

# the big book of data engineering

The Big Book of Data Engineering: Unlocking the Power of Data Pipelines and Infrastructure

**the big book of data engineering** is more than just a catchy title—it represents a comprehensive dive into the art and science of managing, processing, and transforming data at scale. In today's data-driven world, understanding data engineering is essential for building robust systems that fuel analytics, machine learning, and business intelligence. Whether you're a beginner trying to grasp the fundamentals or a seasoned professional looking to refine your skills, exploring the concepts encapsulated in the big book of data engineering can open up new perspectives on how data shapes modern technology.

## Why Data Engineering Matters in the Modern Data Ecosystem

Data engineering forms the backbone of any data-centric organization. While data scientists and analysts often take the spotlight for deriving insights, it's the data engineers who build and maintain the pipelines that enable timely, accurate, and scalable data flow.

Without efficient data engineering practices, organizations face challenges like data silos, unreliable datasets, and slow processing times. The big book of data engineering addresses these issues by emphasizing best practices for designing data architectures, automating workflows, and ensuring data quality.

## The Role of Data Pipelines

At the core of data engineering lies the data pipeline—a series of steps that ingest, transform, and deliver data to various destinations. These pipelines can be as simple as batch jobs running nightly or as complex as real-time streaming systems processing millions of events per second.

Understanding how to architect resilient and scalable pipelines is a key focus area in the big book of data engineering. This includes learning about ETL (Extract, Transform, Load) versus ELT (Extract, Load, Transform) strategies, choosing the right tools, and monitoring pipeline health to prevent data loss or corruption.

## Essential Components Covered in the Big Book of Data Engineering

Data engineering is a multidisciplinary field, touching on aspects of software engineering, database

management, distributed computing, and cloud infrastructure. The big book of data engineering breaks down these components into digestible parts.

## **Data Storage and Databases**

One of the fundamental topics is data storage. Engineers need to decide between various storage options such as relational databases, NoSQL stores, data lakes, and data warehouses. Each has its use cases, advantages, and limitations.

For instance, data warehouses like Snowflake or Amazon Redshift are optimized for analytical queries, while data lakes built on platforms like Hadoop or AWS S3 excel at storing vast amounts of raw data. The big book of data engineering helps readers understand how to select and integrate these storage solutions effectively.

## **Data Processing Frameworks**

Processing large volumes of data efficiently requires specialized frameworks. The big book of data engineering covers popular distributed computing tools such as Apache Spark, Apache Flink, and Google Cloud Dataflow. These platforms enable parallel processing, fault tolerance, and scalability.

Learning how to write optimized code for these frameworks, manage cluster resources, and handle data skew or late arrivals is crucial for engineering teams aiming to build high-performance pipelines.

## **Modern Data Engineering Tools and Technologies**

Technology evolves rapidly, and the big book of data engineering keeps pace by introducing contemporary tools that simplify complex tasks.

## **Orchestration and Workflow Management**

Managing multiple interdependent tasks in a data pipeline requires orchestration tools. Apache Airflow, Prefect, and Dagster are some of the popular platforms that automate scheduling, retries, and dependencies.

The book explains how to design workflows that are both flexible and maintainable, enabling teams to adapt pipelines as business requirements change without significant downtime.

# Cloud Platforms and Serverless Architectures

Cloud computing has revolutionized data engineering by offering scalable infrastructure on demand. AWS, Azure, and Google Cloud provide services tailored for data storage, processing, and analytics.

One of the exciting trends highlighted in the big book of data engineering is serverless computing, where infrastructure management is abstracted away, allowing engineers to focus on writing code and defining data flows. Understanding how to leverage these cloud-native tools can drastically reduce operational overhead.

## Best Practices and Tips from the Big Book of Data Engineering

Beyond tools and technologies, the big book of data engineering shares valuable insights into building reliable and maintainable data systems.

- **Emphasize Data Quality:** Implement validation checks and monitoring to catch anomalies early.
- **Design for Scalability:** Anticipate growth in data volume and complexity by choosing scalable architectures.
- **Automate Everything:** From deployment to testing and monitoring, automation reduces human error and speeds up delivery.
- **Collaborate Across Teams:** Data engineering often intersects with data science, analytics, and business teams; fostering communication is key.
- **Document Thoroughly:** Clear documentation ensures knowledge transfer and helps new team members ramp up quickly.

