"If you want to understand how to lead a Continuous Delivery or DevOps transformation in your company, there's no better book than this. Concise, practical, and based on hard-won executive experience, this book is essential reading for every IT executive." —Jez Humble, VP, Chef

Gary Gruver and Tommy Mouser

LEADING THE TRANSFORMATION

Applying Agile and DevOps Principles at Scale

foreword by Gene Kim

IT Revolution

More praise for *Leading the Transformation*

"It's long past the time when executives who are looking for better performance from software development can expect an "Agile transformation" to solve their problems. Today's wise executive will know enough about the underlying principles of software systems to ask the right questions and make sure that their organization is solving the right problems. That's where this book comes in—it contains just enough theory to inform executives about critical issues and just enough detail to clarify what's important and why."

—Mary Poppendieck, author of *The Lean Mindset* and the Lean Software Development series

"*Leading the Transformation* is a critical asset for any leadership in a large development environment seeking to transform the organization from the swamp of restriction to the freeway of efficient delivery. The book provides real-life data and solid advice for any leader embarking on or in the middle of an enterprise delivery transformation."

—Lance Sleeper, Senior Manager of Operations, American Airlines

"Before you undertake a major change in your development process, you want to learn from people who have gone before you. Gary and Tommy draw on their experience to prepare you for how to plan and what to expect as you roll out Agile/DevOps methodology in your enterprise. Reading this book, I learnt valuable lessons on planning a scaled-out Agile transformation and what signposts to look for along the way as we embarked on the transformation journey at Cisco."

—Vinod Peris, VP Engineering, Routing & Optical, Cisco

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Brian David Smith and Mammoth Collective.

To our amazing wives, Carolyn and Debbie

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FOREWORD

I first came across Gary and Tommy's amazing work transforming how HP developed firmware code for the entire HP LaserJet Enterprise product line when Jez Humble told me about it. It was an astounding story of Continuous Delivery and DevOps for many reasons. Their story of being able to increase the development of new customer functionality by two to three times was a breathtaking leap in developer productivity. But that this success story was for embedded firmware for printers made it almost defy belief.

I believe that the HP LaserJet case study is important because it shows how Continuous Delivery and DevOps principles transcend all technology and that DevOps isn't just for open source software. Instead, it should be equally applicable for complex enterprises systems, systems of record—even those 30-plus-year-old COBOL applications that run on mainframes.

This theory was put to the test and proven when Gary became VP of QE, Release, and Operations at Macys.com. For three years, he helped contribute to the transformation that went from doing thousands of manual tests every ten days to thousands of automated tests being run daily, increasing the ability to have all applications closer to a deployable state.

In fifteen years, I suspect that everything Gary and Tommy have done for large, complex organizations will be common knowledge for technology executives. However, in the meantime, the challenges of how large, complex organizations adopt DevOps will create incredible competitive advantage, and I hope this book becomes a catalyst for making that knowledge more commonplace.

—Gene Kim
Portland, Oregon
April 2015

CHAPTER 1

UNDERSTANDING THE TRANSFORMATION

There are large organizations in the industry using leading-edge techniques such as Agile and DevOps to develop software faster and more efficiently than anyone ever thought possible. These are typically companies that learned how to architect and develop software well while they were still relatively small. They then grew large quickly because of these breakthrough capabilities. Think Google, Amazon, and Facebook.

Currently, however, the majority of software is not developed by leading-edge groups like these, but by more traditional organizations using less efficient approaches. This book is written to help leaders of these traditional organizations understand how to successfully transform their development and delivery processes.

Improving the effectiveness of software development in traditional organizations is essential because software is a key way businesses now compete across a broad range of industries. Mechanical engineers that designed and built cars led the automobile industry. Then, through no fault of their own, they found that computers had infiltrated their product and become a larger part of the value they provide their customers. Now, instead of the salesman showing off the car engine, they start with a screen for the entertainment and control system—all based on software. Financial institutions that used to depend on traders working the floor and brokers forging customer relationships are finding that software for managing trades and interacting with their customers is helping them stay competitive. Retail has gone from building, stocking, and managing stores to creating software that provides a common customer experience across stores, websites, and mobile devices and that manages inventory more efficiently across all these channels.

No industry is immune from the far-reaching changes based on the increasing influence of software. Jeff Immelt, CEO of General Electric, warns, "In an industrial company, avoid [gaining mastery of] software at your peril. We are paranoid because a software company could someday disintermediate GE. I'm going back to school on big data and software."

