

# Introduction

## *While You Were Busy Debugging...*

Engineers have never been afraid of change. It's our job to effect change. We transform scientific principles and theorems into useful products and services of all kinds. In the process, we change the way people work, play, and live.

Virtually everything people touch today has been designed by engineers—from the cars we drive and the roads we drive them on to the mobile phones and GPS devices we use while we should be keeping our eyes on the road. And everything that is engineered is constantly evolving. The perpetual cycle of innovation, optimization, and exploration of new possibilities is what excites us. We relish the fact that the half-life of knowledge in our field is measured in months.

But now change has come to engineering itself. Over the past few years, while engineers have been busy slinging code or testing tolerances, the core requirements and responsibilities of engineering have been evolving faster than any underlying science or technology. And many of us have discovered that the new world of engineering is not the one we prepared for.

What has changed? While it's hard to put a finger on it, we all feel the effects. Some of us find that we're spending more time in meetings than in the lab. Or that we're working on an environmental impact analysis rather than a product design; or burning cycles trying to grok the nuances of the GNU General Public License (GPL) Version 3 as opposed to Version 2; or struggling to comply with yet another new data privacy mandate.

Taken together, these symptoms spell a seismic shift in what it means to be an engineer. Suddenly engineering is no longer solely concerned with finding a simple, elegant way to implement a set of design requirements. Success is no longer solely measured by the speed and efficiency with which design specs are met. Technological prowess and ingenuity are no longer

enough; we need knowledge of subjects well beyond the scope of traditional engineering. A successful engineer needs to be part environmentalist, part intellectual property (IP) attorney, part MBA, and part diplomat—not to mention an expert in an engineering discipline, a great teammate, and a skilled communicator.

Recent trends are also redefining the role of the engineer in society. The increasing complexity of products leads to greater dependence upon engineering; yet most people don't understand engineering or the underlying sciences and technologies. This situation can be scary to the general public, and can lead to bad public policy and misconceptions that hold back new innovations. There is a pressing need for engineers to become more proactive with society—to engage, to communicate, and to lead.

This book takes a closer look at the nature of engineering today and provides practical guidance on topics of increasing interest and urgency to engineers, particularly environmental considerations of product design and intellectual property, licensing, and contractual considerations. The book also explores how eco-effective, techno-responsible products and services can translate to new opportunities for businesses and an accelerated career path for engineers.

In the course of writing this book, we talked to engineers, students, and researchers. We consulted with lawyers, environmentalists, administrators, and managers. We've blended their stories, experiences, and advice together with our own observations, all with a single, overarching goal: to help you become a more effective engineer, while maintaining every iota of the passion, visceral excitement, and creativity that drew you to this profession in the first place.

We're moving past the "Century of Science" into what we believe will be the "Century of Engineering." It's a period that will be both more exhilarating and more daunting for engineers than anything that has come before. It's an era that will redefine the way we think about ourselves as we continue to shape the way people interact with their world. It's an opportunity to become more socially responsible engineers and to create products that are more tightly aligned with our personal ethics. It's the age of the Citizen Engineer.