These principles help teams avoid common pitfalls and create data infrastructure that stands the test of time.

## Handling Data Security and Compliance

The big book of data engineering also stresses the importance of securing data environments. With increasing regulations like GDPR and CCPA, engineers must incorporate encryption, access controls, and auditing into their workflows to protect sensitive information.

Practices such as data masking, role-based access, and regular compliance checks are essential components of a mature data engineering strategy.

## Real-World Applications and Case Studies

One of the most engaging aspects of the big book of data engineering is its exploration of real-world scenarios where data engineering transforms industries.

For example, in e-commerce, data pipelines enable personalized recommendations by processing customer behavior in near real-time. In finance, robust data infrastructure supports fraud detection systems that analyze transaction patterns rapidly and accurately.

By studying these examples, data engineers can grasp how theoretical concepts translate into impactful solutions, inspiring innovative approaches in their own projects.

## Building a Career in Data Engineering

For those intrigued by the big book of data engineering and considering a career in this dynamic field, a few pointers can smooth the journey:

1. **Master Programming Languages:** Python and SQL are foundational, with Scala or Java beneficial for certain frameworks.
2. **Understand Cloud Ecosystems:** Familiarity with AWS, GCP, or Azure is increasingly expected.
3. **Gain Hands-on Experience:** Building personal projects or contributing to open-source pipelines enhances practical skills.
4. **Stay Curious:** The tech landscape changes rapidly; continuous learning is vital.

The big book of data engineering serves as both a guide and inspiration for those navigating this evolving landscape.

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Exploring the big book of data engineering reveals a rich and intricate world where technology meets creativity to solve complex data challenges. Through a blend of conceptual frameworks, practical tools, and

real-life examples, it empowers readers to build data systems that not only function efficiently but also drive meaningful business outcomes. Whether refining existing skills or starting fresh, diving into this comprehensive resource equips data professionals to harness the full potential of data engineering.

## **Frequently Asked Questions**

### **What is 'The Big Book of Data Engineering' about?**

'The Big Book of Data Engineering' is a comprehensive guide that covers essential concepts, tools, and best practices in data engineering, aiming to help both beginners and experienced professionals build scalable and efficient data systems.

### **Who is the target audience for 'The Big Book of Data Engineering'?**

The book is targeted at data engineers, software engineers, data scientists, and anyone interested in learning about data infrastructure, data pipelines, and data management techniques.

### **Does 'The Big Book of Data Engineering' cover cloud data engineering tools?**

Yes, the book includes detailed sections on popular cloud platforms and tools such as AWS, Google Cloud, and Azure, explaining how to leverage cloud services for data storage, processing, and orchestration.

### **Are there practical examples and case studies included in 'The Big Book of Data Engineering'?**

Absolutely, the book provides numerous practical examples, real-world case studies, and hands-on exercises to help readers better understand and apply data engineering concepts.

### **How does 'The Big Book of Data Engineering' address data pipeline orchestration?**

The book discusses various orchestration tools like Apache Airflow, Prefect, and Dagster, explaining how to design, schedule, and monitor complex data pipelines effectively.

### **Is programming knowledge required to benefit from 'The Big Book of Data Engineering'?**

While some programming knowledge, especially in Python and SQL, is beneficial, the book is structured to gradually introduce technical concepts, making it accessible to those with a basic understanding who wish

to deepen their skills.

## Additional Resources

The Big Book of Data Engineering: A Definitive Exploration of Modern Data Practices

**the big book of data engineering** represents more than just a title; it embodies the expansive and evolving landscape of data engineering as a discipline. As organizations increasingly rely on data-driven decision-making, the demand for structured, scalable, and efficient data pipelines has surged. This comprehensive body of knowledge encapsulates the multifaceted challenges and solutions that data engineers face, from ingestion and storage to processing and analytics. Exploring this subject through a professional lens reveals the intricacies of contemporary data ecosystems and the tools that power them.

