

Using Arquillian, Hoverfly,  
AssertJ, JUnit, Selenium,  
and Mockito

# Testing Java Microservices

Alex Soto Bueno  
Andy Gumbrecht  
Jason Porter



# Testing Java Microservices

**Piotr Mińkowski**



## Testing Java Microservices:

Testing Java Microservices Jason Porter,Alex Soto,Andrew Gumbrecht,2018-08-03 Summary Testing Java Microservices teaches you to implement unit and integration tests for microservice systems running on the JVM You ll work with a microservice environment built using Java EE WildFly Swarm and Docker You ll learn how to increase your test coverage and productivity and gain confidence that your system will work as you expect Purchase of the print book includes a free eBook in PDF Kindle and ePub formats from Manning Publications About the Technology Microservice applications present special testing challenges Even simple services need to handle unpredictable loads and distributed message based designs pose unique security and performance concerns These challenges increase when you throw in asynchronous communication and containers About the Book Testing Java Microservices teaches you to implement unit and integration tests for microservice systems running on the JVM You ll work with a microservice environment built using Java EE WildFly Swarm and Docker You ll advance from writing simple unit tests for individual services to more advanced practices like chaos or integration tests As you move towards a continuous delivery pipeline you ll also master live system testing using technologies like the Arquillian Wiremock and Mockito frameworks along with techniques like contract testing and over the wire service virtualization Master these microservice specific practices and tools and you ll greatly increase your test coverage and productivity and gain confidence that your system will work as you expect What s Inside Test automation Integration testing microservice systems Testing container centric systems Service virtualization About the Reader Written for Java developers familiar with Java EE EE4J Spring or Spring Boot About the Authors Alex Soto Bueno and Jason Porter are Arquillian team members Andy Gumbrecht is an Apache TomEE developer and PMC They all have extensive enterprise testing experience Table of Contents An introduction to microservices Application under test Unit testing microservices Component testing microservices Integration testing microservices Contract tests End to end testing Docker and testing Service virtualization Continuous delivery in microservices

Testing Java Microservices Andy Porter,2018 Testing Java Microservices teaches you to implement unit and integration tests for microservice systems running on the JVM Youll work with a microservice environment built using Java EE WildFly Swarm and Docker Youll learn how to increase your test coverage and productivity and gain confidence that your system will work as you expect About the Technology Microservice applications present special testing challenges Even simple services need to handle unpredictable loads and distributed message based designs pose unique security and performance concerns These challenges increase when you throw in asynchronous communication and containers About the Book Testing Java Microservices teaches you to implement unit and integration tests for microservice systems running on the JVM Youll work with a microservice environment built using Java EE WildFly Swarm and Docker Youll advance from writing simple unit tests for individual services to more advanced practices like chaos or integration tests As you move towards a continuous delivery pipeline youll also master live system testing using technologies like the

Arquillian Wiremock and Mockito frameworks along with techniques like contract testing and over the wire service virtualization Master these microservice specific practices and tools and you'll greatly increase your test coverage and productivity and gain confidence that your system will work as you expect

What's inside Test automation Integration testing microservice systems Testing container centric systems Service virtualization About the Reader Written for Java developers familiar with Java EE EE4J Spring or Spring Boot About the Authors Alex Soto Bueno and Jason Porter are Arquillian team members Andy Gumbrecht is an Apache TomEE developer and PMC They all have extensive enterprise testing experience

Hands-On Microservices - Monitoring and Testing Dinesh Rajput, 2018-10-30 Learn and implement various techniques related to testing monitoring and optimization for microservices architecture Key Features Learn different approaches for testing microservices to design and implement robust and secure applications Become more efficient while working with microservices Explore Testing and Monitoring tools such as JMeter Ready API and AppDynamics Book Description Microservices are the latest right way of developing web applications Microservices architecture has been gaining momentum over the past few years but once you've started down the microservices path you need to test and optimize the services This book focuses on exploring various testing monitoring and optimization techniques for microservices The book starts with the evolution of software architecture style from monolithic to virtualized to microservices architecture Then you will explore methods to deploy microservices and various implementation patterns With the help of a real world example you will understand how external APIs help product developers to focus on core competencies After that you will learn testing techniques such as Unit Testing Integration Testing Functional Testing and Load Testing Next you will explore performance testing tools such as JMeter and Gatling Then we deep dive into monitoring techniques and learn performance benchmarking of the various architectural components For this you will explore monitoring tools such as AppDynamics Dynatrace AWS CloudWatch and Nagios Finally you will learn to identify address and report various performance issues related to microservices What you will learn Understand the architecture of microservices and how to build services Establish how external APIs help to accelerate the development process Understand testing techniques such as unit testing integration testing end to end testing and UI functional testing Explore various tools related to the performance testing monitoring and optimization of microservices Design strategies for performance testing Identify performance issues and fine tune performance Who this book is for This book is for developers who are involved with microservices architecture to develop robust and secure applications Basic knowledge of microservices is essential in order to get the most out of this book

