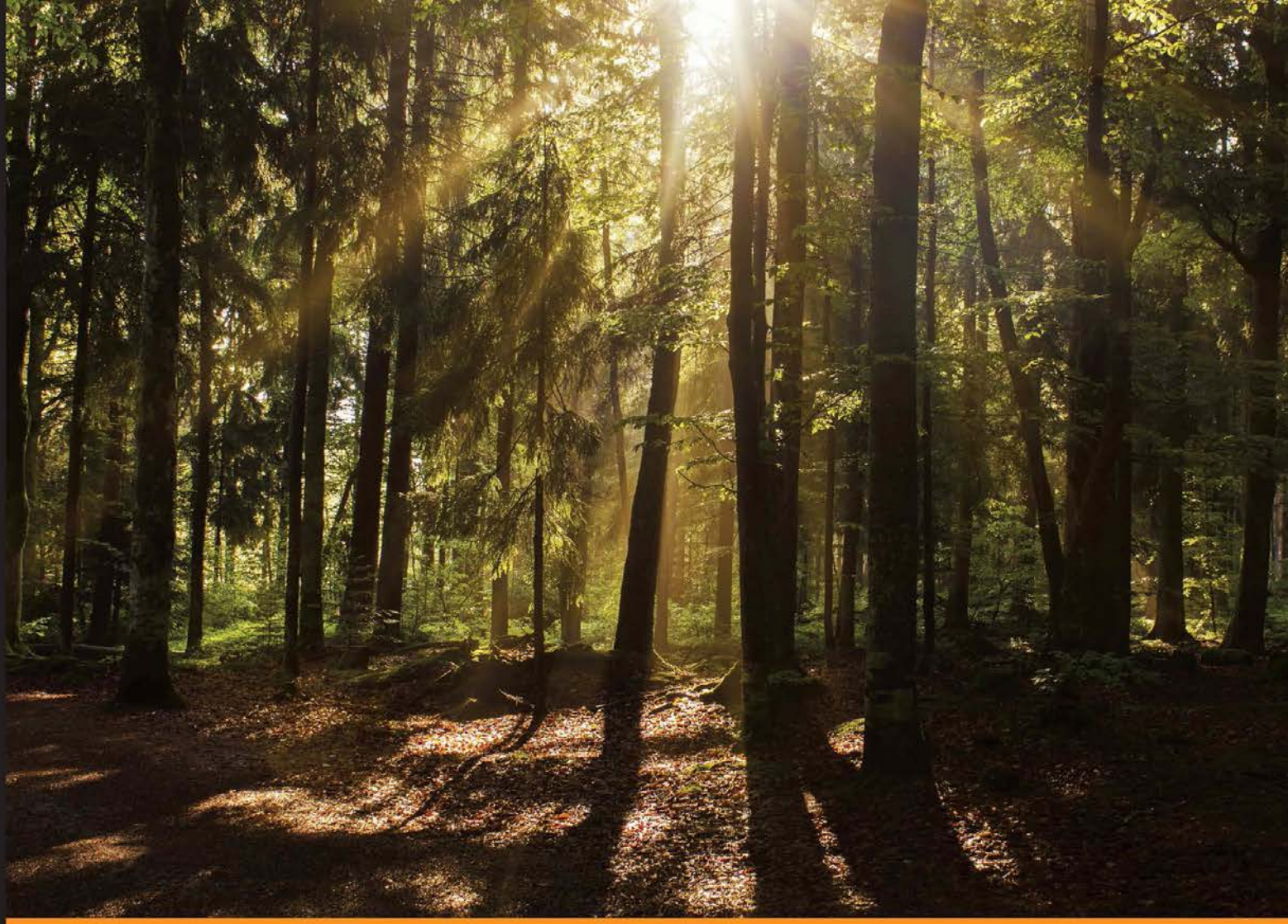

Community Experience Distilled

Learning RabbitMQ

Build and optimize efficient messaging applications with ease

Martin Toshev

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PUBLISHING

BIRMINGHAM - MUMBAI

Learning RabbitMQ

First published: December 2015

Production reference: 1171215

Published by Packt Publishing Ltd.
Livery Place
35 Livery Street
Birmingham B3 2PB, UK.