## Understanding the Scope of The Big Book of Data Engineering

Data engineering, at its core, involves designing and managing systems that collect, transform, and distribute data across an organization. The big book of data engineering is a metaphorical reference to the vast array of concepts, technologies, and methodologies that enable these processes. It covers everything from foundational principles to cutting-edge innovations in big data, cloud computing, and real-time analytics.

This expansive scope underscores the necessity for data engineers to possess a diverse skill set. Mastery over database architectures, ETL (Extract, Transform, Load) workflows, data warehousing, and pipeline orchestration is essential. Furthermore, expertise in programming languages such as Python, Scala, or Java, combined with proficiency in frameworks like Apache Spark or Apache Kafka, distinguishes effective practitioners.

## The Evolution of Data Engineering Practices

Historically, data engineering was closely tied to traditional database management and batch processing. However, the explosion of data volume and velocity has transformed the landscape dramatically. The big book of data engineering now includes real-time processing, distributed computing, and cloud-native architectures as fundamental components.

Cloud platforms like AWS, Azure, and Google Cloud have become pivotal, offering scalable storage solutions such as Amazon S3 and Google BigQuery. These services enable data engineers to handle petabytes of data seamlessly while optimizing costs and performance. Moreover, containerization and orchestration technologies like Docker and Kubernetes have revolutionized deployment and scalability, aspects that are

critical in modern data engineering strategies.

## **Key Components and Technologies Featured in The Big Book of Data Engineering**

The comprehensive nature of the big book of data engineering is reflected in its coverage of diverse tools and platforms. Understanding these components is vital for grasping the full picture of data engineering workflows.

### **Data Ingestion and Integration**

Efficient data ingestion is the foundation of any data engineering project. The big book of data engineering highlights technologies such as Apache NiFi, Kafka Connect, and cloud-native ingestion services that facilitate seamless data flow from various sources, including databases, APIs, and streaming platforms.

Integration challenges, including data format heterogeneity and schema evolution, are addressed through robust solutions like schema registries and data serialization formats (e.g., Avro, Parquet). These tools ensure consistency and compatibility across complex pipelines.

### **Data Storage and Warehousing**

Choosing the right storage solution is pivotal. The big book of data engineering discusses the trade-offs between relational databases, NoSQL stores, and data lakes. Relational databases like PostgreSQL excel in transactional integrity but may falter under massive scale, whereas NoSQL databases such as Cassandra offer horizontal scalability with flexible schemas.

Data warehouses, including Snowflake and Redshift, are emphasized for their ability to support analytical queries efficiently. The integration of data lakes allows organizations to store raw data inexpensively, enabling more flexible downstream processing.

### **Data Processing and Pipeline Orchestration**

Processing massive datasets requires distributed computing frameworks. Apache Spark's in-memory processing and scalability make it a staple in the big book of data engineering. Additionally, stream-processing tools like Apache Flink and Kafka Streams are critical for real-time analytics.

Orchestration frameworks such as Apache Airflow and Prefect automate and monitor complex workflows, ensuring data pipelines run reliably and are maintainable. These tools help manage dependencies, retries, and scheduling, which are essential for operational excellence.

## Challenges and Considerations in Data Engineering

The big book of data engineering does not shy away from discussing the challenges that practitioners face. Data quality, pipeline reliability, and scalability are recurrent themes that require strategic planning and continuous improvement.

- **Data Quality Management:** Inaccurate or inconsistent data undermines business intelligence. Techniques like data validation, cleansing, and anomaly detection are critical.
- **Scalability:** Systems must adapt to growing data volumes without sacrificing performance. This involves leveraging cloud elasticity and efficient resource management.
- **Security and Compliance:** Protecting sensitive data and adhering to regulations such as GDPR or HIPAA is paramount, requiring encryption, access control, and auditing.
- **Monitoring and Observability:** Proactive monitoring ensures prompt detection of pipeline failures or performance bottlenecks, often implemented through logging and alerting systems.

## Balancing Build vs. Buy Decisions

A critical consideration explored in the big book of data engineering is whether to build custom solutions or adopt off-the-shelf platforms. While bespoke systems offer tailored functionality, commercial and open-source tools provide accelerated development and community support. Organizations must weigh factors such as cost, time-to-market, and long-term maintenance when making these choices.

