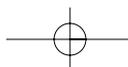
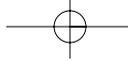


# PREFACE

As the number of devices attached to the Network<sup>1</sup> has grown exponentially, the value of the Network and the benefits of being attached to it have increased dramatically as well. First, thousands of mainframes and mini computers shared business data. Then, millions of PCs connected to the Network did the same, followed by tens of millions of mobile phones and handhelds, which spawned more high-value networked services such as email on any device, instant messaging, push-to-talk, file sharing, business-to-business commerce, and many more. Today, shared applications and services are the norm. But the revolution is just beginning. Soon, billions of devices—each with its own digital heartbeat—will connect to the Network. Many will utilize a single powerful technology: Radio Frequency Identification (RFID).

<sup>1</sup> The Network here refers to a collection of computing and communications devices connected to exchange data. A couple of decades ago, the Network only meant a collection of mainframes or mini computers connected through dedicated lines. In the early 90s, the Internet was added to the Network, and since then has been widely used as a synonym for the Network. Now the Network includes not only computers connected with one another, but also mobile phones, PDAs (Personal Digital Assistants), embedded computers in objects such as cars, and even objects with RFID tags. All these things are capable of some type of data exchange via the Network.



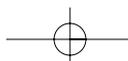


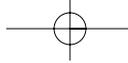
RFID tags will be found embedded in everything from cereal boxes to prescription medicines to parts of an aircraft to a variety of other machinery. These tags, when in proximity of the right type of sensors, will broadcast information about the objects they are embedded in—dimensions, whereabouts, identification numbers, history of temperatures they were exposed to, and many other static and dynamic characteristics. Many sensors located in hospitals, manufacturing plants, stores, or automobiles will collect this data, aggregate it, and route it to various humans and decision support systems.

The benefits derived from offering services based on such information will be tremendous. Businesses will run more efficiently and consumers will experience better and more innovative services. For example, instead of a grocery store losing sales because of consumers not finding meat in stock, the RFID tags in the meat packages being bought will tell the store's in-house sensors that the shelves are more than half empty, triggering a reorder to the supplier. The supplier, armed with the latest information about the location of his meat shipments (thanks to RFID-based pallets used in trucks connected to the central facility via a Global Positioning System), will direct the nearest available shipment to the store. As the truck carrying the goods is being unloaded at the loading dock, the RFID tags in those boxes will alert the store's inventory system, which in turn will alert the stocking clerk to get ready to stock the shelves. The time saved due to automatic detection of low stock levels and corresponding delivery means that the grocery store would not run out of meat, increasing profits.

In addition, the tags will have data about the temperatures the boxes were exposed to in transit. If the refrigeration system in the truck malfunctioned, exposing some of the packages to higher than recommended temperatures, the tags will help the store clerk identify and separate out packages containing spoiled goods. Detection of possibly spoiled goods means that the customers would not have to suffer the consequences, averting a potential health disaster and liability for the store.

These are the promises of RFID. But which of these promises will prove true, and which will be revealed as hype? How can a simple RFID tag make all this possible? What should you, the reader, be doing to embrace this phenomenon of an "RFID-enabled world"? How does this RFID technology work? What types of applications are possible and who is adopting the technology? What is the payoff for an organization from RFID adoption? What are the drivers and barriers to adoption?





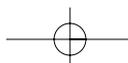
What is the next step for an organization trying to figure out how to proceed with an RFID deployment? We are sure many such questions have come to your mind by now.

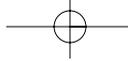
We hope to answer these questions in this book. Our jobs as market developers for Sun Microsystems have exposed us to the latest software being developed at the tiniest software start-ups and to the business and IT needs of the largest Fortune 500 companies. In the process, we have also had a bird's eye view of many new technologies and new applications of existing technologies. We have seen many technology innovations that were high on promise and low on substance. We have also met many vendors who flocked to capitalize on those innovations only to fail, as there was no sizable revenue or business model. At the same time, we have met many customers who routinely use cutting-edge technology as a competitive weapon to strengthen their business.

As we worked with companies that promised to apply RFID to solve complex business problems and customers who looked at this technology to help them leapfrog the competition, we realized that some of the fundamental questions customers were asking were not being addressed sufficiently, placing customer deployments at the risk of failure. At the same time, some early adopters were gaining valuable insights and benefits from the deployment of this technology. We asked ourselves how a company looking at understanding and implementing this technology could make an informed decision and take action. This book should provide the answer.

