Quality for DevOps teams

TMAP®

preview version

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Foreword by Patrick Debois

Even though testers didn't make it to the word DevOps, they have always been an integral part of it. In the old days they would act as the wall between dev and ops, the final gate-keeper to production. Borrowing from systems theory, we want to optimize the whole system and not just the separate parts to achieve better results. This means quality goes beyond the testers group and is a responsibility for everyone. Everyone has to be taken in a very broad sense, not merely on the technical side; it also includes the process on how things are done and what is most important to the business. Sales, marketing and more recently DevRel (developer relations), can be seen as way to get valuable feedback too. If you optimize for quality, you will eliminate bottleneck after bottleneck. This is a noble goal, but one has to be focused on the business value. That balance is tough though: how much quality is enough? Speaking with the different groups inside the company plus, most importantly, the customer who buys and uses it, is crucial: it's all about gathering feedback to improve things.

In this book we see that modern organizations have changed: instead of relying on the strength of individuals, they aim for high-performing teams. By following "you build it, you run it", these teams put quality dead center because they would feel the pain of issues themselves. On their trip across the whole enterprise the authors show us how DevOps made an impact on the concept of quality in all different aspects of the daily work of an IT worker. It is easy to confuse DevOps with faster delivery where in fact it is as much about fast as it is about quality releases.

All the automation happening inside the delivery pipeline has not resulted in having less people involved or even having people fired. It has given humans time to work on things that matter. This continuous process is a learning experience and can only be achieved when we work together to make our jobs better.

Patrick Debois
Author of *The DevOps Handbook* and organizer of the first ever DevOps conference.

Foreword by the authors

Deliver value with the right quality at speed. That's what organizations ask of their IT teams. To achieve this, IT people need to work closely together. Cross-functional teams of business analysts, developers, testers, operations people, and other involved areas of expertise, join forces to work towards business objectives. Collaboration is key. Collaboration between people that have a shared responsibility and pick up the tasks that need to be done, based on competences and roles, no longer worrying about official functions. The DevOps culture is the enabler for this way of high-performance IT delivery, using an automated CI/CD pipeline to deliver at speed. But how do you deliver value with the right quality using DevOps? This book, and our website www.tmap.net, enable teams to implement quality engineering practices using our body of knowledge that contains various approaches, practical examples and concise explanations. We trust that teams will benefit from this and enhance their collaboration to deliver value to their stakeholders.
Aligned with the DevOps culture of IT delivery – where roles are important and functions are not – keep in mind that if in this book you see a term such as developer or tester, we refer to the role of a team member at a specific moment in time, not to a function.

Exploration is an important activity today because in high-performance IT delivery there's not enough time to first work out every detail; during the journey things need to be explored. As Apollo 8 astronaut Frank Borman put it: "Exploration is really the essence of the human spirit, and I hope we will never forget that." [Kluger 2017]
We encourage you to use this book in the same spirit. Explore the book, see what you can use. And adjust it to your own needs and those of the team.

When we created this book, we were inspired by many people. We also used a lot of knowledge from books, articles, conference-presentations, websites and other sources. Where we directly quoted from a source, we have put the reference to that source in the text. But, as you can imagine, we have acquired many ideas and knowledge over the years and can't exactly attribute these to a specific source. Therefore, we apologize to anyone

who is of the opinion that we reused their idea without a direct reference, we trust you will see this as a recognition and appreciation of your good work. We have done our best to make the list of references as complete as possible.

Although the name of Leo van der Aalst is not mentioned on the front cover of this book, Leo has written large parts of this book and was of great inspiration to the other authors. Before this book was finished, Leo had the opportunity to switch his career to a new direction beyond Sogeti, therefore he won't be able to support the other authors to convey the message in the future. The other authors are very grateful for his great contributions and collaboration.
We are grateful to all people that contributed during this endeavor (see our product owners' words for details). We thank our managers for enabling us to make this book a reality, thank you Rob Vijverberg, Christiaan Hoos and Tinus Vellekoop!