## Emerging Trends Captured in The Big Book of Data Engineering

As data engineering evolves, the big book of data engineering continually incorporates emerging trends shaping the future.



## **Data Mesh and Decentralized Architectures**

The concept of data mesh advocates decentralizing data ownership, enabling domain teams to manage their own data products. This paradigm shift addresses bottlenecks in centralized data teams and promotes scalability and agility.

## **Automation and AI Integration**

Automation of data pipelines using machine learning for anomaly detection or predictive maintenance is gaining traction. AI-driven data engineering tools can optimize resource allocation and detect pipeline inefficiencies proactively.

## **Serverless Data Engineering**

Serverless computing models reduce infrastructure overhead, allowing data engineers to focus more on logic than on managing servers. Services like AWS Lambda and Google Cloud Functions integrate well with data processing workflows.

## **The Big Book of Data Engineering as a Learning Resource**

For professionals and organizations seeking to build or enhance data engineering capabilities, the metaphorical big book of data engineering serves as an invaluable guide. It consolidates best practices, architectural patterns, and case studies that illuminate the path from raw data to actionable insights.

Training programs, certifications, and community-driven knowledge bases complement this body of work, helping practitioners stay current in a fast-moving field. Incorporating hands-on experience with tools and technologies discussed ensures a practical understanding that theoretical knowledge alone cannot provide.

In essence, the big book of data engineering is less a single volume and more a continuously expanding compendium of the collective expertise driving modern data infrastructure. Its relevance persists as data continues to underpin innovation and competitive advantage across industries.

## **[The Big Book Of Data Engineering](#)**

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**the big book of data engineering: Kubernetes for Data Engineers: Orchestrating Big Data and AI Pipelines 2025** Author:1- KARAN SINGH ALANG, Author:1- Dr RUPESH MISHRA, PREFACE In today's rapidly evolving world of data engineering, the need for scalable, efficient, and reliable infrastructure has never been more critical. With the advent of big data, artificial intelligence (AI), and machine learning (ML), the complexity of managing and deploying sophisticated data pipelines has grown exponentially. Enter Kubernetes, the open-source platform that has redefined how applications are deployed, scaled, and managed across a distributed environment. Kubernetes for Data Engineers: Orchestrating Big Data and AI Pipelines is written for data engineers, architects, and technologists who seek to leverage the power of Kubernetes in the realm of data processing and AI/ML workflows. This book serves as a practical guide for mastering the skills necessary to efficiently manage large-scale data workloads, while also offering insights into Kubernetes' core features and its application to data-intensive tasks. Throughout this book, we explore how Kubernetes can help streamline the deployment, management, and scaling of big data technologies and AI/ML pipelines, enabling you to manage diverse tools like Hadoop, Spark, TensorFlow, and more, all within a Kubernetes environment. By adopting Kubernetes' orchestration and automation capabilities, data engineers can drive performance, reduce overhead, and ensure resilience across the data processing lifecycle. In addition to covering fundamental Kubernetes concepts, we will also dive deep into the specific challenges faced by data engineers and how Kubernetes addresses them. From managing containerized services for distributed systems to automating data pipelines, this book will walk you through hands-on examples, case studies, and best practices to ensure you can effectively apply these concepts in your own projects. As data engineering becomes more intricate and interwoven with AI-driven innovations, the demand for Kubernetes skills will continue to rise. Whether you are already familiar with Kubernetes or just beginning to

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any data environment regardless of the underlying technology. This book will help you: Assess data engineering problems using an end-to-end data framework of best practices Cut through marketing hype when choosing data technologies, architecture, and processes Use the data engineering lifecycle to design and build a robust architecture Incorporate data governance and security across the data engineering lifecycle. - from Publisher.