**Bootstrapping Microservices, Second Edition** Ashley Davis, 2024-04-23 Bootstrapping Microservices Second Edition is a guide to microservices and cloud native distributed applications In it you'll learn how to configure cloud infrastructure with Terraform package microservices using Docker and deploy your finished project to a Kubernetes cluster *Spring Microservices in Action, Second Edition* John Carnell, Illary Sanchez, 2021-06-08 Spring Microservices in Action Second

Edition teaches you to build microservice based applications using Java and Spring Summary By dividing large applications into separate self contained units Microservices are a great step toward reducing complexity and increasing flexibility Spring Microservices in Action Second Edition teaches you how to build microservice based applications using Java and the Spring platform This second edition is fully updated for the latest version of Spring with expanded coverage of API routing with Spring Cloud Gateway logging with the ELK stack metrics with Prometheus and Grafana security with the Hashicorp Vault and modern deployment practices with Kubernetes and Istio Purchase of the print book includes a free eBook in PDF Kindle and ePub formats from Manning Publications About the technology Building and deploying microservices can be easy in Spring Libraries like Spring Boot Spring Cloud and Spring Cloud Gateway reduce the boilerplate code in REST based services They provide an effective toolbox to get your microservices up and running on both public and private clouds About the book Spring Microservices in Action Second Edition teaches you to build microservice based applications using Java and Spring You ll start by creating basic services then move to efficient logging and monitoring Learn to refactor Java applications with Spring s intuitive tooling and master API management with Spring Cloud Gateway You ll even deploy Spring Cloud applications with AWS and Kubernetes What s inside Microservice design principles and best practices Configuration with Spring Cloud Config and Hashicorp Vault Client side resiliency with Resilience4j and Spring Cloud Load Balancer Metrics monitoring with Prometheus and Grafana Distributed tracing with Spring Cloud Sleuth Zipkin and ELK Stack About the reader For experienced Java and Spring developers About the author John Carnell is a senior cloud engineer with 20 years of Java experience Illary Huaylupo S nchez is a software engineer with over 13 years of experience Table of Contents 1 Welcome to the cloud Spring 2 Exploring the microservices world with Spring Cloud 3 Building microservices with Spring Boot 4 Welcome to Docker 5 Controlling your configuration with the Spring Cloud Configuration Server 6 On service discovery 7 When bad things happen Resiliency patterns with Spring Cloud and Resilience4j 8 Service routing with Spring Cloud Gateway 9 Securing your microservices 10 Event driven architecture with Spring Cloud Stream 11 Distributed tracing with Spring Cloud Sleuth and Zipkin 12 Deploying your microservices

**Effective Software Testing** Maurizio Aniche,2022-05-03 Go beyond basic testing Great software testing makes the entire development process more efficient This book reveals a systemic and effective approach that will help you customize your testing coverage and catch bugs in tricky corner cases In Effective Software Testing you will learn how to Engineer tests with a much higher chance of finding bugs Read code coverage metrics and use them to improve your test suite Understand when to use unit tests integration tests and system tests Use mocks and stubs to simplify your unit testing Think of pre conditions post conditions invariants and contracts Implement property based tests Utilize coding practices like dependency injection and hexagonal architecture that make your software easier to test Write good and maintainable test code Effective Software Testing teaches you a systematic approach to software testing that will ensure the quality of your code It s full of techniques drawn from proven research in