We trust you will find value in this book and wish you success and joy in applying the contents in your daily work.

Rik Marselis, principal quality consultant
Leo van der Aalst, DevOps lead
Berend van Veenendaal, expert backend developer
Dennis Geurts, lead software architect
Wouter Ruigrok, Agile quality coach

Acknowledgements by the product owner

Quality at speed is the challenge for IT delivery teams today. To support all people involved in facing this challenge, we embarked on a journey about a year ago to create an updated version of our body of knowledge, published on the website www.tmap.net, and a book that specifically deals with the challenges around quality and value a DevOps culture brings to organizations. Previously, TMAP was mainly for QA and testing professionals. In DevOps, the delivery of a product, including the quality of that product, is the responsibility of the team as a whole, therefore our body of knowledge supports all people involved: the DevOps team members and also the other people in the organization, with knowledge, skills, tools and more.
In our project, which started in the Netherlands and quickly involved people across many countries, we adhered to the principles of DevOps; we shared the responsibility of creating this book, for example.
Open source is widely adopted today, we have always supported this idea of sharing knowledge so that all can benefit. The TMAP body-of-knowledge is open and available to anyone to use. And I also encourage you to contribute your examples, good practices, building blocks or whatever can be useful, so that we will build a strong quality engineering community together.

Our journey really started with a kickoff meeting in April 2019 where an international group of IT experts came together and spent two days to lay the foundations of this new view on high-performance IT delivery.
The participants were Robbert van Alen, Eveline Moolenaars-Koetsier, Bert Linker, Wouter de Kort, Gitte Ottosen (DK), Nicklas West (SE), Vincent Wijnen, Filip Joele, Joey van Hoek, Jurian de Cocq van Delwijnen and Jan Sleutjes. As a result of this meeting (which was organized and moderated by Rik Marselis and Leo van der Aalst), the team decided on the relevant QA and testing topics, created various definitions and defined the important starting points to further work out our view on high-performance IT delivery.

We had a very inspiring meeting with the following representatives of our clients: Paul Custers (NS), Werner Soeteman (KLM), Willem-Jan van Tongeren (PostNL), Reindrich Geerman (KPN), Edward Elgeti (UWV), Peter Claassen (Rabobank) and Caroline Arkesteijn (NIBC Bank). We are grateful for them clarifying their business challenges. They confirmed the direction to which we were headed, pinpointed specific subjects of interest, shared practical insights and made a number of valuable nuances.

Many people contributed to the contents of this book and the body of knowledge by inspiring the authors and by presenting useful examples, snippets of text and references to valuable sources.
For this we thank (in no particular order) Eva Holmquist (SE), Peter Betting (FR), Tom van de Ven, Andrew Fullen (UK), Barry Weston (UK), Fredrik Scheja (SE), Marianne Duijst, Paul van de Geer, Matthias Hamburg (DE), Sven Fanslau (DE), René Boswinkel, Arno Balemans, Albert Tort Pigubet (ES), Geert Vanhove (BE), Geert Jan Carpay, Gijs Op de Beek, Maurice Siteur, Marc Roekens, Martijn van der Salm, Erwin Riemersma, Mark van der Walle, Emil Wesselink, Charlotte Janus, Rianne Oorebeek – de Neef, Jan Sleutjes, Dirkjan Kaper, Jan-Willem van den Brink, Tinus Vellekoop, Marco van den Brink and Casper Schipper.

I would like to extend special recognition to Richard Ammerlaan, Randy Semeleer, Bas de Heer and Daan Kroese who largely contributed to the chapters about non-functional quality.
We also received contributions from the quality & testing community; thank you Derk-Jan de Grood, Ard Kramer and Bart Broekman. I would also like to recognize all participants to the 24th Testing Retreat for sharing their visions on this topic. The Testing Retreat is an annual independent informal meeting of international QA & testing experts.

