# Editor's foreword

By Chris A. Ciufo, Editor

## Ethernet: Teaching an old dog new tricks

Ethernet's ubiquity and routine turbo charging is as much a "given" in the embedded market as Moore's Law. Over the years, we've come to expect that Ethernet just gets faster and more optimized, and that all manner of boards and systems come equipped with RJ-45 10BASE-T copper jacks for 10/100/1000 connections[1]. So imagine my surprise recently when a spate of Ethernet announcements broke the routine and offered something different from the norm.

### Bow-wow, like, right *now*

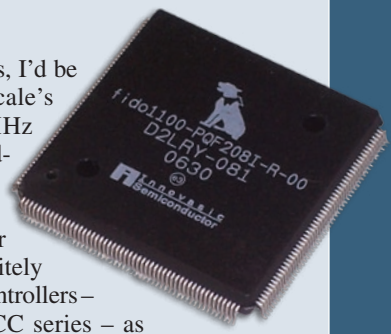
The first comes from Innovasic, a 15-year-old microcontroller company that describes itself as focusing on from "engine controllers to missiles" in long life-cycle markets. Well, that kind of talk gets our attention here in the critical systems business. The company's Flexible Input Deterministic Output ("fido," which still makes me chuckle) is a 32-bit *real-time industrial* MCU that's 68000 software compatible (see photo). All those buzzwords piqued our interest even more. So where's the Ethernet connection? Bear with me a bit.

Fido is like many MCUs and contains several I/O engines including an SDRAM controller, 10-bit eight channel ADC, and JTAG. But the device also contains four *universal I/O controllers* and a unique hardware memory partition controller and context state machine. The UICs and *context manager* together effectively create a tightly coupled hardware RTOS and highly programmable "bit banger" peripheral engine. One or more UICs, for example, can be programmed to realize 10/100 Ethernet, 18 GPIO lines, or a dual 16550 UART. Additionally, link protocols can be implemented in hardware such as TCP/IP (with modest performance – not a hard-core TOE), CAN 2.0B, I2C, SPI, LCD, or your favorite proprietary packet language.

Based upon this extremely intriguing fido architecture, Innovasic is targeting the industrial Ethernet market, which ARC Advisory Group (2005) says is growing at 51 percent CAGR. The company cites a customer (Schneider) testimonial for an industrial 100 Mbps Ethernet controller and 100 Hz factory data that partitions up three UICs to assure that high-priority packets are received by the CPU in Context 1, while low-priority packets are handled by Context 2. The amazing part of this design is that a single fido MCU handles the Ethernet stack (with an external MAC), TCP/IP, and the RTOS necessary to solve the mission-critical factory jitter and priority inversion problems.

If this hardware-partitioned, bit-banging implementation sounds sort of familiar, it should. In defense systems, ARINC-653 documents a way to separate software processes in secure and mission-critical systems, and Microchip's PIC microcontroller has a similar blank canvas approach to implementing peripherals. But Innovasic's fido1100 32-bit, 66 MHz, 68000-like architecture and multiple functional blocks should make it an immediate hit in mission- and life/safety-critical systems. Truthfully, I'm still digging into this chip and am still finding loads of possibilities its designers haven't yet pursued.

### Ethernet, real QUICC




And speaking of 68000-like MCUs, I'd be remiss if I didn't mention Freescale's original highly integrated 33 MHz MCU-oriented, 32-bit QUICC product line. Several of those variants contained Ethernet, such as the 68EN360, which boasted four Ethernet channels. Innovasic definitely views Freescale's ColdFire microcontrollers – the follow-on family to the QUICC series – as competition. But these days, when it comes to Ethernet-equipped MCUs, Freescale concentrates on the PowerPC-based PowerQUICC series.

The company's latest MPC8360E PowerQUICC II Pro is geared toward high-end telecom, Internet infrastructure, and wireless applications and is complete with two 10/100/1000 Ethernet cores and dual PowerPC 603e RISC engines. Freescale just announced that it too is targeting industrial Ethernet platforms (sound familiar?) and making available EtherNet/IP and DeviceNet industrial communications protocols from Real Time Automation, along with Green Hills' INTEGRITY for safety-certified applications.

### Mirror, mirror on the wall … fastest Ethernet of all?

In the race for fastest, AdvancedIO and Critical I/O have become the AMD versus Intel of the GbE world (actually the *embedded 10 GbE* world). AdvancedIO's V1020 is a COTS XMC/PMC 10 GbE board based on FPGAs to aggregate packet inspection, load balancing, and on-the-fly signal processing. The company's UDP/IP offload engine technology (not to be confused with TCP/IP) performs stack processing and frees the host CPU from becoming 100 percent loaded just servicing data packets.

Meanwhile, long-time Fibre Channel acceleration pro Critical I/O has gotten into the 10 GbE game as well. Earlier this past summer, the company brought out its own PMC module called SensorLink SLX101 specifically designed for 1 and 10 GbE sensor fabric networks. And just last month, the company announced their XGE 10 GbE family of *Silicon Stack* technology boards that promises TCP/IP offload and "wire speed" data transfer for "embedded, military, and avionics applications." First available on XMC, AMC and PMC versions are also planned.

Two interesting things to note: Critical I/O's Sept. 25, 2007 press release claims their board to be the "first" – though AdvancedIO's V1020 was announced long before – and Critical I/O is focusing on the much more ubiquitous TCP/IP with native support for IPv4 and IPv6. This contrasts with AdvancedIO's assertion that UDP/IP is more significant. It'll be interesting to see these two very credible I/O experts battle it out in the marketplace.

[1] I remember heated arguments at a previous employer years ago when I suggested supplementing a VME board's RS-422 ports with a 10 Mbps Ethernet jack.