

The Embedded Muse 111

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Editor's Notes

Want to increase your team's productivity? Reduce bugs? Meet deadlines? Take my one day Better Firmware Faster seminar. You'll learn how to estimate a schedule accurately, thwart schedule-killing bugs, manage reuse, build predictable real-time code, better ways to deal with uniquely embedded problems like reentrancy, heaps, stacks and hardware drivers, and much, much more.

I'm presenting this:

- Austin, TX on April 18
- Baltimore, MD on April 20

Want to be your company's embedded guru? Join us! There's more info at <http://www.ganssle.com/classes.htm>, including cheap flights to these cities from around the USA.

If your outfit has a dozen or more engineers who can benefit from this training I can present the seminar on-site.

Next week the Embedded Systems Conference runs at the Moscone Center in San Francisco. It's always a fascinating event; the days just fly by. I'll be giving three talks there (Managing Embedded Projects, Learning from Disaster, and Really Real Time), so if you're there stop by and say hello.

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That Fiendishly Clever Circular Buffer and Testing

Last issue I published a cool circular buffer routine. Turns out there's an error in the code – the macro should have been casted (unsigned char). Many people have pointed this out; several have also noted that the code is not re-entrant. My thanks to all.

Interestingly, the code passed all of my tests since I never constructed one to check for the buffer full condition. Once again, this points out the importance – and the difficulty of constructing – good tests. Though I disagree with some of the philosophy behind Test Driven Development (TDD), their relentless focus on constructing great tests in parallel with writing the code is spot on.

To those unfamiliar with TDD, the canonical book is Kent Beck's Test Driven Development. He believes that to write, for instance, a factorial routine one should start with a test for the simplest condition.

So we'd write code that looks like:

```
if(factorial(1) != 1) printf("error at 1");
```

and

```
int factorial(int i)
{return 1}
```

The next test is:

```
if(factorial(2) != 2) printf("error at 2");
```

Obviously, this test will fail, so the factorial code is improved till it passes.

The resulting tests can be fabulous, but I argue there are better ways to craft the function. This is too much like a random walk that converges on a solution.

The TDD approach will yield code that must be tossed. Iterating in this fashion gives code that looks something like:

```
int factorial(int i)
{
if(i==1)return 1;
if(i==2)return 2;
if(i==3)return 6;
etc.
}
```

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We know a better solution is recursive. All of this code will ultimately be deleted once the developer spots the emerging pattern.

Better: craft a careful design from the start. But do develop tests in parallel to catch all possible conditions.

The Zuse Machines

Imagine a programmable computer that's purely mechanical, no tubes, transistors or relays, using no electricity at all, except to turn one motor. Let's say it has 64 words, each 22 bits long, with 8 instructions... including floating point.

Impossible? Or just implausible?

Apparently not. Konrad Zuse built this machine in his parent's living room (they must have been very patient people) in 1938.

It was programmable from a paper tape and ran at a blistering 1 Hz, yet Zuse had no knowledge of Babbage or any other computer work. He apparently invented all of the concepts independently.

By 1941 he created his Z3 machine which used relays. Still no tubes. This computer had 9 instructions, though no conditional branches, and ran at 5.3 Hz.

Zuse built a computer company and sold many machines. It wasn't till his 1957 Z22 that he created an electronic computer.

While at the Deutsches Museum in Munich last year I saw a replica of the Z3 and the original Z4, but their place in history eluded me at the time. (More here: http://www.deutsches-museum.de/ausstell/dauer/inform/e_infor3.htm). Then I came across this site: <http://www.epemag.com/zuse> , which is a fascinating history of Zuse the man and Zuse the company. Though the site is written worshipfully by his son Horst, it's still an amazing story that has been all but neglected in the USA. Recommended for those interested in the history of this field.

Consulting – For the Boss

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There's an interesting white paper on the web called "How to Buy Consultancy and Survive" by Stephen Summers, at <http://www.praxis-his.com/pdfs/buying.pdf>. At only 6 pages it's a quick primer about managing outside consultants, and has some good advice.

I'd add one important point: never contract out core competencies. If you build cell phones it might make sense to put the consultants on GUI features or gaming functions, but never on the CDMA/GSM protocols and the like. There are many reasons for buying consultant services; an important and oft-forgotten one is that consultants are easy to fire.

Why doesn't Ford use an in-house ad agency? When the advertisements flop they can fire the agency and hire another.

But if you fire outsiders who are masters of critical parts of your technology, you're doomed.

USB

I'm getting a lot of email from people looking for help in putting USB into their products. USB is somewhat complex and can be trickier than folks initially realize.

Jan Axelson's USB Complete is a great reference on the subject. Her web page (<http://www.lvr.com>) has information about the book, and other USB resources.

I recently came across a tool that writes USB code after you answer questions about your application. See http://tracesystemsinc.com/usb_tools.ivnu. It's cheap (\$399), and a related tool will create test code that watches your device's USB traffic. Though I have no experience with these products, Jeff Bachiochi reviewed them in Circuit Cellar Ink last year. See <http://www.circuitcellar.com/library/print/0504/Bachiochi166/5.htm> for the review.

Jobs!

Let me know if you're hiring firmware or embedded designers. I'll continue to run notices for embedded developers as long as the job situation stays in the dumper. No recruiters please.

InHand Electronics, Rockville, MD, is seeking a highly-motivated individual with excellent engineering and leadership skills for a rewarding position designing electronics board-level solutions and managing InHand's electronics engineering staff. The successful candidate will have strong working knowledge of system design and be eager

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to learn about exciting new technologies in the world of wireless and handheld devices. The successful candidate will create/modify electronic board-level design procedures, manage hardware engineering employees, create and document hardware designs, interface with other InHand managers and executives for technical and business issues, and interface with customers as necessary during the completion of projects. A complete job listing is at www.inhandelectronics.com/careers.asp .

InHand is also seeking a highly-motivated individual with excellent engineering for a rewarding position designing electronics board-level solutions for handheld and wireless devices. The successful candidate should have strong working knowledge of system design and be eager to learn about exciting new technologies in the world of wireless and handheld devices. The successful candidate will create and document hardware designs, interface with the Director of Hardware Engineering for technical and management issues, and interface with customers as necessary during the completion of projects. A complete job listing is at www.inhandelectronics.com/careers.asp .

Creative Lab's Advanced Technology Center in Scotts Valley, CA has an opening for an experienced Embedded Firmware Engineer. Responsibilities will include working as part of a multi-disciplinary engineering team to define and implement overall system requirements, and assisting in the specification and implementation of VLSI, board and firmware architectures from concept through production design.

The ideal candidate will have experience in all aspects of firmware development for embedded systems, a Bachelors degree in Computer Science, Electrical Engineering or related field, a minimum 7 years experience developing embedded firmware, demonstrated proficiency in structured C and C++ development, proficiency in assembly language programming, excellent written and oral communication skills, and the ability to work as part of a small but highly capable engineering team

Send your resume to recruiter@creativelabs.com or fax to 831-430-1725. Check us out at us.creative.com .

Joke for the Week

Christian A. Schreiner sent along this Valentine Day's joke:

The ring thou wearest is not a mere token ring. Its depth arcs from the highest ether to the most concrete devotion one CAN have.

(which of course plays on token ring arcnet, ethernet, and CAN networks.)

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