While it is clear that software is becoming a more and more important aspect of how these companies need to compete, most large, traditional organizations are struggling to deliver. They can't respond to changes in the marketplace fast enough, and the businesses are getting frustrated. These companies are typically struggling with lots of hard-to-change, tightly coupled legacy software that requires them to coordinate development, qualification, and deployment efforts across hundreds to thousands of engineers, making frequent deliveries impossible. The deliveries they do provide require lots of brute-force manual effort that is frustrating and burning out their teams.

The net result is that most large, traditional organizations are finding it more and more difficult to compete in the marketplace and deliver the software innovations that their businesses require. Their current software delivery approaches are constraining their businesses and limiting their ability to compete.

Because their current approaches don't work, many larger organizations are looking to leverage the successes that smaller businesses have seen using Agile methodologies. They bring in Agile coaches and start forming Agile teams to apply Agile principles at the team level. The problem with this approach is that in small organizations, a couple of small Agile teams can organize to support the business. In large, traditional organizations, however, most of the time individual teams can't independently deliver value to the customer because it requires integrating work across hundreds of developers and addressing all the inefficiencies of coordinating this work. These are issues that the individual teams can't and won't solve on their own. This is why the executives need to lead the transformation. They are uniquely positioned to lead the all-important cultural changes and muster the resources to make the necessary organization-wide technical changes.

In this book we, the authors, will provide a fundamentally different approach for transforming the software development processes in large, traditional organizations by addressing the organization-wide issues that you, the executives, are uniquely positioned to handle. While most Agile implementations start with a focus on applying Agile principles at the team level, the approach presented in this book focuses on applying the basic principles of Agile and DevOps across the organization. It is based on what we, as executives leading complex transitions in large, traditional organizations, have found to be most effective for delivering solid business results.

Many specifics referenced in this book are leveraged from a case study of transformation at HP, detailed in *A Practical Approach to Large-Scale Agile Development*, by Gary Gruver, Mike Young, and Pat Fulghum.

This case study includes the following dramatic results:

» Development costs reduced from ~$100M to ~$55M

» 140% increase in the number of products being supported

» Increased capacity for innovation from 5% to 40%

The organization at HP achieved these results through applying DevOps and Agile principles at scale. Our focus was on applying the principles at the executive staff level, and we left the teams with as much flexibility in operational choices as possible. There were some groups that applied all the team-level Agile principles and some that chose to operate with more traditional methods.

What we found in the end is that there were not dramatic differences in the teams' productivity based on the methods they used. There were, though, dramatic improvements in the overall productivity of the entire organization. This lead to our conclusion that *how teams come together to deliver value* in large organizations is the first-order effect, while *how individual teams work* was a second-order effect. Therefore, this book will primarily focus on how to transform the way the teams come together to provide value to the business by integrating all their changes early and often in an operation-like environment. This is one of the most important steps in improving the effectiveness of large organizations, because it forces resolving conflicts between teams early before too much time and effort is wasted on code that won't work together in production. Then, when that part of the transformation is complete, the organization will have the right framework in place to continue improving and fine-tuning how the individual teams work with more traditional Agile methods at the team level.

Executives need to understand that applying Agile and DevOps principles at scale both differs significantly from typical Agile implementations and provides quicker time to value. To help executives understand why, they need to understand the challenges that large organizations experience with traditional approaches. In chapter 2 we will dissect the Waterfall Method, look at the Agile principles that

answer Waterfall's shortcomings, and then uncover key challenges that result from using a more traditional Agile approach in the enterprise.

The first step executives need to understand about our approach is that it is paramount to begin with business objectives. You should never "do Agile or DevOps" just so you can say you did them. A large-scale transformation is too much work and turmoil just to be able to say you are "doing Agile." We believe that the key reason executives would be willing to take on this much change is that their current development processes are failing to meet the overarching needs of the business. Executives are in the best position to understand those failings and the needs of the business, so they are best suited to clarify the objectives of the transformation. In chapter 3, we will go into how executives begin to lead the transformation, using these objectives to communicate the vision, prioritize improvements, and show progress.