This book is not a theoretical treatise on competitive advantage—although it does point out examples of how companies can gain competitive advantage from RFID deployments; nor is it a technical manual providing code samples—although it does go into detailed technical discussion of the fundamentals of RFID. This book is a *field guide* for the practitioner.

A practitioner could be a business person, a technical person, or a person wearing both hats. It could be a senior executive trying to separate reality from the hype surrounding RFID and wondering if this technology can give him a leg up on the competition. Or, it could be a plant manager trying to figure out sourcing and production issues involved in applying RFID tags to an item in production. In this book, each of these practitioners will find real-life examples of RFID deployments relevant to their needs; issues related to people, processes, and technology; and tips for making an RFID deployment successful.



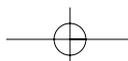


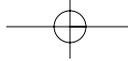
The book is organized into three parts. The first part explains RFID technology by providing its history, its components, and a perspective on what it can do for you. Because no technology can succeed and proliferate unless it helps businesses meet one or more of their primary economic needs—reducing cost, increasing revenue, and providing a competitive advantage—we also provide some examples of RFID usage and its benefits to businesses and end users.

The second part explains how you can leverage RFID in your organization. RFID standards, an RFID analysis and deployment framework, cost-benefit considerations, and RFID vendor considerations are explained here. It outlines a holistic approach to doing an RFID project that can harness this complex technology for achieving real business benefits. You may think that putting an RFID tag on a box is not a complex task (which, by the way, is true—it takes only 10 seconds for an assembly worker to put a tag on a box and pass it along, an activity known as *slap & ship*). However, unless the process has been thought through, you are not likely to see much benefit from tagging an item. The challenge is not in applying the tag to an item, but in rethinking existing business processes or creating new ones to fully leverage the powerful, real-time data collection capability offered by RFID. RFID also brings with it a new set of challenges—for example, how to process all the data generated by billions of tags in the supply chain, how to filter the processed data, and how to integrate the filtered data into existing systems and processes to increase benefits. The framework and tools we provide in the second part help you think through such issues pertinent to your environment.

The third part looks at the path ahead. It explains how external factors such as mandates, legislation, regulations, political interest, and consumer concerns such as security and privacy can affect a technology's proliferation. It also provides a high-level view of the trends surrounding RFID deployments—from trends in tag design to invention of new business models.

The book is designed to cater to various types of practitioners. Some may be interested in reading the whole book first to get a comprehensive understanding of the technology. Others may simply want an answer to their specific questions. To balance the needs of both types of readers, we have put in a section at the beginning of each chapter titled “Five Questions This Chapter Will Answer.” Advanced readers will find these questions quite useful in determining the type of information covered





in each chapter. For example, do you want to find out about the different types of tags and the frequencies they operate at? Turn to Chapter 3. Confused about RFID standards between the U.S., Europe, and China? Turn to Chapter 4 for clarification. Want to educate your CFO on why he should care about RFID? Turn to Chapter 7 for discussion of short-term and long-term benefits of RFID and advice on developing a cost-benefit analysis. Want to learn about the emerging trends in RFID? You will like the discussion in Chapter 11.

While our name appears on the cover, a project of this magnitude almost always involves a larger team: a team consisting of customers, vendors, editors, and reviewers. Without their generous help, support, and suggestions, this book would have remained only in concept. The virtual team members are too many to mention, but a few deserve special credit. We would like to thank the team at our publishers Prentice Hall and Sun Microsystems Press for their tireless effort in getting the book in its current format: Greg Doench, Jennifer Blackwell, Stephane Nakib, Michael Thurston, Jill Tomich, Kelli Brooks, Matt Thompson, Myrna Rivera, and Jennifer Kohnke. We would also like to thank the reviewers for taking the time to review the book: Bill Camarda, Sanjay Sharma, and Bob Ganley. Special thanks to Angela Chen, Jim Clarke, Eli Covert, Sandy Frye, Robert Fourdraine, Kevin Kirk, Stephen Lambright, Kijoon Lee, Michael Liard, Fred Nadel, Paula Phelan, Stephen Philpy, Jerry Proc, Vijay Sarathy, Scott Stuart, Karen deVries, and Jihye Wang for their contributions and help with our research. During the course of this book, we conducted many interviews with customers and industry practitioners. Their insights and knowledge around real-world issues surrounding RFID deployments have been instrumental in making this book a *field guide*. We couldn't have created this field guide without their generosity. To them, we extend our most sincere gratitude.

We hope that you walk away from this book with a better appreciation for the technology as well as a practical understanding of how to make RFID work in your business.

Shahram Moradpour • Manish Bhuptani

