator, 802.11ac Wi-Fi and a 14-bit image signal processor (ISP) capable of handling 28-megapixel images.
- **Results:** The BrailleNote Touch 32 Plus allows vision-impaired users to interact with applications in ways that sighted users take for granted.

Introduction:
Providing effective participation in the sighted world

For people with blindness, low vision and learning disabilities, HumanWare designs and commercializes assistive technology products, including a tablet for taking notes and using the web in braille. The consumer device is used in schools to train children on reading through a braille display and entering text through a Perkins keyboard.

Making a tablet useful to vision-impaired users takes tight integration between special hardware (keyboard, screen, camera) and software (braille reading application and encoding/decoding algorithms). Keeping it useful for the long haul takes smartphone-caliber processing and continuous Android updates.

When the chip powering the existing product reached end of life, HumanWare made plans for a more powerful replacement called the BrailleNote Touch 32 Plus. The company's engineers had several requirements:

- The new product would have to provide long-term Android support with continuous upgrades to newer versions.
- The new processor had to deliver much higher performance than the legacy one while conforming to the existing mechanical design and physical enclosure.
- With 802.11ac the standard in most of the environments where assistive learning devices are used, the new processor's Wi-Fi radio had to support it.
- The new processor had to meet image quality standards for text scanning and be powerful enough to handle a codec for real-time text-to-speech conversion.

HumanWare turned to their long-time development partner Mistral Solutions for the engineering services needed to design a high-performing, mainstream Android device for users with visual impairments.

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Mistral believed that the processing power and features of the APQ8096SG application processor were well suited to the new product.

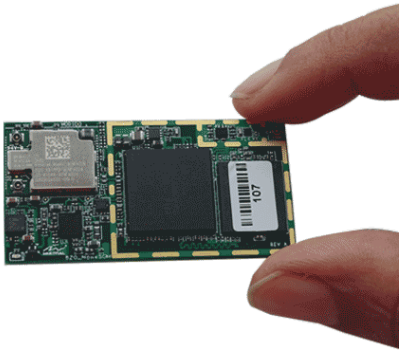
The Power of APQ8096SG

- Customized quad-core Qualcomm® Kryo™ 64-bit CPU delivers maximum performance and low power consumption
- Adreno 530 GPU with 64-bit addressing @653MHz with latest API support
- Highly integrated platform for compact designs; designed to reduce the bill-of-material (BOM) delivering board-area savings

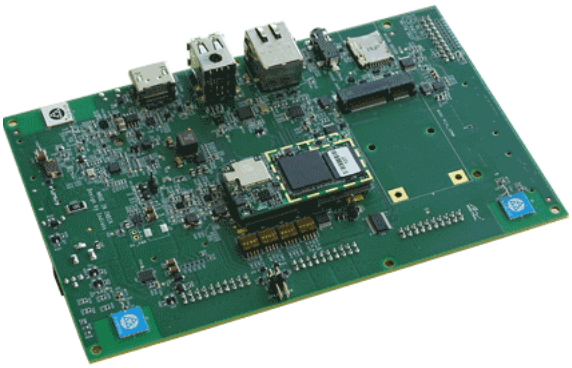
Solution: Abstracting complexity with the Mistral 820 Development Kit

Mistral, an authorized design center working with Qualcomm Technologies, Inc. (QTI), believed that the processing power and features of the APQ8096SG application processor were well suited to the new product. Instead of the single-board computer in the previous design, Mistral proposed the 820 Nano SoM, a system on module it had built around the APQ8096SG. The SoM includes a 64-bit quad-core CPU, the Qualcomm® Adreno™ 530 3D graphics accelerator, 802.11ac Wi-Fi and a 14-bit image signal processor (ISP) capable of handling 28-megapixel images.

So that Humanware could validate the performance of the 820 Nano SoM, Mistral suggested its own 820 Development Kit. The Kit provides termination to exercise all the interfaces available on the 820 Nano SOM, including USB 3.0 over Type-C, touchscreen and display, HDMI, power and extended storage.



