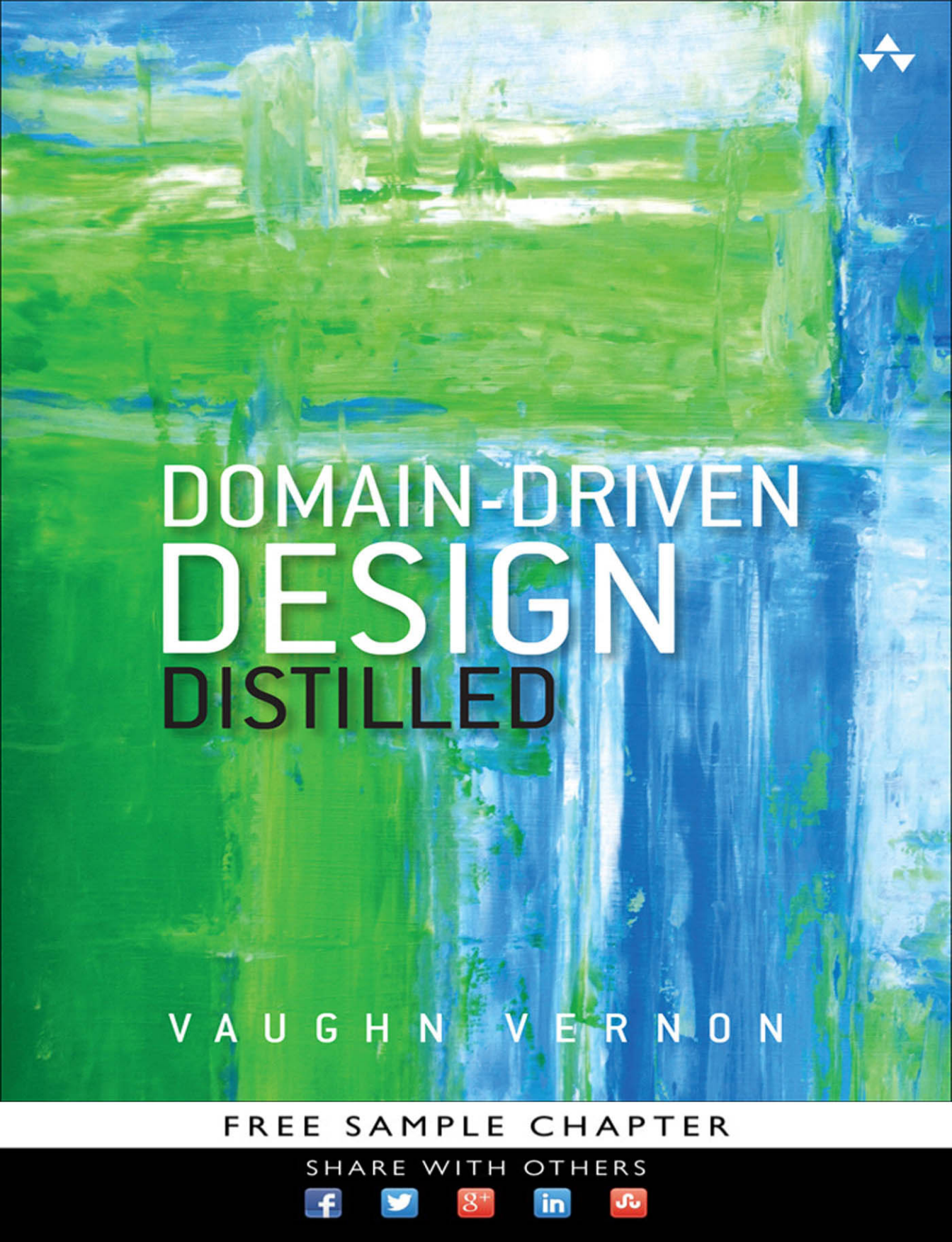
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Domain-Driven Design Distilled

Vaughn Vernon

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Nicole and Tristan
We did it again!

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Contents

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Preface

Why is model building such a fun and rewarding activity? Ever since I was a kid I have loved to build models. At that time I mostly built models of cars and airplanes. I am not sure where LEGO was in those days. Still, LEGO has been a big part of my son's life since he was very young. It is so fascinating to conceive and build models with those small bricks. It's easy to come up with basic models, and it seems you can extend your ideas almost endlessly.