When the book neared its completion, a great number of people invested their valuable time in reviewing the semi-finished text blocks and the complete manuscript. We especially thank the clients and partners that helped us: René Tuinhout (RDW), John Bertens (Achmea), Bart Enkelaar (Bol.com), Pascal Nicolakis (Micro Focus), Arno van der Velde (Micro Focus) and Patrice Chorot (Micro Focus).
Our colleagues contributed a great number of suggestions, comments and improvements, thank you Albert Tort Pigubet (ES), Andrew Fullen (UK), Antoine Aymer (FR), Barry Weston (UK), Blue Ityalam (IR), Eva Holmquist (SE), Fethi Mebrouk (FR), Gitte Ottosen (DK), Jürgen Beniermann (DE), Maheshwar Kanitkar (IN), Markus Niehammer (DE), Matthias Hamburg (DE), Mona Iversen (NO), Monish Pawar (IR), Nicklas West (SE), Peter Betting (FR), Sven Fanslau (DE), Torunn-Cathrine Ludvigsen (NO), Vishal Rai (IR), Arno Balemans, Bert Linker,

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Organizing this review process and merging all feedback was a job very conscientiously done by Sander van Logchem.

In the process of creating a book there are some activities that need to be done by specialists. We are very happy with the support we got from our publisher, LINE UP boek en media, in particular Peter ten Hoor, Minke Sikkema, Mirjam Kroondijk and Annelies Gallagher. The professional look and feel of this book can all be attributed to the Axioma design team, Richard Wouters, Lex Stuip and Pepijn van der Meer, and to our colleagues of marketing & communications Linda van Tilborgh, Jolien Dusseldorp-Schipper and Nicolette van der Heide.

Last but most certainly not least I would like to thank the authors of this book. Creating a book like this is a long journey. A journey that isn't always a smooth ride; the road can be bumpy or even rocky sometimes, a journey of taking one step forward and two steps back by occasion. They persisted in achieving their goal to create a book accessible to all members in a high-performance team. Hats off for Rik Marselis, Berend van Veenendaal, Dennis Geurts and Wouter Ruigrok! Of course, special recognition for Leo van der Aalst and Richard Ammerlaan who contributed by supplying substantial content for this book.

I trust you will enjoy reading this book and hope you will be inspired to apply the knowledge and use the insights and tools to the benefit of your IT delivery process.

Rob Vijverberg, Head of Digital Assurance and Testing, Sogeti NL
Vianen, February 2020

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Part 1
Introduction

1

What value will you find in this book?

Organizations can only be successful when properly supported by IT systems. People involved in the creation and use of IT systems face many challenges. Updates and changes have to be delivered faster than ever before. The right quality is vital to maintain service in our 24/7 economy. User experience should be right first time to retain customers. Teams need to deal with these challenges, integrating quality measures throughout the IT delivery process and using tools to deliver at speed.

Information Technology (IT) has made giant technological leaps forward and still evolves at an incredible pace. The way IT systems are created and delivered has also evolved. Today, IT systems are preferably delivered incrementally with frequent adaptation to new business needs and user expectations, and with increasing speed, supported by state-of-the-art tools. We should keep a close eye on what it is all about: delivering software – which will generate business value – at the right time with the desired quality!

This book provides information on how to build in quality and establish a level of confidence so that the pursued business value can be achieved, as described in our VOICE model.

We call the modern iterative-incremental way of creating IT systems: high-performance IT delivery.

> High-performance IT delivery is an approach that enables cross-functional teams to continuously improve the products, processes and people that are required to deliver value to the end users.

