Resolving the Babylonian Confusion in the ARM® Module Market

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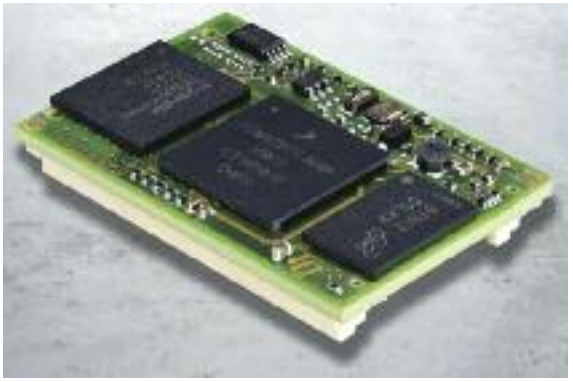
In the race for market leadership, ARM® processor quantities are now ahead of processors with x86 architecture, since many devices on the mass market, such as mobile telephones and PDAs, rely on ARM processors. However, the x86 architecture still has its nose in front on the embedded market, and particularly the module market. The power of ARM processors has nevertheless been steadily growing in recent years, and ARM and x86 processors have been becoming increasingly similar in terms of the number and type of interfaces. ARM processors are thus now of interest to the embedded module market. Unlike the x86 module market, on which standards have clearly prevailed, the ARM module market appears very divergent. Where do standards fit in here?

Standards are either defined by non-profit organizations, such as the PICMG, or by special interest groups. This is generally pushed by market pressures to accept and employ a specific form of technology. Standards have developed in all places where there is great consistency in the functions required and offered. Examples from the embedded module market include ETX as the standard of a special interest group, and COM Express as a standard managed under PICMG. Absolute Standards such as COM Express have a long process for defining functions, which can last for up to two years or longer, but they can be exchanged among various providers and are available long-term. However, Absolute Standards are sometimes only a compromise laboriously negotiated on the relevant boards, where many people tend to put in their two cents worth. The standards of special interest groups, such as ETX, are defined relatively quickly, but the products offered are not always exchangeable in all aspects. In any case, standardization increases acceptance on the market, and sometimes also opens the market up to new applications.

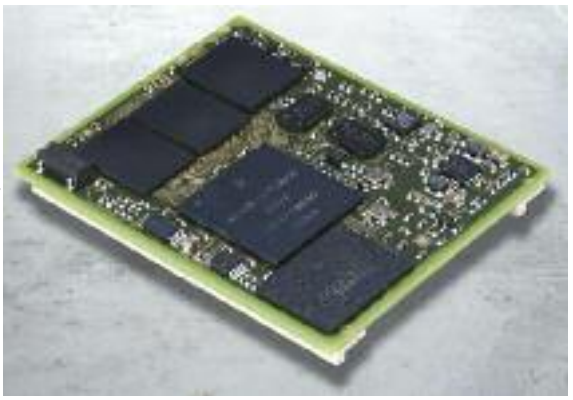
ETX, XTX, Qseven and COM Express have clearly asserted themselves in the x86 sector in recent years; ETX was the industry standard, per se, for almost ten years. This was possible due to the fact that the type and number of PC interfaces did not change during that time. New standards did not become necessary until the switch to the serial interfaces, such as SATA and PCI Express, and to higher transfer speeds. XTX forms acts as an initial bridge here, and the first real module standard was introduced on the market in 2006 with COM Express. Barring a few exceptions and niche products, the x86 module sector has committed itself to COM Express, without which no provider can be successful on the x86 market.