software engineering and each chapter puts a new technique into practice Follow the real world use cases and detailed code samples and you ll soon be engineering tests that find bugs in edge cases and parts of code you d never think of testing Along the way you ll develop an intuition for testing that can save years of learning by trial and error About the technology Effective testing ensures that you ll deliver quality software For software engineers testing is a key part of the development process Mastering specification based testing boundary testing structural testing and other core strategies is essential to writing good tests and catching bugs before they hit production About the book Effective Software Testing is a hands on guide to creating bug free software Written for developers it guides you through all the different types of testing from single units up to entire components You ll also learn how to engineer code that facilitates testing and how to write easy to maintain test code Offering a thorough systematic approach this book includes annotated source code samples realistic scenarios and reasoned explanations What s inside Design rigorous test suites that actually find bugs When to use unit tests integration tests and system tests Pre and post conditions invariants contracts and property based tests Design systems that are test friendly Test code best practices and test smells About the reader The Java based examples illustrate concepts you can use for any object oriented language About the author Dr Mauricio Aniche is the Tech Academy Lead at Adyen and an Assistant Professor in Software Engineering at the Delft University of Technology Table of Contents 1 Effective and systematic software testing 2 Specification based testing 3 Structural testing and code coverage 4 Designing contracts 5 Property based testing 6 Test doubles and mocks 7 Designing for testability 8 Test driven development 9 Writing larger tests 10 Test code quality 11 Wrapping up the book

[Mastering Spring Cloud](#) Piotr Mińkowski, 2018-04-26 Learn how to build test secure deploy and efficiently consume services across distributed systems Key Features Explore the wealth of options provided by Spring Cloud for wiring service dependencies in microservice systems Create microservices utilizing Spring Cloud s Netflix OSS Architect your cloud native data using Spring Cloud Book Description Developing deploying and operating cloud applications should be as easy as local applications This should be the governing principle behind any cloud platform library or tool Spring Cloud an open source library makes it easy to develop JVM applications for the cloud In this book you will be introduced to Spring Cloud and will master its features from the application developer s point of view This book begins by introducing you to microservices for Spring and the available feature set in Spring Cloud You will learn to configure the Spring Cloud server and run the Eureka server to enable service registration and discovery Then you will learn about techniques related to load balancing and circuit breaking and utilize all features of the Feign client The book now delves into advanced topics where you will learn to implement distributed tracing solutions for Spring Cloud and build message driven microservice architectures Before running an application on Docker container s you will master testing and securing techniques with Spring Cloud What you will learn Abstract Spring Cloud s feature set Create microservices utilizing Spring Cloud s Netflix OSS Create synchronous API microservices based on a message driven architecture Explore advanced topics

such as distributed tracing security and contract testing Manage and deploy applications on the production environment Who this book is for This book appeals to developers keen to take advantage of Spring cloud an open source library which helps developers quickly build distributed systems Knowledge of Java and Spring Framework will be helpful but no prior exposure to Spring Cloud is required

**Cracking Spring Microservices Interviews** Munish Chandel,2018-02-28 This ebook discusses 100 plus real problems and their solutions for microservices architecture based on Spring Boot Spring Cloud Cloud Native Applications It covers core concepts of microservices architecture various design patterns interview questions answers security in microservices testing strategies and best practices in distributed system design Table of Contents 1 Core concepts related Spring powered microservices architecture 2 Introduction to Spring Boot Spring Cloud Cloud Native Applications Netflix OSS 3 Design Patterns in microservices architecture API Gateway Hystrix etc 4 100 plus Interview Questions 5 Security OAuth2 and JWT 6 Testing Strategies in microservices architecture 7 Best Practices and common pitfalls