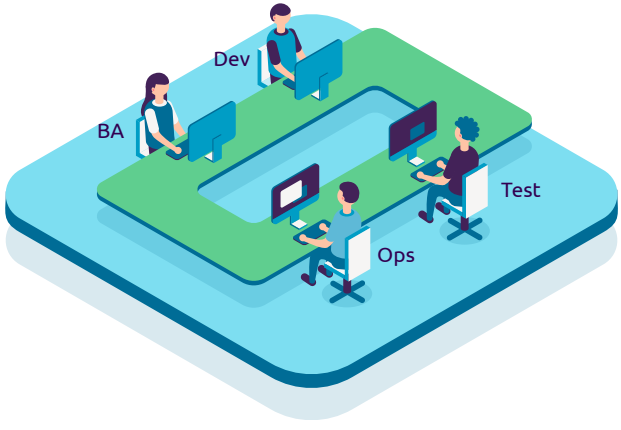
The title – *Quality for DevOps teams* – demonstrates that this book is primarily meant for those that want to deliver quality solutions in a DevOps setting. Although IT is often about tools and techniques, people still make the difference between dissatisfaction or success. Do you work in a high-performance IT delivery approach, such as DevOps, and do you want to make sure you deliver value to users by assuring the right level of quality? And do you want to establish the level of confidence that the pursued business value can be achieved? Then you will find great benefit in the valuable ideas, approaches and experiences in this practical book.

1.1 The DevOps IT delivery model

Since DevOps is the main IT delivery model in this book, let us briefly describe DevOps.

DevOps is a cross-functional systems engineering culture that aims at unifying systems development (Dev) and systems operations (Ops) with the ability to create and deliver fast, cheap, flexible and with adequate quality, whereby the team as a whole is responsible for the quality. Other areas of expertise, such as business analysis and quality assurance (including testing) are usually integrated in the team. A DevOps culture has an Agile mindset that can be supported/implemented by, for example, the Scrum framework.

Figure 1.1 DevOps cross-functional team.

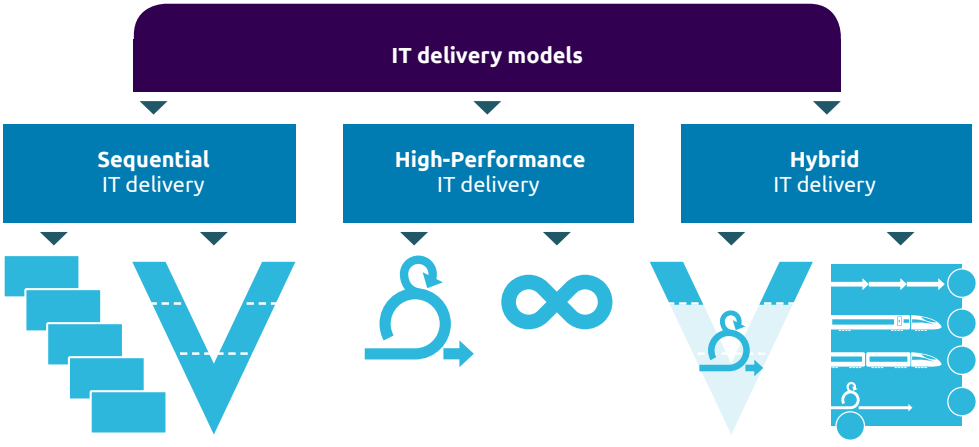


Working in a cross-functional team means that the team as a whole is responsible for delivering value. The team has all competencies and skills to perform the necessary tasks and no team member has the monopoly on performing any task. This way the team can always go forward, even when a team member is temporarily not available. And of course, a team can work together with specialists from other teams or support groups for specific tasks.

Overview of IT delivery models

In addition to DevOps, Scrum is also considered one of the high-performance IT delivery models. Besides the high-performance IT delivery models, we distinguish two other IT delivery models (Figure 1.2): Sequential models (e.g. waterfall and V model) and a blend of sequential and high-performance IT delivery models, resulting in a hybrid IT delivery model (e.g. demand/supply and SAFe). You can read more about IT delivery models in Chapter 7, "Overview of IT delivery models".

Figure 1.2 IT delivery models.



1.2 Continuous quality engineering

In the DevOps IT delivery model, there is continuous focus on quality engineering. Actually, commonly DevOps teams try to implement "continuous everything", which means that they strive to automate as many tasks and activities as possible. This leads to, among

other things, Continuous Integration and Continuous Deployment (commonly abbreviated to CI/CD).
To implement continuous quality engineering, of which continuous testing is a part, DevOps teams must use state-of-the art tools powered by artificial intelligence and machine learning. This will enable them to deliver quality at speed, for example by forecasting quality problems and solving them before anyone experiences a failure.