ISBN 978-1-78398-456-5

www.packtpub.com

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Héctor also helped with the reviewing process of *RabbitMQ Cookbook* and *RabbitMQ Essentials*, both from *Packt Publishing*.

I would like to thank my parents, Pilar and Jose Carlos, as well as my sister, Paula, for always supporting me and motivating me to keep pushing on. Without them, all this would not have been possible.

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I would like to thank all of the people that supported me during the process of writing this book and especially my mother Milena, my beloved Tsveti and my grandmother Maria. Without them this would not have been possible.

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Preface

Learning RabbitMQ provides you with a practical guide for the notorious message broker and covers the essentials required to start using it. The reader is able to build up knowledge along the way—starting from the very basics (such as what is RabbitMQ and what features does it provide) and reaching the point where more advanced topics, such as RabbitMQ troubleshooting and internals, are discussed. Best practices and important tips are provided in a variety of scenarios; some of them are related to external systems that provide integration with the message broker or that are integrated as part of the message broker in the form of a RabbitMQ plugin. Practical examples are also provided for most of these scenarios that can be applied in a broader context and used as a good starting point.

An example system called **CSN** (**Corporate Social Network**) is used to illustrate the various concepts provided throughout the chapters.

Each chapter ends with an Exercises section that allows the reader to test his understanding on the presented topic.

What this book covers

Chapter 1, *Introducing RabbitMQ*, provides you with a brief recap on enterprise messaging and a short overview of RabbitMQ along with its features. Other similar technologies are mentioned and an installation guide for the message broker is provided at the end of the chapter. The basic terminology behind RabbitMQ such as exchanges, queues, and bindings is introduced.

Chapter 2, *Design Patterns with RabbitMQ*, discusses what messaging patterns can be implemented using RabbitMQ, including point-to-point, publish-subscribe, request-reply, and message router types of communication. The patterns are implemented using the building blocks provided by the message broker and using the Java client API.

Chapter 3, *Administration, Configuration and Management*, reveals how to administer and configure RabbitMQ instances, how to install and manage RabbitMQ plugins, and how to use the various utilities provided as part of the RabbitMQ installation in order to accomplish a number of administrative tasks. A brief overview of the RabbitMQ management HTTP API is provided.

Chapter 4, *Clustering*, discusses what built-in clustering support is provided in the message broker and how it can be used to enable scalability in terms of message queues. A sample RabbitMQ cluster is created in order to demonstrate how nodes can be added/removed from a cluster and how RabbitMQ clients can connect to the cluster.

Chapter 5, *High Availability*, extends on the concepts of clustering by providing an overview of how a RabbitMQ cluster can be made more reliable in terms of mirrored queues and how messages can be replicated between remote instances using the Federation and Shovel plugins. High availability in terms of client connections and reliable delivery is also discussed with AMQP transactions, publisher confirms, and client reconnections.

Chapter 6, *Integrations*, provides you with a number of practical scenarios for integration of the message broker with the Spring framework, with ESB (enterprise services bus) systems such as MuleESB and WS02, and with database management systems (RDBMS and NoSQL). Deployment options for RabbitMQ using systems such as Puppet, Docker, and Vagrant are discussed in the chapter. A brief overview of how RabbitMQ applications can be tested using third-party frameworks is provided at the end of the chapter.

Chapter 7, *Performance Monitoring and Tuning*, gives a detailed list of factors that must be considered in terms of performance tuning of the message broker. The PerfTest tool is used to demonstrate how the RabbitMQ performance can be tested. At the end of the chapter, several monitoring solutions that provide support for RabbitMQ such as Nagios, Munin, and Monit are used to demonstrate how the message broker can be monitored in terms of stability and performance.

Chapter 8, *Troubleshooting*, illustrates a number of problems that can occur during the startup of the message broker and normal operation along with the various causes and resolutions in such cases. A brief primer on the Erlang programming language is provided for the purpose of understanding and analyzing the RabbitMQ crash dump—either directly or using the Crashdump Viewer for convenience.

Chapter 9, *Security*, provides a high-level overview of the vulnerability landscape related to the message broker along with a number of techniques to secure a RabbitMQ setup. Authentication, authorization, and secure communication are among the most important concepts covered in the chapter.