**Mastering Microservices with Java** Sourabh Sharma,2016-06-30

**Enterprise Java Microservices** Kenneth Finnigan,2018-09-27 Summary Enterprise Java Microservices is an example rich tutorial that shows how to design and manage large scale Java applications as a collection of microservices Purchase of the print book includes a free eBook in PDF Kindle and ePub formats from Manning Publications About the Technology Large applications are easier to develop and maintain when you build them from small simple components Java developers now enjoy a wide range of tools that support microservices application development including right sized app servers open source frameworks and well defined patterns Best of all you can build microservices applications using your existing Java skills About the Book Enterprise Java Microservices teaches you to design and build JVM based microservices applications You ll start by learning how microservices designs compare to traditional Java EE applications Always practical author Ken Finnigan introduces big picture concepts along with the tools and techniques you ll need to implement them You ll discover ecosystem components like Netflix Hystrix for fault tolerance and master the Just enough Application Server JeAS approach To ensure smooth operations you ll also examine monitoring security testing and deploying to the cloud What s inside The microservices mental model Cloud native development Strategies for fault tolerance and monitoring Securing your finished applications About the Reader This book is for Java developers familiar with Java EE About the Author Ken Finnigan leads the Thorntail project at Red Hat which seeks to make developing microservices for the cloud with Java and Java EE as easy as possible Table of Contents PART 1 MICROSERVICES BASICS Enterprise Java microservices Developing a simple RESTful microservice Just enough Application Server for microservices Microservices testing Cloud native development PART 2 IMPLEMENTING ENTERPRISE JAVA MICROSERVICES Consuming microservices Discovering microservices for consumption Strategies for fault tolerance and monitoring Securing a microservice Architecting a microservice hybrid Data streaming with Apache Kafka

**Mastering Microservices with Java 9** Sourabh Sharma,2017-12-07 Master the art of implementing scalable

microservices in your production environment with ease About This Book Use domain driven design to build microservices Use Spring Cloud to use Service Discovery and Registration Use Kafka Avro and Spring Streams for implementing event based microservices Who This Book Is For This book is for Java developers who are familiar with the microservices architecture and now wants to take a deeper dive into effectively implementing microservices at an enterprise level A reasonable knowledge level and understanding of core microservice elements and applications is expected What You Will Learn Use domain driven design to design and implement microservices Secure microservices using Spring Security Learn to develop REST service development Deploy and test microservices Troubleshoot and debug the issues faced during development Learning best practices and common principals about microservices In Detail Microservices are the next big thing in designing scalable easy to maintain applications It not only makes app development easier but also offers great flexibility to utilize various resources optimally If you want to build an enterprise ready implementation of the microservices architecture then this is the book for you Starting off by understanding the core concepts and framework you will then focus on the high level design of large software projects You will gradually move on to setting up the development environment and configuring it before implementing continuous integration to deploy your microservice architecture Using Spring security you will secure microservices and test them effectively using REST Java clients and other tools like RxJava 2 0 We ll show you the best patterns practices and common principals of microservice design and you ll learn to troubleshoot and debug the issues faced during development We ll show you how to design and implement reactive microservices Finally we ll show you how to migrate a monolithic application to microservices based application By the end of the book you will know how to build smaller lighter and faster services that can be implemented easily in a production environment Style and approach This book starts from the basics including environment setup and provides easy to follow steps to implement the sample project using microservices [CompTIA Cloud Essentials+ Certification Study Guide, Second Edition \(Exam CLO-002\)](#) Daniel

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Implementing queries in a microservice architecture External API patterns Testing microservices part 1 Testing microservices part 2 Developing production ready services Deploying microservices Refactoring to microservices [Google Cloud Certified Professional Cloud Architect All-in-One Exam Guide](#) Iman Ghanizada,2021-02-19 Everything you need to succeed on the Google Cloud Certified Professional Cloud Architect exam in one accessible study guide Take the challenging Google Cloud Certified Professional Cloud Architect exam with confidence using the comprehensive information contained in this invaluable self study guide The book provides a thorough overview of cloud architecture and Google Cloud Platform GCP and shows you how to pass the test Beyond exam preparation the guide also serves as a valuable on the job reference Written by a recognized expert in the field Google Cloud Certified Professional Cloud Architect All In One Exam Guide is based on proven pedagogy and features special elements that teach and reinforce practical skills The book contains accurate practice questions and in depth explanations You will discover how to design develop and manage robust secure scalable and highly available solutions to drive business objectives Offers 100% coverage of every objective for the Google Cloud Certified Professional Cloud Architect exam Online content includes 100 additional practice questions in the TotalTester customizable exam engine Written by a Google Cloud Certified Professional Cloud Architect **Full Stack Development with JHipster** Deepu K. Sasidharan,Sendil Kumar N,2018 Discover the world of Full Stack Development with real world examples Key Features Leverage the full power of the JHipster platform to build complex web applications Create microservices from scratch and convert JHipster monolith apps into microservices Build and deploy applications locally in Docker and on various cloud platforms Book Description JHipster is a development platform to generate develop and deploy Spring Boot and Angular React applications and Spring microservices It provides you with a variety of tools that will help you quickly build modern web applications This book will be your guide to building full stack applications with Spring and Angular using the JHipster tool set You will begin by understanding what JHipster is and the various tools and technologies associated with it You will learn the essentials of a full stack developer before getting hands on and building a monolithic web application with JHipster From here you will learn the JHipster Domain Language with entity modeling and entity creation using JDL and JDL studio Moving on you will be introduced to client side technologies such as Angular and Bootstrap and will delve into technologies such as Spring Security Spring MVC and Spring Data You will learn to build and package apps for production with various deployment options such as Heroku and more During the course of the book you will be introduced to microservice server side technologies and how to break your monolithic application with a database of your choice Next the book takes you through cloud deployment with microservices on Docker and Kubernetes Going forward you will learn to build your client side with React and master JHipster best practices By the end of the book you will be able to leverage the power of the best tools available to build modern web applications What you will learn Build business logic by creating and developing entity models us the JHipster Domain Language Customize web applications with Angular Bootstrap and Spring