The 820 Development Kit also gave HumanWare access to the latest version of Android. Capitalizing on the tight integration between hardware and software, Mistral took the base port of Android from QTI and modified it for the kit. HumanWare then used the kit to benchmark the tablet's hardware features and software against a nearly production-ready distribution of Android, running on the 820 Nano SoM.



The prominence of QTI in mobile assures OEMs of ongoing support for Android and of continued access to the most important features in the OS. From the standard Android images to recovery boot and over-the-air firmware upgrades, tight integration is a big advantage for device manufacturers.

By greatly reducing the complexity of testing the SoM, Mistral's 820 Development Kit was the first step toward confirming the APQ8096SG as a suitable processor for the new tablet. Once testing on the kit was finished, HumanWare was confident enough to take the 820 Nano SoM into production.

More about APQ8096SG

More about Mistral 820 Nano SoM and Dev Kit

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BrailleNote Touch 32 Plus is the most powerful and up-to-date note taker in the assistive technology industry packed with educational tools.
—HumanWare

Engineering and profiling of the faster BrailleNote Touch 32 Plus

From there, the increase in system speed was even more compelling. The 2.2GHz Kryo quad-core CPU and 4 GB of LPDDR4 RAM lent an appreciable boost in performance to the BrailleNote Touch Plus.

Mistral had to implement additional layers and services for features outside the 820 Nano SoM. That work included developing drivers and supporting interfaces to Android so that HumanWare's apps could access hardware like the touch screen and the braille display.

The BrailleNote Touch 32 Plus includes a software implementation to realize a 9-key Perkins keyboard. This touch-based keyboard captures keys from the way the user's fingers are positioned on the screen. An algorithm running on the APQ8096SG detects the combination of fingers on the screen and then generates the scan code for the corresponding key.

Late in the project, Mistral noticed that the APQ8096SG was heating up when playing back 4K video with prolonged streaming over Wi-Fi. HumanWare wanted to know whether the Linux kernel had safety measures to deal with overheating and keep the system in a reliable state of operation. Using Qualcomm® Snapdragon™ Profiler, Mistral demonstrated the system load on all cores and showed how cores automatically throttle back to keep the system stable until temperature falls. Profiler also depicted how the APQ8096SG distributed most of the 4K video load across GPU and hardware codecs, sparing the CPU.

Results: Most powerful, up-to-date note taker

The touch screen on the BrailleNote Touch 32 Plus allows vision-impaired users to interact with applications in ways that sighted users take for granted. With HumanWare's KeySoft suite running on the APQ8096SG processor, users enjoy first-letter navigation, speech and braille feedback, and access to both braille-first and mainstream apps available from Google Play. BrailleNote Touch Plus is the most powerful and up-to-date note taker in the assistive technology industry packed with educational tools.

Designed to be used in the classroom, at home or at work, the revolutionary BrailleNote Touch Plus will be your guide through your life journey! Plus, the product has earned strong marks from sighted parents, teachers, peers and IT professionals who can finally use an assistive device as they would an ordinary Android tablet.

To learn more visit: qualcomm.com

Qualcomm Snapdragon Profiler is a product of Qualcomm Technologies, Inc. and/or its subsidiaries.

About HumanWare

- **Company Name:** HumanWare Group
- **Description:** For over 30 years, HumanWare's inspirational vision has resulted in a range of highly intuitive and intelligent solutions that empower people who are blind or with low vision by giving them the independence to participate effectively within a sighted world
- **Headquarters:** Drummondville, Quebec, Canada
- **Website:** **www.humanware.com**

Humanware
see things. differently.

About Mistral

- **Company Name:** Mistral Solutions Inc.
- **Description:** R&D center recognized by the Department of Science and Technology, Govt. of India. "Fuelled by our passion for embedded technology, we strive to innovate, utilize latest technologies and development methodologies to help customers and ODMs design cutting-edge, innovative products across various domains."
- **Headquarters:** USA: Fremont, CA
  India: Bangalore
- **Website:** **www.mistralsolutions.com**

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