You can probably relate to some kind of youthful model building.

Models occur in so many situations in life. If you enjoy playing board games, you are using models. It might be a model of real estate and property owners, or models of islands and survivors, or models of territories and building activities, and who knows what all. Similarly, video games are models. Perhaps they model a fantasy world with fanciful characters playing fantastic roles. A deck of cards and related games model power. We use models all the time and probably so often that we don't give most models a well-deserved acknowledgment. Models are just part of our lives.

But why? Every person has a learning style. There are a number of learning styles, but three of the most discussed are auditory, visual, and tactile styles. The auditory learners learn by hearing and listening. The visual learners learn by reading or seeing imagery. The tactile learners learn by doing something that involves touching. It's interesting that each learning style is heavily favored by the individual to the extent that he or she can sometimes have trouble with other types of learning. For example, tactile learners likely remember what they have done but may have problems remembering what was said during the process. With model building, you would think that visual and tactile learners would

have a huge advantage over the auditory learners, because model building seems to mostly involve visual and tactile stimulation. However, that might not always hold true, especially if a team of model builders uses audible communication in their building process. In other words, model building holds out the possibility to accommodate the learning style of the vast majority of individuals.

With our natural affinity to learning through model building, why would we not naturally desire to model the software that ever increasingly assists and influences our lives? In fact, to model software appears to be, well, human. And model software we should. It seems to me that humans should be elite software model builders.

It is my strong desire to help you be as human as you can possibly be by modeling software using some of the best software modeling tools available. These tools are packaged under the name "Domain-Driven Design," or DDD. This toolbox, actually a set of patterns, was first codified by Eric Evans in the book *Domain-Driven Design: Tackling Complexity in the Heart of Software* [DDD]. It is my vision to bring DDD to everyone possible. To make my point, if I must say that I want to bring DDD to the masses, then so be it. That is where DDD deserves to be, and DDD is the toolbox that model-oriented humans deserve to use to create their most advanced software models. With this book, I am determined to make learning and using DDD as simple and easy as possible and to bring that to the broadest conceivable audience.

For auditory learners, DDD holds out the prospect of learning through the team communication of building a model based on the development of a *Ubiquitous Language*. For visual and tactile learners, the process of using DDD tools is very visual and hands-on as your team models both strategically and tactically. This is especially true when drawing *Context Maps* and modeling the business process using *Event Storming*. Thus, I believe that DDD can support everyone who wants to learn and achieve greatness through model building.

Who Is This Book For?

This book is for everyone interested in learning the most important DDD aspects and tools and in learning quickly. The most common readers

are software architects and software developers who will put DDD into practice on projects. Very often, software developers quickly discover the beauty of DDD and are keenly attracted to its powerful tooling. Even so, I have made the subject understandable for executives, domain experts, managers, business analysts, information architects, and testers alike. There's really no limit to those in the information technology (IT) industry and research and development (R&D) environments who can benefit from reading this book.

If you are a consultant and you are working with a client to whom you have recommended the use of DDD, provide this book as a way to bring the major stakeholders up to speed quickly. If you have developers—perhaps junior or midlevel or even senior—working on your project who are unfamiliar with DDD but need to use it very soon, make sure that they read this book. By reading this book, at minimum, all the project stakeholders and developers will have the vocabulary and understand the primary DDD tools being used. This will enable them to share things meaningfully as they move the project forward.

Whatever your experience level and role, read this book and then practice DDD on a project. Afterward, reread this book and see what you can learn from your experiences and where you can improve in the future.

What This Book Covers

The first chapter, "DDD for Me," explains what DDD can do for you and your organization and provides a more detailed overview of what you will learn and why it's important.

Chapter 2, "Strategic Design with Bounded Contexts and the Ubiquitous Language," introduces DDD strategic design and teaches the cornerstones of DDD, *Bounded Contexts* and the *Ubiquitous Language*. Chapter 3, "Strategic Design with Subdomains," explains *Subdomains* and how you can use them to deal with the complexity of integrating with existing legacy systems as you model your new applications. Chapter 4, "Strategic Design with Context Mapping," teaches the variety of ways that teams work together strategically and ways that their software can integrate. This is called *Context Mapping*.

