

Synopsys and Netro

Netro insources FPGA-to-ASIC conversion for first point-to-multipoint network solution

Netro's core competence is inventing broadband wireless networks for high-capacity voice, data, and video communications—not designing ASICs. When Netro needed to convert FPGAs to ASICs for its innovative AirStar point-to-multipoint ATM network solution, Netro enlisted a partner whose core competence is ASIC design—Synopsys Professional Services.

"ASIC development requires a tremendous infrastructure that includes people, tools, and experience. Going from FPGAs to ASICs is a huge step and very difficult for a small company like Netro. Synopsys made it easier. They helped us make that step."

Steve Patterson, Netro Corporation, Director of Engineering

netro network

Issues

- Shorten development time
- Contain development costs
- Minimize overhead and maximize internal resources

Solution

- Synopsys Professional Services
- FPGA design flow consulting
- FPGA-to-ASIC conversion

Benefits

- Fast design prototyping
- Parallel development for faster time-to-market
- 100 percent functionality on first-pass silicon

Business

Netro Corporation provides wireless Metropolitan Area Networks (MANs) and local-loop access solutions for telecommunications service providers worldwide.

point to

The first true point-to-multipoint wireless system, the Netro AirStar system breaks new ground by providing a flexible telecommunications infrastructure above ground in urban areas. A base station located on top of a building broadcasts a 90° radio beam to multiple low-cost subscriber terminals. Each subscriber terminal acts like an asynchronous transfer mode (ATM) node, utilizing the available bandwidth and allotting it to users based on priority.

The Netro AirStar system enables competitive local exchange carriers (CLECs) to enter the telecommunications

market against the entrenched carriers, the Regional Bell Operating Companies (RBOCs), who own the wireline infrastructure. The Netro AirStar system installs in a day, allowing alternate operators to deploy local-loop connections in a hurry. And unlike traditional telephony networks, bandwidth allocation is adjusted dynamically.

"Competing products have a dedicated point-to-point radio link from each customer terminal to the base station," explains Steve Patterson, director of engineering, Netro Corporation. "The links function like leased T1 lines and are limited to 1.5

megabits/second per user. We offer the only true point-to-multipoint shared system that can deliver up to 8 megabits/second per user." This unique capability allows Netro customers to compete in the local telecommunications market by offering subscribers lower rates and flexible rate plans based on user bandwidth requirements. "AirStar lets up-and-coming carriers make maximum use of the limited frequency spectrum assigned to them," says Patterson. "Essentially they can sell the same bandwidth to multiple subscribers while delivering the level of service each subscriber requires."

One AirStar Base Station serves thousands of subscribers per sector who dynamically share bandwidth in the air.



multipoint

Fast, Low-Cost Development

As a start-up company in a highly competitive market, Netro is concerned about time-to-market. "We must get products to market quickly to maintain the sound revenue stream that our venture capitalists like to see," explains Patterson. At the same time, Netro has to keep development costs as low as possible. For fast, low-cost development, Netro prototypes its designs as field programmable gate arrays (FPGAs). Netro-exclusive features and functions are downloaded from software to off-the-shelf FPGAs, like

those from Altera. Product logic can be modified through simple software upgrades. Then when the design is stable, the FPGAs are converted to ASICs.

"FPGAs are large, slow, and expensive. Application-specific integrated circuits (ASICs) are smaller, faster, and cheaper in volume," explains Patterson. "But ASIC development requires a huge investment in resources and infrastructure." That's an investment that a relatively small, start-up company like Netro doesn't want to make. Another way Netro keeps

development costs low is through the strategic use of consultants to augment its lean, highly focused engineering team as needed. That's where Synopsys Professional Services comes in. "We're the experts in system design. Synopsys is the expert in ASIC development," says Patterson. "They have the people, tools, training, expertise, and vendor experience that, for the most part, Netro does not maintain in-house. Their assistance on the AirStar project allowed us to focus on our core technologies."

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Inourcing Cuts Development Time

The involvement of Synopsys Professional Services in the Netro AirStar system actually began well ahead of ASIC conversion. Netro utilized Synopsys Professional Services' expertise in high-level design for the prototype base station FPGAs. "Synopsys consultants worked on-site as members of the Netro team, implementing our system design specifications," says Patterson. Inourcing expertise from Synopsys helped speed development in more ways than one.

Synopsys Professional Services provided the additional expert manpower that enabled Netro to develop the base station and subscriber terminal in parallel, instead of sequentially, which would add many months to the development schedule. With Synopsys consultants working on the base station, Netro engineers were able to focus on the critical design issues of the

subscriber terminal. The competitiveness of Netro's AirStar system depends on delivering high volumes of compact, highly reliable, low-cost units for subscriber premises.

By inourcing, Netro retained the management control it wanted over the whole project. It also ensured close coordination between the base station and subscriber-terminal efforts, which was necessary to keep the whole project moving ahead as rapidly as possible.

Netro carried over the FPGA design flow used on the base station to the subscriber terminal as well, employing the same coding guidelines to ensure synthesizable code and utilizing the same tool, *FPGA Express*[™], for fast, efficient synthesis. Synopsys Professional Services also helped Netro build simulation test benches and test cases for both the base station and subscriber terminal FPGAs to verify that the register transfer level

(RTL) functioned properly. Synopsys Professional Services continued to support Netro during the field trials of the FPGA prototypes, providing debugging assistance.

Seamless ASIC Conversion

When it came time for ASIC conversion, Netro conserved its valuable internal engineering resources by handing off the process to the Synopsys ASIC experts. For the base station, the conversion involved integrating and repartitioning the functionality of five FPGAs into a single chip. For both the base station and subscriber terminal, Synopsys consultants were responsible for the entire ASIC conversion process. The process included netlist translation, mapping of logic functions to an ASIC equivalent, additional coding for enhanced functionality, ASIC optimization, pre- and post-layout static timing analysis, and test bench generation.

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Conclusion

The Netro AirStar system is on target. "The base station ASIC is complete and achieved 100 percent functionality on first-pass silicon," reports Patterson. "Synopsys provided a significant advantage that helps us get to market faster and holds down development costs." The subscriber terminal ASIC prototypes are being tested, and Patterson is confident that it will achieve 100 percent functionality, as well. In summing up the value that Synopsys Professional Services brought to the project, Patterson has this to say: "There is a tremendous amount of infrastructure required to develop ASICs, including people, tools, and experience. It's a huge step from doing FPGAs to ASICs and is very difficult for a small company, like Netro. Synopsys made it easier by helping us make that step."

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