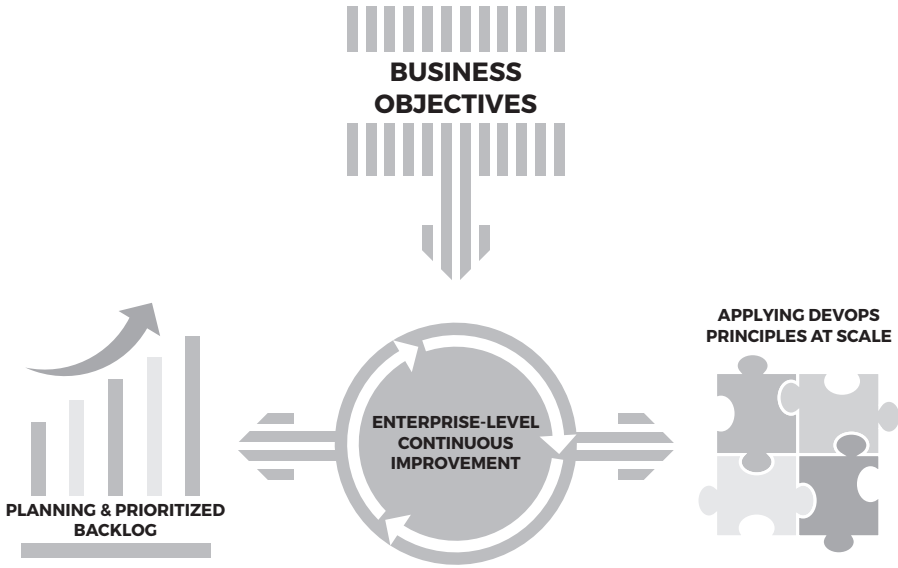
Once the business objectives have clarified the long-term goals of the transformation, executives then will use an enterprise-level continuous improvement process to engage the organization throughout the journey. Because it is so hard to measure process improvements with software, executives can't just manage the change by metrics like they would other parts of their business. They are going to have to engage with the organization to get a more qualitative understanding of what is working and what needs fixing next. This transformation can't be top-down, just like it can't be bottom-up.

The continuous improvement process is designed to engage the broader organization in setting objectives the team feels are important and achievable. Additionally, since a transformation of this size can take years and is going to be such a discovery process, it is designed to capture and respond to what everyone is learning along the way. The executives will use a combination of the business objectives and the continuous improvement process to lead the transformation and prioritize improvements based on what will provide the biggest benefit to the business. We will cover the continuous improvement process in more detail in chapter 4, including setting short-term objectives for each iteration, focusing on what everyone is learning, and identifying what is and isn't working to determine priorities for the next iteration.

In this book we will use the term *enterprise-level* to describe an organization with software development efforts that require 100 or more engineers to coordinate the development, qualification, and release of their code. It does not refer

to a coordinated effort across an organization the size of HP, because that would just be too complex. The plan for transforming the organization should be kept as small as possible to reduce complexity. But if different applications in the enterprise have to be qualified together to ensure they work in production, then they should be included as part of the same enterprise-level transformation.

FIGURE 1



Once the business objectives and continuous improvement process are in place, executives can start changing development processes by applying Agile and DevOps principles at scale. This will require two big changes: applying Agile principles to the planning process and using DevOps to address the basic Agile principle of being able to economically release smaller batches of changes on a more frequent basis.

Executives need to understand that managing software and the planning process in the same way that they manage everything else in their organization is not the most effective approach. Software has a few characteristics that are different enough from everything else that it makes sense to take a different approach. First, each new software project is new and unique, so there is a higher degree of uncertainty in the planning. Second, the ability of organizations to predict the effectiveness of software changes is so poor that literally 50% of all

software is never used or does not meet its business objectives.[1] Third, unlike any other asset in a business, if software is developed correctly it is much more flexible and cheaper to change in response to shifts in the market. If the planning process doesn't take these differences into account, executives are likely to make the classic mistake of locking in their most flexible asset to deliver features that will never be used or won't ever meet the business intent. Additionally, if executives don't design the planning process correctly, it can end up using a lot of the organization's capacity without providing much value. In chapter 5, we will cover how to design processes to minimize investments in planning and requirement breakdown but still support the critical business decisions by breaking the planning process into different time horizons and locking in capacity over time.

The DevOps approach of integrating working code across the organization in an operation-like environment is one of the biggest challenges for large, traditional organizations, but it provides the most significant improvements in aligning the work across teams. It also provides the real-time feedback engineers need to become better developers. For this to work well, the continuous deployment pipeline needs to be designed to quickly and efficiently localize issues in large, complex systems and organizations. It requires a large amount of test automation, so it is important that the test automation framework is designed to quickly localize issues and can easily evolve with the application as it changes over time. This is a big challenge for most organizations, so the executives need to make sure to start with achievable goals and then improve stability over time as the organization's capabilities improve. Teams can't and won't drive this level of change, so the executives need to understand these concepts in enough detail to lead the transformation and ensure their teams are on the right track. Therefore, we spend a lot of time on applying DevOps principles at scale in chapters 6–11.

Transforming development and delivery processes in a large, traditional organization requires a lot of technical changes that will require some work, but by far the biggest challenges are with changing the culture and how people work on a day-to-day basis.