Chapter 5, "Tactical Design with Aggregates," switches your attention to tactical modeling with *Aggregates*. An important and powerful tactical modeling tool to be used with *Aggregates* is *Domain Events*, which is the subject of Chapter 6, "Tactical Design with Domain Events."

Finally, in Chapter 7, "Acceleration and Management Tools," the book highlights some project acceleration and project management tools that can help teams establish and maintain their cadence. These two topics are seldom if ever discussed in other DDD sources and are sorely needed by those who are determined to put DDD into practice.

Conventions

There are only a few conventions to keep in mind while reading. All of the DDD tools that I discuss are printed in italics. For example, you will read about *Bounded Contexts* and *Domain Events*. Another convention is that any source code is presented in a monospaced Courier font. Acronyms and abbreviations for works listed in the References on pages 136-137 appear in square brackets throughout the chapters.

Even so, what this book emphasizes most, and what your brain should like a lot, is visual learning through lots of diagrams and figures. You will notice that there are no figure numbers in the book, because I didn't want to distract you with so many of those. In every case the figures and diagrams precede the text that discusses them, which means that the graphic visuals introduce thoughts as you work your way through the book. That means that when you are reading text, you can count on referring back to the previous figure or diagram for visual support.

Acknowledgments

This is now my third book within the esteemed Addison-Wesley label. It's also my third time working with my editor, Chris Guzikowski, and developmental editor, Chris Zahn, and I am happy to say that the third time has been as much a charm as the first two. Thanks again for choosing to publish my books.

As always, a book cannot be successfully written and published without critical feedback. This time I turned to a number of DDD practitioners who don't necessarily teach or write about it but are nonetheless working on projects while helping others use the powerful toolbox. I felt that this kind of practitioner was crucial to make sure this aggressively distilled material said exactly what is necessary and in just the right way. It's kind of like, if you want me to talk for 60 minutes, give me 5 minutes to prepare; if you want me to talk for 5 minutes, give me a few hours to prepare.

In alphabetical order by last name, those who helped me the most were Jérémie Chassaing, Brian Dunlap, Yuji Kiriki, Tom Stockton, Tormod J. Varhaugvik, Daniel Westheide, and Philip Windley. Thanks much!

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About the Author

Vaughn Vernon is a veteran software craftsman and thought leader in simplifying software design and implementation. He is the author of the best-selling books *Implementing Domain-Driven Design* and *Reactive Messaging Patterns with the Actor Model,* also published by Addison-Wesley. He has taught his IDDD Workshop around the globe to hundreds of software developers. Vaughn is a frequent speaker at industry conferences. He is most interested in distributed computing, messaging, and in particular with the Actor model. Vaughn specializes in consulting around Domain-Driven Design and DDD using the Actor model with Scala and Akka. You can keep up with Vaughn's latest work by reading his blog at www.VaughnVernon.co and by following him on his Twitter account @VaughnVernon.

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Chapter 1

DDD for Me

You want to improve your craft and to increase your success on projects. You are eager to help your business compete at new heights using the software you create. You want to implement software that not only correctly models your business's needs but also performs at scale using the most advanced software architectures. Learning *Domain-Driven Design* (DDD), and learning it quickly, can help you achieve all of this and more.

DDD is a set of tools that assist you in designing and implementing software that delivers high value, both strategically and tactically. Your organization can't be the best at everything, so it had better choose carefully at what it must excel. The DDD strategic development tools help you and your team make the competitively best software design choices and integration decisions for your business. Your organization will benefit most from software models that explicitly reflect its core competencies. The DDD tactical development tools can help you and your team design useful software that accurately models the business's unique operations. Your organization should benefit from the broad options to deploy its solutions in a variety of infrastructures, whether in house or in the cloud. With DDD, you and your team can be the ones to bring about the most effective software designs and implementations needed to succeed in today's competitive business landscape.

In this book I have distilled DDD for you, with condensed treatment of both the strategic and tactical modeling tools. I understand the unique demands of software development and the challenges you face as you work to improve your craft in a fast-paced industry. You can't always take months to read up on a subject like DDD, and yet you still want to put DDD to work as soon as possible.