1.2.1 Vision: "built-in quality"

We strongly believe that high-performance IT delivery teams have capabilities as a team, the capabilities of the people in the team contribute to the team as a whole, and tasks can be performed by various team members. One team member may be more skilled than another, but that is no reason to only provide work to the team member with the most experience and skills. Think of all tasks as a team effort in which each team member plays a role. Specifically, we think that quality assurance (QA) and testing activities should be integrated in both the DevOps activities as well as the people involved.

1.2.2 DevOps activities

DevOps is an elusive phenomenon. There are discussions about who is the founder of DevOps and what the DevOps IT delivery model looks like exactly. To avoid this discussion, we use a simplified model in this book, on which the common activities are plotted (Figure 1.3).

Figure 1.3 The six DevOps activities.

We identify six DevOps activities:

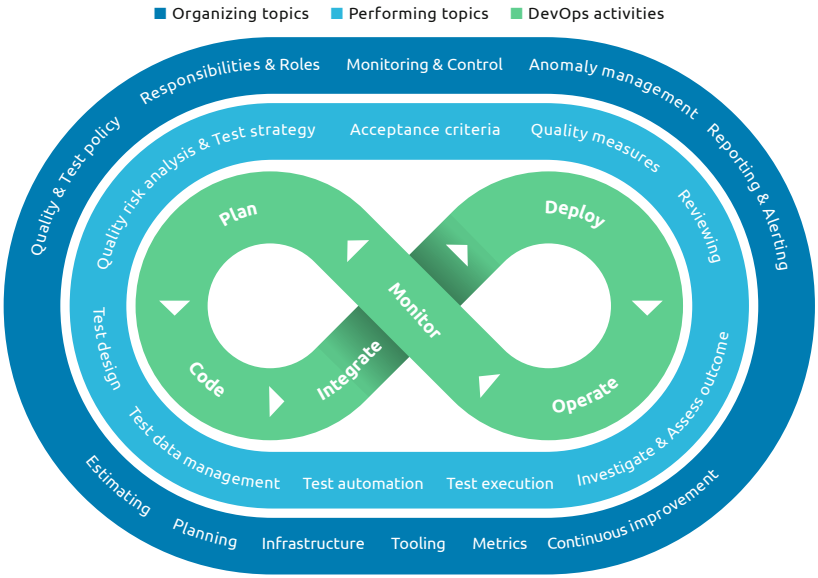
- Monitor
- Plan
- Code
- Integrate
- Deploy
- Operate

These activities provide excellent support to explain the integration of DevOps activities with the QA and testing topics. For more information on the DevOps activities see the description in Chapter 9, “High-performance IT delivery models”.

1.2.3 Quality assurance & testing topics

In this book, we take a list of quality assurance & testing activities, grouped in “Organizing” and “Performing” topics (Figure 1.4), as our starting point. We describe how these topics relate to the DevOps activities and what the people involved need to know and need to do related to these various topics.

Figure 1.4 Quality assurance & testing topics and DevOps activities.



The topics are not directly and one-on-one related to the DevOps activities. Depending on the activity, you will see that one or more topics can relate to a specific activity. See Chapter 14, "Topics plotted on the IT delivery models".
These topics can – or even should – be applied by all DevOps people. Not just by a tester or a person with a quality assurance role. In general, quality assurance and testing topics are integrated with all DevOps activities and executed by all people involved.
This book will support you in organizing and performing quality engineering tasks within DevOps, irrespective of whether you see yourself as a developer, an operations person, a business analyst, a quality engineer, a tester, a product owner, a coach, a manager or any other role or function.

