Microservices, IoT, and Azure

Leveraging DevOps and Microservice Architecture to Deliver SaaS Solutions

Bob Familiar
I dedicate this book to my incredible wife, Mandy, who is a continuous stream of inspiration and to my children, Ariana and Bobby, who never cease to amaze me with their talent, insight, and intelligence.
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About the Author

**Bob Familiar** is the Practice Director for Cloud & Services at BlueMetal. BlueMetal is a Modern Application company and the Cloud & Services team is a practitioner of lean engineering, a high velocity product development process that applies lean methodology, service-oriented patterns and practices, automation, and cloud platform capabilities for the design and development of modern applications.

Bob Familiar has been in the software industry for 30 years, having worked for both ISVs such as Dunn & Bradstreet Software and ON Technology and for Microsoft as a Principal Consultant, Architect Evangelist, and Director of Technology Evangelism. Bob holds a Masters in Computer Science from Northeastern and a patent for Object Relational Database and Distributed Computing.
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I would like to thank Liam Spaeth, who has dedicated his life to both inspiring me with his creativity and keeping me employed for the past 20 years, and the leadership team at BlueMetal, Scott Jamison and Matt Jackson, for their support and encouragement.

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Finally, I would like to thank Ron Bokleman, my PowerShell Sensei, who was instrumental in the creation of the automation scripts for the reference implementation.
Microservices, IoT, and Azure make the case for adopting a high velocity, continuous delivery process to create reliable, scalable Software as a Service solutions that are designed and built using a microservice architecture, deployed to the Azure cloud, and managed through automation. SaaS applications are software products that are available 24x7, work on any device, scale elastically, and are resilient to change. This book provides software developers, architects, and operations engineers with practical guidance on this approach to software development through code, script, exercises, and a working reference implementation.

A working definition of microservices will be presented, and the approach will be contrasted with traditional, monolithic, layered architecture. A reference implementation for a fictitious home-biomedical startup will be used to demonstrate microservice architecture and automation capabilities for cross-cutting and business services as well as connected device scenarios for Internet of Things (IoT). Several Azure PaaS services will be detailed including storage, SQL Database, DocumentDb, Redis Cache, Cloud Services, Web APIs, API management, IoT Hub, IoT Suite, Event Hub, Stream Analytics. Finally, we will look to the future and examine Service Fabric to see how microservices are becoming the de facto approach to building reliable software in the cloud.

The Reference Implementation

The Reference Implementation provides automation scripts and source code for several microservices along with several client applications that play various roles in the context of the solution. The PowerShell scripts automate the provisioning, build, and deployment tasks that get the Home Biomedical solution up and running in Azure. In order to control costs of running the reference implementation, deprovisioning scripts are also provided.

The reference implementation consists of several independent microservices built using C#, ASP.NET Web API, DocumentDb, and Redis Cache and deployed as Azure websites. In addition, there is an IoT subsystem that is built using Event Hub, Stream Analytics, Cloud Services, and SQL Database. There is a sample real-time data visualization client that demonstrates how to orchestrate the microservices into a complete solution.

Viewed as a whole, the Reference Implementation demonstrates how to use several Azure PaaS services along with custom code and automation scripts to create a complete, modern application.
You will learn...

The combination of the book and the reference implementation provide a resource to learn the following:

- What microservices are and why they are a compelling architecture pattern for SaaS applications
- How to design, develop, and deploy microservices using Visual Studio, PowerShell, and Azure
- Microservice patterns for cross-cutting concerns and business capabilities
- Microservice patterns for Internet of Things and big data analytics solutions using IoT Hub, Event Hub, and Stream Analytics
- Techniques for automating microservice provisioning, build, and deployment
- What Service Fabric is and why it is the future direction for microservices on Microsoft Azure

**Chapter 1: From Monolithic to Microservice** - Shifting demographics and competitive pressure on business to drive impact at velocity is requiring us to evolve our approach to how we develop, deploy, and support our software products. This chapter lays out a roadmap to evolve not only application architecture but also process and organization.

**Chapter 2: What Is a Microservice?** - This chapter provides a working definition of microservices and details the benefits as well as the challenges to evolving to this architecture pattern.

**Chapter 3: Microservice Architecture** - Traditionally, we have used separation of concerns, a design principle for separating implementation into distinct layers in order to define horizontal seams in our application architecture. Microservice architecture applies separation of concern to identify vertical seams that define their isolation and autonomous nature. This chapter will compare and contrast microservice architecture with traditional layered architecture.

**Chapter 4: Azure - A Microservice Platform** - The Azure platform exudes characteristics of microservices. This chapter examines several Azure services to identify common patterns of services that are designed and implemented using microservices. Storage, SQL Database, DocumentDb, Redis Cache, Service Bus, API management, and app containers are reviewed.

**Chapter 5: Automation** - Automation is the key to being able to evolve to a continuous delivery approach and realize the benefits of SaaS. This chapter outlines a framework for defining and organizing your automation process and takes you through 10 exercises that will provision, build, and deploy the reference implementation using PowerShell.
**Chapter 6: Microservice Reference Implementation** - The epic story of Home Biomedical, a wholly owned subsidiary of LooksFamiliar, Inc., is detailed, and the implementation details of the reference microservices are revealed. The common libraries for ReST calls and DocumentDb and Redis Cache for data access are reviewed. Designing for both public and management APIs is discussed along with the implementation details for the model, interface, service, API, SDK, and console components.

**Chapter 7: IoT and Microservices** - IoT is becoming a more common solution pattern as we learn to incorporate streaming data into our solutions. This chapter outlines the capabilities needed to realize an IoT solution and maps them to the Azure IoT stack. IoT Hub, IoT Suite, Event Hub, and Stream Analytics are detailed, as is how to use Event Hub, Cloud Services, and Notification Hub to support mobile alerts. A working example of data visualization using a JavaScript client along with SignalR, ReST, and SQL Database is reviewed.

**Chapter 8: Service Fabric** - Service Fabric is the microservice management, runtime, and infrastructure that Microsoft uses to build, deploy, and manage their own first-class cloud services such as SQL Database, DocumentDb, Bing Cortana, Halo Online, Skype for Business, In Tune, Event Hubs, and many others. This chapter provides a primer and demonstrates Service Fabric by migrating one of the Web API microservices to Service Fabric.