I am the author of the best-selling book *Implementing Domain-Driven Design* [IDDD], and I have also created and teach the three-day IDDD Workshop. And now I have also written this book to bring you

DDD in an aggressively condensed form. It's all part of my commitment to bringing DDD to every software development team, where it deserves to be. My goal, of course, includes bringing DDD to you.

Will DDD Hurt?

You may have heard that DDD is a complicated approach to software development. Complicated? It certainly is not complicated of necessity. Indeed, it is a set of advanced techniques to be used on complex software projects. Due to its power and how much you have to learn, without expert instruction it can be daunting to put DDD into practice on your own. You have probably also found that some of the other DDD books are many hundreds of pages long and far from easy to consume and

apply. It required a lot of words for me to explain DDD in great detail in order to provide an exhaustive implementation reference on more than a dozen DDD topics and tools. That effort resulted in *Implementing Domain-Driven Design* [IDDD]. This new condensed book is provided to familiarize you with the most important parts of DDD as quickly and simply as possible. Why? Because some are overwhelmed by the larger texts and need a distilled guide to help them take the initial steps to adoption. I have found that those who use DDD revisit the literature about it several times. In fact, you might even conclude that you will never learn enough, and so you will use this book as a quick reference, and refer to others for more detail, a number of times as your craft is refined. Others have had trouble selling DDD to their colleagues and the all-important management team. This book will help you do that, not only by explaining DDD in a condensed format, but also by showing that tools are available to accelerate and manage its use.

Of course, it is not possible to teach you everything about DDD in this book, because I have purposely distilled the DDD techniques for you. For much more in-depth coverage, see my book *Implementing Domain-Driven Design* [IDDD], and look into taking my three-day IDDD Workshop. The three-day intensive course, which I have delivered around the globe to a broad audience of hundreds of developers, helps get you up to speed with DDD rapidly. I also provide DDD training online at http://ForComprehension.com.

The good news is, DDD doesn't have to hurt. Since you probably already deal with complexity on your projects, you can learn to use DDD to reduce the pain of winning over complexity.

Good, Bad, and Effective Design

Often people talk about good design and bad design. What kind of design do you do? Many software development teams don't give design even a passing thought. Instead, they perform what I call "the task-board shuffle." This is where the team has a list of development tasks, such as with a Scrum product backlog, and they move a sticky note from the "To Do" column of their board to the "In Progress" column. Coming up with the backlog item and performing "the task-board shuffle"

constitutes the entirety of thoughtful insights, and the rest is left to coding heroics as programmers blast out the source. It rarely turns out as well as it could, and the cost to the business is usually the highest price paid for such nonexistent designs.

This often happens due to the pressure to deliver software releases on a relentless schedule, where management uses Scrum to primarily control timelines rather than allow for one of Scrum's most important tenets: *knowledge acquisition*.

When I consult or teach at individual businesses, I generally find the same situations. Software projects are in peril, and entire teams are hired to keep systems up and running, patching code and data daily. The following are some of the insidious problems that I find, and interestingly ones that DDD can readily help teams avoid. I start with the higher-level business problems and move to the more technical ones:

- Software development is considered a cost center rather than a profit center. Generally this is because the business views computers and software as necessary nuisances rather than sources of strategic advantage. (Unfortunately there may not be a cure for this if the business culture is firmly fixed.)
- Developers are too wrapped up with technology and trying to solve problems using technology rather than careful thought and design. This leads developers to constantly chase after new "shiny objects," which are the latest fads in technology.
- The database is given too much priority, and most discussions about the solutions center around the database and a data model rather than business processes and operations.
- Developers don't give proper emphasis to naming objects and operations according to the business purpose that they fill. This leads to a large chasm between the mental model that the business owns and the software that developers deliver.
- The previous problem is generally a result of poor collaboration with the business. Often the business stakeholders spend too much time in isolated work producing specifications that nobody uses, or that are only partly consumed by developers.