Tests and Continuous Integration with Jenkins Utilize the JHipster microservice stack which includes Netflix Eureka Spring Cloud config HashiCorp Consul and so on Understand advanced microservice concepts such as API rout load balancing rate limit circuit break centralized configuration server JWT authentication and more Run microservices locally using Docker and Kubernetes in production Who this book is for This book will appeal to developers who would like to build modern web applications quickly A basic knowledge of the Spring ecosystem would be an added advantage CCSK Certificate of Cloud Security Knowledge All-in-One Exam Guide Graham Thompson,2020-03-23 Publisher s Note Products purchased from Third Party sellers are not guaranteed by the publisher for quality authenticity or access to any online entitlements included with the product This effective study guide provides 100% coverage of every topic on the challenging CCSK exam from the Cloud Security Alliance This highly effective self study guide covers all domains of the challenging Certificate of Cloud Security Knowledge v4 exam Written by a cloud security trainer and consultant in collaboration with the Cloud Security Alliance CCSK Certificate of Cloud Security Knowledge All in One Exam Guide offers clear explanations real world examples and practice questions that match the content and format of those on the actual exam To aid in retention each chapter includes exam tips that highlight key information a review that serves as a quick recap of salient points and practice questions that allow you to test your comprehension Sample cloud policies and a glossary of key terms are also provided COVERS ALL EXAM TOPICS INCLUDING Cloud Computing Concepts and Architectures Governance and Enterprise Risk Management Legal Issues Contracts and Electronic Discovery Compliance and Audit Management Information Governance Management Plane and Business Continuity Infrastructure Security Virtualization and Containers Incident Response Application Security Data Security and Encryption Identity Entitlement and Access Management Security as a Service Related Technologies ENISA Cloud Computing Benefits Risks and Recommendations for Information Security Online content includes 120 practice exam questions Test engine that provides full length practice exams and customizable quizzes by exam topic

*Microservices with Spring Boot and Spring Cloud* Magnus Larsson,2021-07-29 A step by step guide to creating and deploying production quality microservices based applications Key FeaturesBuild cloud native production ready microservices with this comprehensively updated guideUnderstand the challenges of building large scale microservice architecturesLearn how to get the best out of Spring Cloud Kubernetes and Istio in combinationBook Description With this book you ll learn how to efficiently build and deploy microservices This new edition has been updated for the most recent versions of Spring Java Kubernetes and Istio demonstrating faster and simpler handling of Spring Boot local Kubernetes clusters and Istio installation The expanded scope includes native compilation of Spring based microservices support for Mac and Windows with WSL2 and an introduction to Helm 3 for packaging and deployment A revamped security chapter now follows the OAuth 2.1 specification and makes use of the newly launched Spring Authorization Server from the Spring team Starting with a set of simple cooperating microservices you ll add persistence and resilience make your microservices