What do these cultural shifts look like? Developers create a stable trunk in a production-like environment as job #1. Development and Operation teams use common tools and environments to align them on a common objective. The

1. Ronny Kohavi et al, "Online Experiments at Microsoft," Microsoft Research website, accessed April 1, 2015, http://research.microsoft.com/en-us/projects/thinkweek/expthinkweek2009public.pdf.

entire organization agrees that the definition of done at the release branch means that the feature is signed off, defects-free, and the test automation is ready in terms of test coverage and passing rates. The organization embraces the unique characteristics of software and designs a planning process that takes advantage of software's flexibility. These are big changes that will take time, but without the executives driving these cultural shifts, the technical investments will be of limited value.

From business objectives and continuous improvement to planning and DevOps, *Leading the Transformation* takes you through the step-by-step process of how to apply Agile and DevOps principles at scale. It is an innovative approach that promises markedly better business results with less up-front investment and organizational turmoil.

CHAPTER 2

CHALLENGES WITH SCALING AGILE TEAMS

Traditional implementations that focus on scaling small Agile teams across the organization are very different from applying Agile and DevOps principles at scale. Executives play a key role in communicating the advantages of the latter approach and in explaining how it differs from what is typically done in the industry. This chapter outlines the basic Agile principles for executives and highlights the limitations of the typical approach of scaling small teams across the organization. This information is vital to executives looking to avoid the struggles of traditional implementations and to capitalize on the business benefits of a successful transformation.

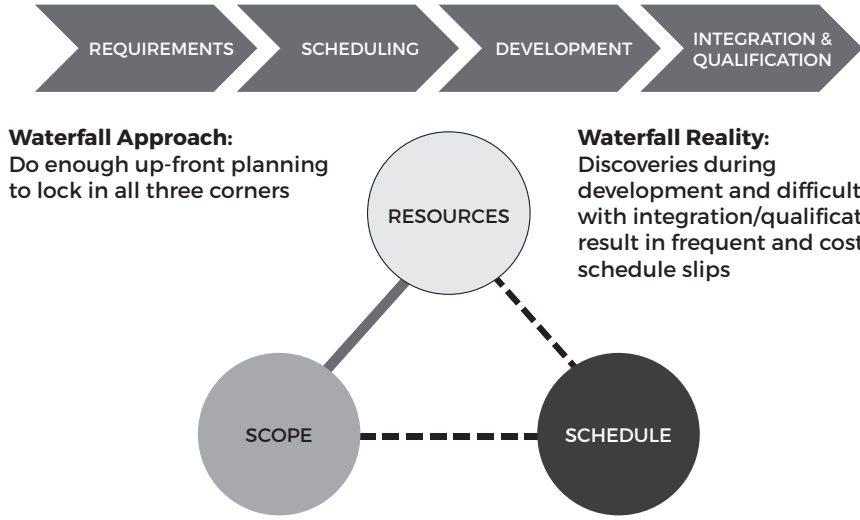
Waterfall Method vs. Agile

As many executives know, the Waterfall Method of development leverages project management principles used for managing many types of projects. It starts by gathering requirements and then planning all the work. Development begins after the planning, and then software is integrated for the final qualification and release. The goal of this approach is to structure the program such that you can determine the schedule, scope, and resources up front.

Large, complex software development projects, however, are fundamentally different than other types of projects, and traditional project management approaches are not well equipped to deal with these differences. Software development is such a discovery process that many of the assumptions made in the planning stage quickly become obsolete during development. Additionally, integration and qualification tends to uncover major issues late in the process, which results in frequent and costly schedule slips and/or working the teams to death.

The first step in leading the transformation is understanding that Agile principles are a response to the shortcomings of using traditional Waterfall project management approaches for software. They were proposed as a framework to address these unique software development challenges.

FIGURE 2: WATERFALL DEVELOPMENT MODEL



Instead of long phases of requirements, planning, development, and qualification, there are much smaller iterations where complete features are integrated and qualified on a regular basis. Additionally, the entire code base is kept stable so that the code can be released at the end of each iteration, if required. This fixes the schedule and resources while letting the scope absorb the program uncertainty. The features are all worked on in priority order, with the most valuable features being developed first. Agile practitioners have numerous examples where after delivering less than 50% of the original must-have features, the customer is happy with the product and no longer requesting more features.

Contrast this with the Waterfall Method, where there are no regular code drops. The qualification and integration process would not have started until all the must-have features were complete, taking much longer to deliver any value and creating features that may not have been necessary. While there are many other benefits to Agile, this highlights the key breakthrough for the business and as such is imperative for executives to understand when contemplating leading a large-scale Agile transformation.

Change Management Capacity

Transitioning to Agile is a very big effort for a large organization. There are technical and process changes required. Frequently, organizations focus on the