- Project estimates are in high demand, and very frequently producing them can add significant time and effort, resulting in the delay of software deliverables. Developers use the "task-board shuffle" rather than thoughtful design. They produce a *Big Ball of Mud* (discussed in the following chapters) rather than appropriately segregating models according to business drivers.
- Developers house business logic in user interface components and persistence components. Also, developers often perform persistence operations in the middle of business logic.
- There are broken, slow, and locking database queries that block users from performing time-sensitive business operations.
- There are wrong abstractions, where developers attempt to address all current and imagined future needs by overly generalizing solutions rather than addressing actual concrete business needs.
- There are strongly coupled services, where an operation is performed in one service, and that service calls directly to another service to cause a balancing operation. This coupling often leads to broken business processes and unreconciled data, not to mention systems that are very difficult to maintain.

This all seems to happen in the spirit of "no design yields lower-cost software." And all too often it is simply a matter of businesses and the software developers not knowing that there is a much better alternative. "Software is eating the world" [WSJ], and it should matter to you that software can also eat your profits, or feed your profits a banquet.

It's important to understand that the imagined economy of No Design is a fallacy that has cleverly fooled those who apply the pressure to produce software without thoughtful design. That's because design still flows from the brains of the individual developers through their fingertips as they wrangle with the code, without any input from others, including the business. I think that this quote sums up the situation well:

> Questions about whether design is necessary or affordable are quite beside the point: design is inevitable. The alternative to good design is bad design, not no design at all.
>
> —*Book Design: A Practical Introduction* by Douglas Martin

Although Mr. Martin's comments are not specifically about software design, they are still applicable to our craft, where there is no substitute for thoughtful design. In the situation just described, if you have five software developers working on the project, No Design will actually produce an amalgamation of five different designs in one. That is, you get a blend of five different made-up business language interpretations that are developed without the benefit of the real *Domain Experts*.

The bottom line: we model whether we acknowledge modeling or not. This can be likened to how roads are developed. Some ancient roads started out as cart paths that were eventually molded into well-worn trails. They took unexplained turns and made forks that served only a few who had rudimentary needs. At some point these pathways were smoothed and then paved for the comfort of the increasing number of travelers who used them. These makeshift thoroughfares aren't traveled today because they were well designed, but because they exist. Few of our contemporaries can understand why traveling one of these is so uncomfortable and inconvenient. Modern roads are planned and designed according to careful studies of population, environment, and predictable flow. Both kinds of roads are modeled. One model employed minimal, base intellect. The other model exploited maximum cognition. Software can be modeled from either perspective.

If you are afraid that producing software with thoughtful design is expensive, think of how much more expensive it's going to be to live with or even fix a bad design. This is especially so when we are talking about software that needs to distinguish your organization from all others and yield considerable competitive advantages.

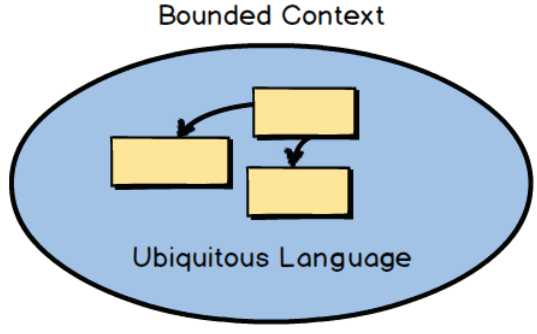
A word closely related to *good* is *effective,* and it possibly more accurately states what we should strive for in software design: *effective design*. Effective design meets the needs of the business organization to the extent that it can distinguish itself from its competition by means of software. Effective design forces the organization to understand what it must excel at and is used to guide the creation of the correct software model.

In Scrum, *knowledge acquisition* is done through experimentation and collaborative learning and is referred to as "buying information" [Essential Scrum]. Knowledge is never free, but in this book I do provide ways for you to accelerate how you come by it.

Just in case you still doubt that effective design matters, don't forget the insights of someone who seems to have understood its importance:

> Most people make the mistake of thinking design is what it looks like. People think it's this veneer—that the designers are handed this box and told, "Make it look good!" That's not what we think design is. It's not just what it looks like and feels like. Design is how it works.
>
> —Steve Jobs

In software, effective design matters, most. Given the single alternative, I recommend effective design.



