ZYNQ®

Xilinx and BEEcube

Product: nanoBEE cost-effective terminal gateway emulator

With the Xilinx Zynq®-7000 All Programmable SoC, BEEcube was able to develop its highly innovative, extremely flexible, and uniquely mobile nanoBEE 5G integration and 3GPP UE-compliant prototyping system platform in under 18 months - and be early to market.

"Zynq opened up a lot of capabilities that we couldn't do before. For example, a traditional processor interface requires communicating to the processer via PCIe or USB, which are both extremely slow and have high latency. In the Zynq SoC, we can run actual Linux on the ARM core and communicate to the FPGA fabric using the built-in AXI bus. It has a much tighter integration between the FPGA and processor with much shorter delays."

Chen Chang, BEEcube founder and CEO

Executive Summary

Customer
▪ BEEcube

Challenges
▪ Highly differentiated mobile functionality
▪ Lower cost and increased ease of use
▪ Faster time to market ahead of 5G ramp

Xilinx Solutions
▪ Single chip (ARM + Logic) unlocks performance
▪ Logic and transceivers enabled 5G support
▪ All Programmability enables small form-factor
▪ AXI bus enables HW/SW IP reuse

Results
▪ nanoBEE delivers unique mobile emulation
▪ Quick to market - cut TTM by 30%
▪ Modular/add-on platform product model

Challenges

Prototyping systems for the wireless market are meant to develop and test the macro and micro base station, receivers, etc. that create the infrastructure of wireless networks. Historically, the interaction with the network isn't complete until the hardware is delivered, then in-situ bugs are typically found, requiring redesign of the systems. BEEcube's challenge was to help developers of upcoming 5G networks proactively test mobile handset and small cell functionality with infrastructure equipment prior to network availability.

BEEcube's 5G offering needed to be:
▪ 3GPP UE (categories 1-8) compliant and flexible for emerging 5G standards
▪ Mobile (battery powered) yet high performance
▪ Radio functional out of the box w/GPS tracking
▪ Expandable high speed I/O daughter card add-ons
▪ Early to market for 5G development ramp

nanoBEE:
Mobile Terminal
Gateway Emulator

Xilinx Solutions

BEEcube chose the Zynq®-7000 All Programmable SoC as the central processing system for its nanoBEE product, launched in December 2014. The Zynq SoC's dual-core ARM® Cortex® A9 MPCore plus ample FPGA logic, all on a single chip, allowed nanoBEE to be a mobile prototyping platform that can be battery powered to perform realistic, in-the-field testing. The Zynq SoC's logic capacity and high speed transceivers ensured nanoBEE could be 3GPP UE (categories 1-8) compliant, able to support legacy network protocols while being suited for 5G network development and testing. The ARM AXI bus allowed BEEcube customers to reuse previous generations of IP from their earlier ARM-based designs.

The Zynq SoC's programmable I/O allowed BEEcube to make nanoBEE expandable through analog FMC cards. The logic capacity and I/O allowed GPS tracking to be integrated into nanoBEE and be radio-functional out of the box by controlling it in the Zynq SoC's logic. Customers could perform real-time, in situ testing and debug of 5G network technologies. BEEcube also leveraged the Vivado Design Suite's use of interoperability standards in the BEEcube Platform Studio for nanoBEE users.

Results

With the Zynq AP SoC, BEEcube developed its highly innovative, extremely flexible, and uniquely mobile nanoBEE 5G integration and 3GPP UE-compliant prototyping system platform in under 18 months - and early to market. "Zynq opened up a lot of capabilities that we couldn't do before. For example, a traditional processor interface requires communicating to the processer via PCIe or USB, which are both extremely slow and have high latency. In the Zynq SoC, we can run actual Linux on the ARM core and communicate to the FPGA fabric using the built-in AXI bus. It has a much tighter integration between the FPGA and processor with much shorter delays." -Chen Chang, BEEcube founder and CEO.

This level of system integration gives nanoBEE a real-time performance not possible with other SoCs, because Xilinx standardized on the AXI bus, BEEcube and its customers can reuse IP from previous ARM-based designs, saving design time. The nanoBEE, as a commercial offering is radio-functional out of the box, can cut 12 months out of customer design cycles, by eliminating the need to build their own custom board.

The Zynq AP SoC enabled BEEcube to deliver an innovative and differentiated product and allowed BEEcube to offer a modular solution providing the company with an additional revenue stream.

> **"We are leveraging the ARM processing system within the Zynq platform for high level application, MAC, and network layers and use Zynq SoC's logic for the physical layer. The system can be used to emulate a cell phone, a femtocell, or an LTE gateway" – David Squires, BEEcube VP of Business Development.**
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More about BEEcube:

A commercial offshoot of UC Berkley's Wireless Center, BEEcube, a National Instruments company (Fremont, CA) offers highly advanced prototyping systems that enable R&D and design teams to develop next-generation products in wired and wireless networking, aerospace and defense and HD video imaging.