1.3 README.TXT (reading guide)

Quality for DevOps teams is not a book to read from cover to cover. Also it is not intended as a step by step implementation of quality engineering activities in DevOps. Instead, this book provides relevant parts of the TMAP body of knowledge. Depending on your needs, interests and experience with quality engineering, parts can be read carefully, scanned quickly, or even skipped altogether.
The book is intended for all people involved in DevOps. But every person will want to use another subset from this book. The parts, chapters and sections provide a handy division. The table of contents at the beginning of the book and the index at the end of the book will also assist you in locating relevant knowledge.
You will find an extensive glossary with over 300 terms on the website. The relevant definitions are included in this book and are clearly shown in a textbox. If you are looking for a specific definition, please use the index to find the page where the term is explained or find the glossary on www.tmap.net.

1.3.1 Overview of the parts of the book

This book is divided into eight parts. A short overview:

- *Part 1 Introduction*
  In this part, we explain the reason why you should read this book, that successful high-performance IT delivery depends on people; we explain the VOICE model (confidence in pursued value), and give an introduction to quality assurance & testing. At the end of this part we describe the CI/CD pipeline.

- *Part 2 IT delivery models*
  In this part, we provide an overview of three IT delivery models: sequential, high-performance and hybrid. And, since this is the focus of our book, we provide an in-depth explanation of the high-performance IT delivery model DevOps.
- *Part 3 QA & testing topics*
  In this part, you will find an introduction to QA & testing topics, which are grouped into "Organizing" and "Performing" topics. Examples of cross references between these topics and the three IT delivery models can be found in this part as well.
- *Part 4 Organizing topics explained for DevOps*
  In this part, the eleven organizing topics are described (Figure 1.4). These organizing topics are aimed at arranging, planning, preparing and controlling QA & testing activities.
- *Part 5 Performing topics explained for DevOps*
  In this part, the nine performing topics are described (Figure 1.4). These performing topics are aimed at the operational, specifying and executing QA & testing activities.
- *Part 6 Quality measures and skills*
  In this part, a wide variety of quality measures is described. These can be used independently as part of quality assurance as well as to cover risks. In this part, you will also find a description of personal, interpersonal and team skills.
- *Part 7 Test varieties*
  In this part, we explain the concept of test varieties and describe four test varieties in more detail. The testing pyramid and the testing quadrants are also discussed.
- *Part 8 Test design*
  In this part, you will find a description of experienced-based testing and its four approaches (checklist, error guessing, exploratory testing, crowd testing). We also provide an explanation of coverage-based testing, its four groups (process, condition, data, appearance) and at least one application of a test design technique for each group.

1.3.2 Target groups of this book

The main target group of this book is people working in DevOps teams. Others with an interest in quality engineering in today's IT delivery will also find a lot of interesting knowledge in this book.

If you have never read anything about TMAP, this book certainly will help you get an overview of what it has to offer. On the other hand, if you are experienced in applying TMAP in your work, you will notice that we have made significant additions and adaptations to make it completely fit in today's IT world.

As an aid to choosing the parts that are of interest in connection with certain roles, we also provide you with reading suggestions.
In general, our suggestion is first to determine the challenges in your own situation, and then select the parts, chapters and topics in this book as a source of inspiration and information to implement improvements.
Since every person has a different need for information, we cannot specify which parts of this book are of interest to you. However, the following hints and tips may help you find your way in this book.
We advise everyone to start with Part 1 to understand the basic starting points.
If you are interested in different ways of IT delivery read Part 2, if you are only interested in DevOps, you may skip this part.
QA & testing consists of many activities; we have structured these activities in twenty topics as described in Part 3.
If you are involved in organizing QA and testing in DevOps (for example as a product owner, agile coach, test manager etc.), we refer to Part 4.
If you are involved in performing QA and testing in DevOps (for example as a business analyst, a developer, a tester or an operations person), we refer to Part 5.
Part 6 is valuable as a reference to specific quality measures; please select from the table of contents the quality measures that are relevant in your situation.
If you set up quality engineering, you have to make sure there is sufficient variety in testing; Part 7 will give you the information needed.
If you are involved in specifying and executing tests, you will find very useful information about test design and execution (and the test design techniques that TMAP is famous for) in Part 8.
If you need to define the focus of quality engineering, you will find an overview of quality characteristics in the appendix.