Strategic Design

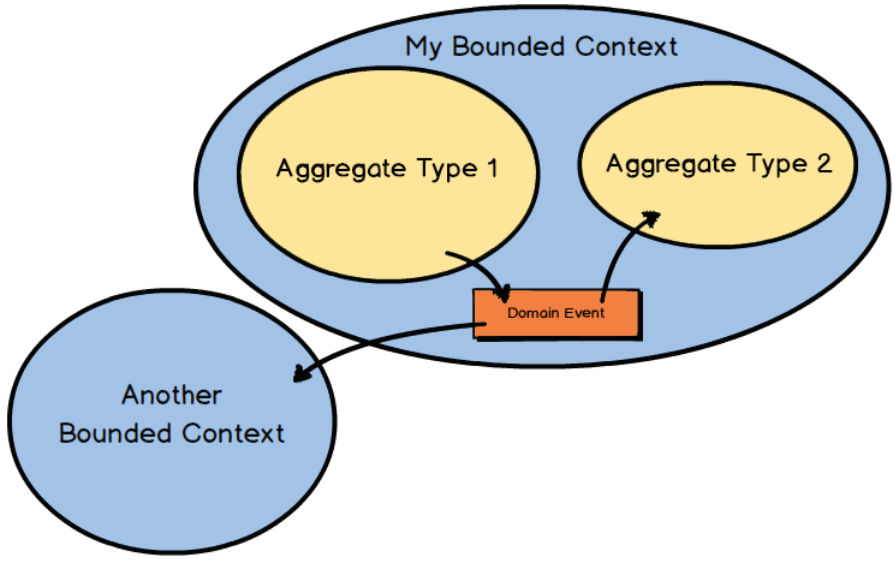
We begin with the all-important strategic design. You really cannot apply tactical design in an effective way unless you begin with strategic design. Strategic design is used like broad brushstrokes prior to getting into the details of implementation. It highlights what is strategically important to your business, how to divide up the work by importance, and how to best integrate as needed.

First you will learn how to segregate your domain models using the strategic design pattern called *Bounded Contexts*. Hand in glove, you will see how to develop a *Ubiquitous Language* as your domain model within an explicitly *Bounded Context*.

You will learn about the importance of engaging with not only developers but also *Domain Experts* as you develop your model's *Ubiquitous Language*. You will see how a team of both software developers and

Domain Experts collaborate. This is a vital combination of smart and motivated people who are needed for DDD to produce the best results. The language you develop together through collaboration will become ubiquitous, pervasive, throughout the team's spoken communication and software model.

As you advance further into strategic design, you will learn about *Subdomains* and how these can help you deal with the unbounded complexity of legacy systems, and how to improve your results on greenfield projects. You will also see how to integrate multiple *Bounded Contexts* using a technique called *Context Mapping*. *Context Maps* define both team relationships and technical mechanisms that exist between two integrating *Bounded Contexts*.



Tactical Design

After I have given you a sound foundation with strategic design, you will discover DDD's most prominent tactical design tools. Tactical design is like using a thin brush to paint the fine details of your domain model. One of the more important tools is used to aggregate entities and value objects together into a right-sized cluster. It's the *Aggregate* pattern.

DDD is all about modeling your domain in the most explicit way possible. Using *Domain Events* will help you both to model explicitly and to share what has occurred within your model with the systems that need to know about it. The interested parties might be your own local *Bounded Context* and other remote *Bounded Contexts*.

The Learning Process and Refining Knowledge

DDD teaches a way of thinking to help you and your team refine knowledge as you learn about your business's core competencies. This learning process is a matter of discovery through group conversation and experimentation. By questioning the status quo and challenging your assumptions about your software model, you will learn much, and this all-important knowledge acquisition will spread across the whole team. This is a critical investment in your business and team. The goal should be not only to learn and refine, but to learn and refine as quickly as

possible. There are additional tools to help with those goals that can be found in Chapter 7, “Acceleration and Management Tools.”

Let’s Get Started!

Even in a condensed presentation, there’s plenty to learn about DDD. So let’s get started with Chapter 2, “Strategic Design with Bounded Contexts and the Ubiquitous Language.”

Index

B

C

D

E

N

O

P

Q

R

S

T

U

V

W