reactive and document their APIs using OpenAPI You ll understand how fundamental design patterns are applied to add important functionality such as service discovery with Netflix Eureka and edge servers with Spring Cloud Gateway You ll learn how to deploy your microservices using Kubernetes and adopt Istio You ll explore centralized log management using the Elasticsearch Fluentd and Kibana EFK stack and monitor microservices using Prometheus and Grafana By the end of this book you ll be confident in building microservices that are scalable and robust using Spring Boot and Spring Cloud What you will learn Build reactive microservices using Spring Boot Develop resilient and scalable microservices using Spring Cloud Use OAuth 2 1 OIDC and Spring Security to protect public APIs Implement Docker to bridge the gap between development testing and production Deploy and manage microservices with Kubernetes Apply Istio for improved security observability and traffic management Write and run automated microservice tests with JUnit testcontainers Gradle and bash Who this book is for If you are a Java or Spring Boot developer who wants to learn how to build microservice landscapes from scratch this book is for you No familiarity with microservices architecture is required

*Principles of Computer Security: CompTIA Security+ and Beyond, Sixth Edition (Exam SY0-601)* Wm. Arthur Conklin, Greg White, Chuck Cothren, Roger L. Davis, Dwayne Williams, 2021-07-29 Fully updated computer security essentials mapped to the CompTIA Security SY0 601 exam Save 10% on any CompTIA exam voucher Coupon code inside Learn IT security fundamentals while getting complete coverage of the objectives for the latest release of CompTIA Security certification exam SY0 601 This thoroughly revised full color textbook covers how to secure hardware systems and software It addresses new threats and cloud environments and provides additional coverage of governance risk compliance and much more Written by a team of highly respected security educators Principles of Computer Security CompTIA Security TM and Beyond Sixth Edition Exam SY0 601 will help you become a CompTIA certified computer security expert while also preparing you for a successful career Find out how to Ensure operational organizational and physical security Use cryptography and public key infrastructures PKIs Secure remote access wireless networks and virtual private networks VPNs Authenticate users and lock down mobile devices Harden network devices operating systems and applications Prevent network attacks such as denial of service spoofing hijacking and password guessing Combat viruses worms Trojan horses and rootkits Manage e mail instant messaging and web security Explore secure software development requirements Implement disaster recovery and business continuity measures Handle computer forensics and incident response Understand legal ethical and privacy issues Online content features Test engine that provides full length practice exams and customized quizzes by chapter or exam objective Each chapter includes Learning objectives Real world examples Try This and Cross Check exercises Tech Tips Notes and Warnings Exam Tips End of chapter quizzes and lab projects

Testing Practitioner Handbook Renu Rajani, 2017-03-22 Gain insights into the latest technology and business trends within testing domains About This Book This book covers the latest trends that every Testing and QA professional should keep up to date with given the advancements in digital technologies Master cutting edge testing

techniques for emerging areas such as IOT Machine Learning Cognitive Best practices for Testing and Quality Assurance within several industry domains Who This Book Is For This book is targeted at those working in the QA and Testing areas The book does not cover testing basics which QA professional are already familiar with for example writing a test plan or test case and so on What You Will Learn Understand the TCOE model managed services the structure of testing in Agile DevOps engagements factory models and crowdsourcing Implement testing processes practices and automation tools in the Agile DevOps life cycle Adapt to current technologies in social media mobile analytics and the Cloud Leverage cognitive intelligence machine learning robotics and the Internet of Things in testing How key industries domains consumer products and retail energy and utilities healthcare telecom and automotive adapt to digital transformation Future directions for the QA industry consulting careers testing profession and professionals In Detail The book is based on the author s experience in leading and transforming large test engagements and architecting solutions for customer testing requirements bids problem areas It targets the testing practitioner population and provides them with a single go to place to find perspectives practices trends tools and solutions to test applications as they face the evolving digital world This book is divided into five parts where each part explores different aspects of testing in the real world The first module explains the various testing engagement models You will then learn how to efficiently test code in different life cycles The book discusses the different aspects of Quality Analysis consideration while testing social media mobile analytics and the Cloud In the last module you will learn about futuristic technologies to test software By the end of the book you will understand the latest business and IT trends in digital transformation and learn the best practices to adopt for business assurance Style and approach This book is a compilation of the latest business and IT trends in digital transformation Tools and Best Practices that QA professionals need to adopt for business assurance

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