Chapter 10, *Internals*, discusses the internal architecture of the message broker and provides a detailed overview on the most important components that RabbitMQ comprises of.

Appendix A, *Contributing to RabbitMQ*, provides a short guide on how to get the RabbitMQ sources, how to set up a development environment, and how to build the message broker. A short discussion on how to contribute to the RabbitMQ ecosystem is provided as part of the appendix.

What you need for this book

In order to get the most out of this book, the reader is expected to have at least a basic understanding of what messaging is all about and a good understanding in at least one object-oriented programming language. As the book features the RabbitMQ Java client API in order to demonstrate how to use the message broker, it is good to have at least a basic understanding of the Java programming language. Most of the examples are not specific to a particular operating system; if they are, it is explicitly mentioned whether this is, for example, a Windows- or Unix-based distribution such as Ubuntu. For this reason, there is no particular requirement for an operating system in order to run the examples.

Who this book is for

If you are a developer or system administrator with basic knowledge in messaging who wants to learn RabbitMQ or further enhance your knowledge in working with the message broker, then this book is ideal for you. For a full understanding of some the examples in the book, basic knowledge of the Java programming language is required. Feeling comfortable with RabbitMQ is a great way to leverage your expertise in the world of messaging systems.

Conventions

In this book, you will find a number of text styles that distinguish between different kinds of information. Here are some examples of these styles and an explanation of their meaning.

Code words in text, names of third-party applications, utilities, folder names, filenames, file extensions andpathnames are shown in bold as follows: "We already saw how easy it is to `start/stop/restart` instances using the `rabbitmqctl` and `rabbitmq-server` utilities that are part of the standard RabbitMQ installation."

A block of code displayed in a box with console font:

```
<dependency>
 <groupId>log4j</groupId>
 <artifactId>log4j</artifactId>
 <version>1.2.16</version>
</dependency>
```

A block of configuration or output is also displayed in a box as follows:

```
sudo apt-get install rabbitmq-server -y
sudo rabbitmq-plugins enable rabbitmq_management
sudo service rabbitmq-server restart
```

New terms and **important words** are also shown in bold. Words that you see on the screen, for example, in menus or dialog boxes, appear in the text like this: "Clicking the **Next** button moves you to the next screen."

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1
Introducing RabbitMQ

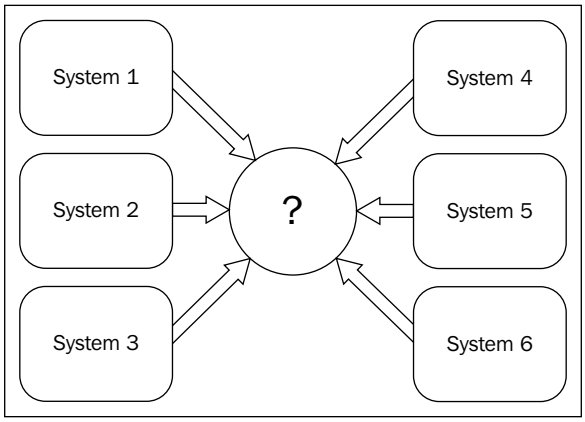
In the world of enterprise messaging systems there are a number of patterns and practices that are already successfully applied in order improve to scalability and interoperability between different components in a system or between varying in size and complexity systems. RabbitMQ is one such messaging solution, which combines powerful messaging capabilities with easy use and availability on a number of target platforms.

The following topics will be covered in this chapter:

- Fundamentals of enterprise messaging
- RabbitMQ brief overview
- RabbitMQ features
- Comparing RabbitMQ to other technologies
- Installing RabbitMQ