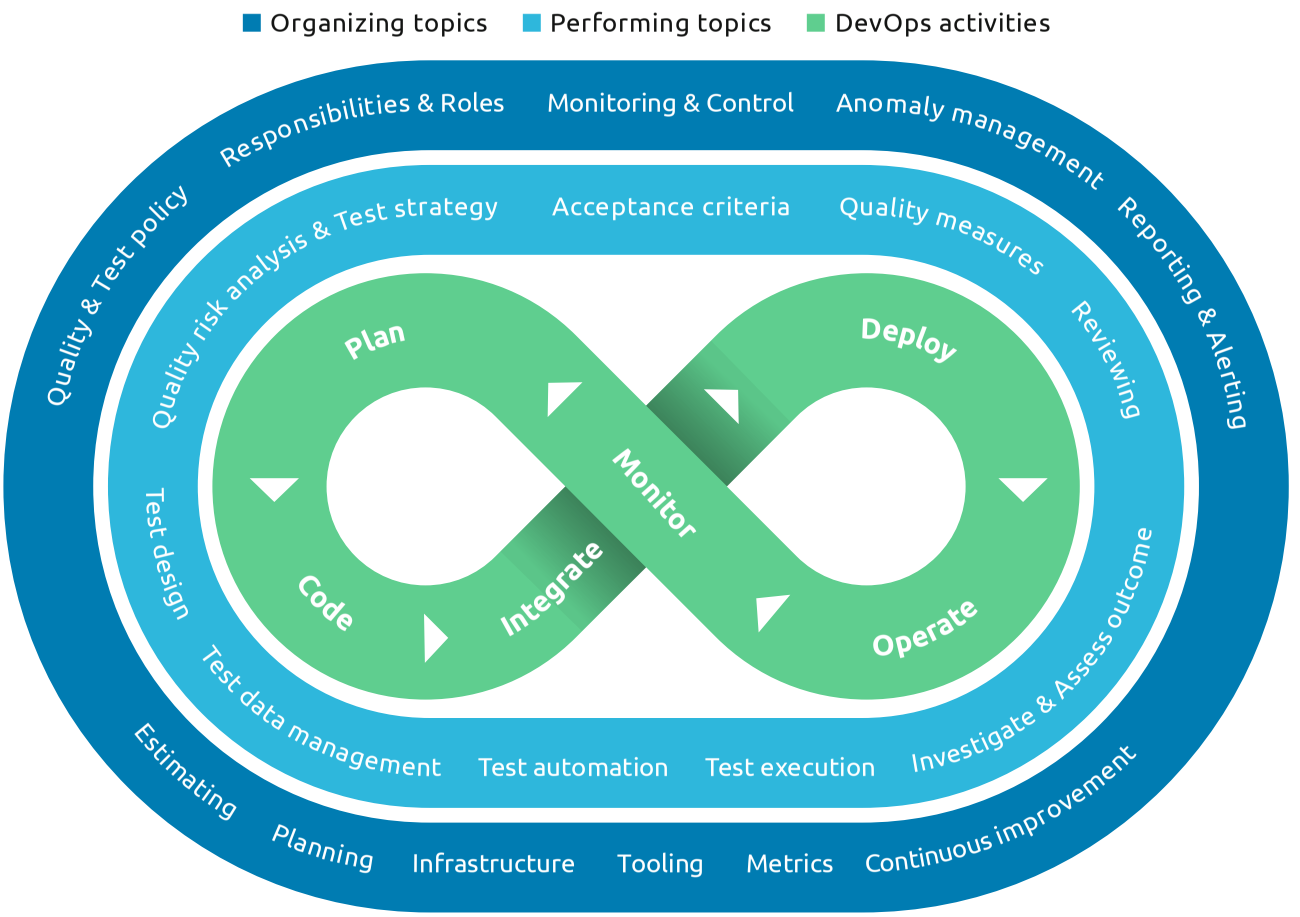
1.4 TMAP evolution

TMAP is a body of knowledge for quality engineering in IT delivery. The strength of TMAP can be largely attributed to the considerable practical experience that is the basis for the body of knowledge. This experience comes from thousands of IT professionals in as many projects over the last twenty-five years.
TMAP was created in 1995 and back then mainly contained a process description for testing. Over the years, TMAP has evolved from process-driven, business-driven and human-driven to a body of knowledge with which quality assurance & testing activities can be