Over the last two to three years, ARM processors have been increasingly surging onto the industrial market, and therefore also the embedded module market. This way has been paved by various chip manufacturers, including Freescale, Samsung and TI, who have integrated the ARM core into their own chips and equipped it with additional special functions. Apart from the standard interfaces such as Ethernet, USB, serial, memory interface and graphics, each manufacturer has its own “specials”, depending on the market’s target audience. These can include a camera interface, ADC, GPIO, Keypad, SATA, MMC and SD Card or I²C interface. And this is precisely where the problem of standardizations arises. On the x86 market, the interfaces and

other functions are defined in a fixed manner, i.e. functions and a standardized interface are easy to define. Every x86 processor and chipset virtually fits into this grid pattern. Conversely, the interface variation in the ARM processors offered is so great that it cannot be easily pressed into a set pattern. Although most processors in a group (ARM9™, ARM11™, etc.) have a number of interfaces common to all, the processor manufacturers store their special knowledge and market requirements in the chip using the "special." tandardization would mean that approximately 60 percent are defined in a fixed manner and 40 percent are manufacturer-specific. A standard covering the performance categories from ARM9 to Cortex™-A9 would be even more difficult. An embedded standard module taking into account all the functions of the various providers would thus have a lot of pins which would rarely be used. A module defined in this way could direct all signals externally with 400 pins, whereby approximately 200 pins would be the common pins and 200 pins could be different depending on the manufacturer - so not really an exchangeable standard. Superfluous pins also cost money and generally make a module unnecessarily large. It is, how-ever, expected that, in the upper ARM processor performance sector, things will increasingly appropriate the x86 sphere, meaning standardization such as that found on the x86 module market appears possible. But which approaches are being offered on the market today?



TQ ARM9 module with Freescale i.MX28 processor



TQ ARM11 module with Freescale i.MX35 processor

Some providers on the market have "defined" their "company standard." To ensure the module is not too big, however, a maximum of only 60 percent of interfaces is generally available for company standards, and these are the ones common to all processors. In extreme cases involving a standard with 100 defined pins, of which approximately 70 are signal pins, using a TI OMAP35xx with approximately 250 signals, this leads to approximately 180 signals which are not built in from the module, i.e. are not available to the user. On the x86 market, it makes perfect sense to switch modules if, for example, the application requires more output. As the core is always x86, i.e. the software is always the same, it is possible to switch from one COM Express module to the next without any problem. The so-called company standards often even involve different processors from ARM9 to x86, which covers a wide range of performance, but requires varying software. An exchange, particularly with differing sizes, appears to be more of a marketing ploy than a real solution.

An x86 derivative is another means of standardization. Qseven Boards, among other things, are offered with ARM9 processors. Qseven standard signals are not available here, or are simulated by elaborate additional circuits. The clear advantage of an ARM processor's very little power loss is not always utilized here. Once again, lots of unused space must be paid for and many ARM processor functions are not available in the application. As stated above, this only makes sense for high-performance ARM processors which virtually work like an x86. Here, only the remaining specific ARM processor functions are lost.

A standard for ARM modules is not currently anticipated, and probably not feasible either. The almost 40 providers on the module market prove this nearly 60 different form factors. Clear differences become apparent when the modules from the various providers are examined in detail, including the processor used, the size of the module, the plug system used, signals existing on the plug, memory types and sizes, and most importantly the operating systems supporting the module.

How can the user choose the right module from this wide range of options? It depends heavily on whether the main focus is on the application or the specific processor. If it is on the processor, the module should provide the full range of processor functions, which therefore excludes all so-called "standards" in this case. In terms of the remaining module providers, the user should check whether the module complies with the specifications relating to function, reliability, robustness and long-term availability, and thus offers the user security for the future. If the application is the main priority, a "standard" can be an adequate solution. In any case, the price will ultimately play a major role. For the user, however, it is even more important to have long-term supply guarantees and to therefore have faith in the supplier. Establishing a relevant ECO system can create more certainty and compensate somewhat for the lack of standardization. From the user's perspective, the long-term, reliable availability of the module is crucial. The provider must offer the security guaranteed for standards by Second Source. TQ, as an established, leading company on the market, and TQ modules, with their optimized, heavily integrated, consistent, industry-standard design offering all processor functions, provide the user with perfect solutions and security for the future. However, the search still continues for standards on the ARM module market.

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