Enterprise messaging

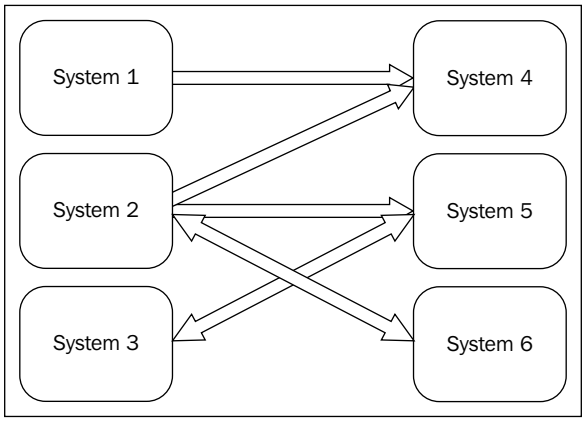
A typical enterprise will have a number of systems that must typically communicate with each other in order to implement a well-defined business process. A question that is frequently tackled for this reason is how to implement the communication channel between these types of systems? For example, consider the following diagram:



The question mark in the preceding picture denotes the communication media for the six systems that are illustrated. In the diagram, we can think of these separate systems as the components of one large system and the problem stays the same. Before discussing the various alternatives for integration, a number of key factors are considered, as follows:

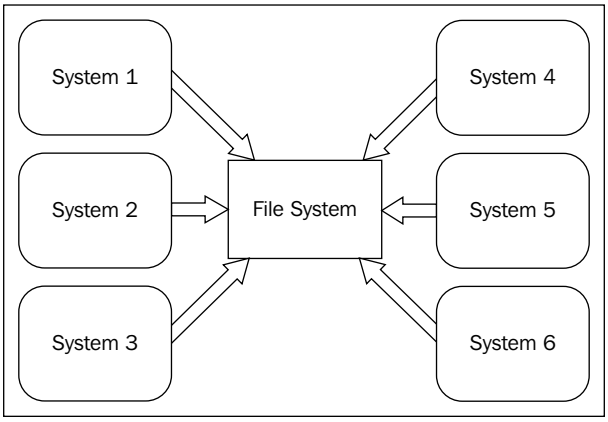
- **Loose coupling**: At what degree do the different systems depend on each other or can operate independently?
- **Real-time workload processing**: How fast is the communication between the systems?
- **Scalability**: How does the entire system scale when more systems are added and the workload demands an increase?
- **Maintainability**: How hard it is to maintain the integrated systems?
- **Extensibility**: How easy it is to integrate new systems?

Let's assume that the systems communicate directly via some kind of remote procedure calls as shown in the following diagram:



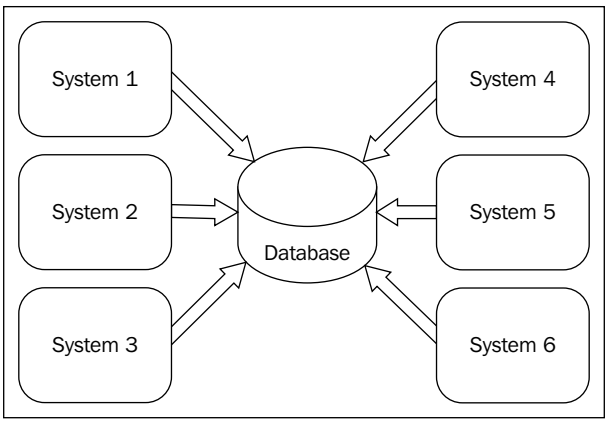
This implies that separate communication links must be established between each pair of systems, which leads to tight coupling, a lot of effort to maintain all of the links, reduced scalability, and reduced extensibility (for every new system that is added, a few more communication links with other systems must be created). However, real-time communication requirements might be met with some additional effort to design the communication links.

A second approach is to use a shared file system in order to exchange files between the systems that are being integrated, as illustrated in the following diagram:



A shared file system is used to provide the communication medium. Each system may export data to a file that can be imported and used by other systems. The fact that each system may support its own data format leads to the fact that each system must have a particular mechanism to import data from every other system that it needs to communicate with. This, on other hand, leads to the same problems that are described in the case of direct communication. Moreover, real-time communication requirements might be more difficult to establish and reading or writing data from disk is also an expensive operation.

A third option is to use a shared database as shown in the following diagram:



Here, all the systems should depend on the same database schema. Although this reduces coupling between systems and improves extensibility (new systems must conform to a single database schema in order to integrate with other systems), real-time workload processing is still an issue. Scalability and maintainability depend directly on the type of database that is being used and they could turn out to be weak factors especially if it is a relational database (this may not be the case if NoSQL solutions are applicable for the particular use case).