integrated in all IT delivery models. The body of knowledge contains a wide range of approaches, good practices, techniques and tools for organizing and performing of activities related to quality assurance and testing of IT systems.
Today we use TMAP as a term on its own, rather than a meaningful abbreviation. For this reason TMAP is now written with four capital letters.

TMAP website

The TMAP body of knowledge is easily accessible on the website www.tmap.net. There are also numerous books available in the TMAP series. Books are static, IT delivery landscapes are changing faster and faster. We therefore aim to keep the website up to date. You can find most of the content of this book on this website, as well as many in-depth explanations, additions to the content of this book and up-to-date overviews of relevant tools.
In addition, the quality assurance & testing topics are worked out for other IT delivery models.
In summary, this book is supportive of the website, which is constantly updated and adapted to changed IT delivery landscapes and new insights.
We wish you a lot of useful insights and good luck with applying TMAP knowledge in your situation.



Quality assurance & testing topics and DevOps activities

This is a preview version.

Please refer to the full version for chapters 2 through 47.

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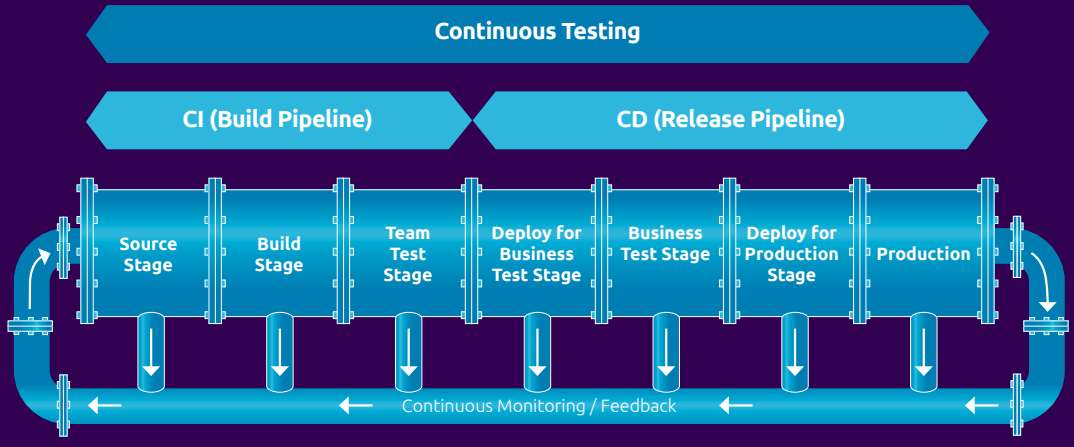
To continuously deliver IT systems at speed with a focus on business value, DevOps teams integrate quality engineering in their way of working.
This book supports teams in implementing quality in their DevOps culture, with practical examples, useful knowledge and some theoretical background. For example, it describes how to benefit from a CI/CD pipeline.



TMAP is the body of knowledge for quality engineering in IT delivery and builds on practical experience from thousands of people in more than twenty-five years. The website, www.tmap.net, supports any kind of IT delivery model. This book, however, focuses on DevOps: today's implementation of high-performance IT delivery.

The authors of this book have combined experience in every relevant role in today's high-performance IT delivery. While creating this book, we practiced what we describe about bringing together all disciplines needed to deliver business value. This book would not have existed without the efforts of **Leo van der Aalst**. His contribution is based on three decades of IT experience combined with 21 years of TMAP knowledge. Leo wrote large parts of this book and supported the authors in many ways. Many thanks to him! Another vital source of knowledge and experience was **Richard Ammerlaan**, who wrote the parts about automation, tooling and performance testing.

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