**the big book of data engineering: Data Engineering with AWS** Gareth Eagar, 2023-10-31  
Looking to revolutionize your data transformation game with AWS? Look no further! From strong foundations to hands-on building of data engineering pipelines, our expert-led manual has got you covered. Key Features Delve into robust AWS tools for ingesting, transforming, and consuming data, and for orchestrating pipelines Stay up to date with a comprehensive revised chapter on Data Governance Build modern data platforms with a new section covering transactional data lakes and data mesh Book Description This book, authored by a seasoned Senior Data Architect with 25 years of experience, aims to help you achieve proficiency in using the AWS ecosystem for data engineering. This revised edition provides updates in every chapter to cover the latest AWS services and features, takes a refreshed look at data governance, and includes a brand-new section on building modern data platforms which covers; implementing a data mesh approach, open-table formats (such as Apache Iceberg), and using DataOps for automation and observability. You'll begin by reviewing the key concepts and essential AWS tools in a data engineer's toolkit and getting acquainted with modern data management approaches. You'll then architect a data pipeline, review raw data sources, transform the data, and learn how that transformed data is used by various data consumers. You'll learn how to ensure strong data governance, and about populating data marts and data warehouses along with how a data lakehouse fits into the picture. After that, you'll be introduced to AWS tools for analyzing data, including those for ad-hoc SQL queries and creating visualizations. Then, you'll explore how the power of machine learning and artificial intelligence can be used to draw new insights from data. In the final chapters, you'll discover transactional data lakes, data meshes, and how to build a cutting-edge data platform on AWS. By the end of this AWS book, you'll be able to execute data engineering tasks and implement a data pipeline on AWS like a pro! What you will learn Seamlessly ingest streaming data with Amazon Kinesis Data Firehose Optimize, denormalize, and join datasets with AWS Glue Studio Use Amazon S3 events to trigger a Lambda process to transform a file Load data into a Redshift data warehouse and run queries with ease Visualize and explore data using Amazon QuickSight Extract sentiment data from a dataset using Amazon Comprehend Build transactional data lakes using Apache Iceberg with Amazon Athena Learn how a data mesh approach can be implemented on AWS Who this book is for This book is for data engineers, data analysts, and data architects who are new to AWS and looking to extend their skills to the AWS cloud. Anyone new to data engineering who wants to learn about the foundational concepts, while gaining practical experience with common data engineering services on AWS, will also find this book useful. A basic understanding of big data-related topics and Python coding will help you get the most out of this book, but it's not a prerequisite. Familiarity with the AWS console and core services will also help you follow along.

**the big book of data engineering: Data Engineering on the Cloud: A Practical Guide 2025** Raghu Gopa, Dr. Arpita Roy, PREFACE The digital transformation of businesses and the exponential growth of data have created a fundamental shift in how organizations approach data management, analytics, and decision-making. As cloud technologies continue to evolve, cloud-based data engineering has become central to the success of modern data-driven enterprises. "Data Engineering on the Cloud: A Practical Guide" aims to equip data professionals, engineers, and organizations with the knowledge and practical tools needed to build and manage scalable, secure, and efficient data engineering pipelines in cloud environments. This book is designed to bridge the gap between the theoretical foundations of data engineering and the practical realities of working with cloud-based data platforms. Cloud computing has revolutionized data storage, processing, and analytics by offering unparalleled scalability, flexibility, and cost efficiency. However, with these opportunities come new challenges, including selecting the right tools, architectures, and strategies

to ensure seamless data integration, transformation, and delivery. As businesses increasingly migrate their data to the cloud, it is essential for data engineers to understand how to leverage the capabilities of the cloud to build robust data pipelines that can handle large, complex datasets in real-time. Throughout this guide, we will explore the various facets of cloud-based data engineering, from understanding cloud storage and computing services to implementing data integration techniques, managing data quality, and optimizing performance. Whether you are building data pipelines from scratch, migrating on-premises systems to the cloud, or enhancing existing data workflows, this book will provide actionable insights and step-by-step guidance on best practices, tools, and frameworks commonly used in cloud data engineering. Key topics covered in this book include:

- The fundamentals of cloud architecture and the role of cloud providers (such as AWS, Google Cloud, and Microsoft Azure) in data engineering workflows.
- Designing scalable and efficient data pipelines using cloud-based tools and services.
- Integrating diverse data sources, including structured, semi-structured, and unstructured data, for seamless processing and analysis.
- Data transformation techniques, including ETL (Extract, Transform, Load) and ELT (Extract, Load, Transform), in cloud environments.
- Ensuring data quality, governance, and security when working with cloud data platforms.
- Optimizing performance for data storage, processing, and analytics to handle growing data volumes and complexity.

This book is aimed at professionals who are already familiar with data engineering concepts and are looking to apply those concepts within cloud environments. It is also suitable for organizations that are in the process of migrating to cloud-based data platforms and wish to understand the nuances and best practices for cloud data engineering. In addition to theoretical knowledge, this guide emphasizes hands-on approaches, providing practical examples, code snippets, and real-world case studies to demonstrate the effective implementation of cloud-based data engineering solutions. We will explore how to utilize cloud-native services to streamline workflows, improve automation, and reduce manual interventions in data pipelines. Throughout the book, you will gain insights into the evolving tools and technologies that make data engineering more agile, reliable, and efficient. The role of data engineering is growing ever more important in enabling businesses to unlock the value of their data. By the end of this book, you will have a comprehensive understanding of how to leverage cloud technologies to build high-performance, scalable data engineering solutions that are aligned with the needs of modern data-driven organizations. We hope this guide helps you to navigate the complexities of cloud data engineering and helps you unlock new possibilities for your data initiatives. Welcome to “Data Engineering on the Cloud: A Practical Guide.” Let’s embark on this journey to harness the full potential of cloud technologies in the world of data engineering. Authors

**the big book of data engineering: Introduction to Data Engineering** Dr. RVS Praveen , 2024-09-23 Data engineering is a rapidly evolving discipline at the heart of every data-driven organization. It involves designing, building, and managing data infrastructure, ensuring the seamless flow of data across various systems, and making data accessible for analysis and business intelligence. This book is designed to provide a comprehensive introduction to data engineering, from foundational concepts to advanced practices. The first part of the book covers the core principles of data engineering, including data modeling, data integration, and the architecture of modern data systems. As you progress, you will delve into the tools and technologies that data engineers use daily, such as SQL, cloud platforms, big data technologies, and data lakes. A significant focus is placed on building scalable, efficient, and reliable data pipelines that enable organizations to harness the full potential of their data. Throughout, the book emphasizes practical learning, with real-world examples and exercises that help readers grasp the complexities of data engineering in a hands-on manner. Whether you're new to the field or looking to deepen your expertise, this book provides a roadmap for mastering the key skills required to excel in data engineering and contribute to building robust data architectures.

**the big book of data engineering: Data Engineering with AWS Cookbook** Trâm Ngọc Phạm, Gonzalo Herreros González, Viquar Khan, Huda Nofal, 2024-11-29 Master AWS data engineering services and techniques for orchestrating pipelines, building layers, and managing

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**the big book of data engineering: *Data Engineering Best Practices*** Richard J. Schiller, David Larochelle, 2024-10-11 Explore modern data engineering techniques and best practices to build scalable, efficient, and future-proof data processing systems across cloud platforms Key Features Architect and engineer optimized data solutions in the cloud with best practices for performance and cost-effectiveness Explore design patterns and use cases to balance roles, technology choices, and processes for a future-proof design Learn from experts to avoid common pitfalls in data engineering projects Purchase of the print or Kindle book includes a free PDF eBook Book Description Revolutionize your approach to data processing in the fast-paced business landscape with this essential guide to data engineering. Discover the power of scalable, efficient, and secure data solutions through expert guidance on data engineering principles and techniques. Written by two industry experts with over 60 years of combined experience, it offers deep insights into best practices, architecture, agile processes, and cloud-based pipelines. You'll start by defining the challenges data engineers face and understand how this agile and future-proof comprehensive data solution architecture addresses them. As you explore the extensive toolkit, mastering the capabilities of various instruments, you'll gain the knowledge needed for independent research. Covering everything you need, right from data engineering fundamentals, the guide uses real-world examples to illustrate potential solutions. It elevates your skills to architect scalable data systems, implement agile development processes, and design cloud-based data pipelines. The book further equips you with the knowledge to harness serverless computing and microservices to build resilient data applications. By the end, you'll be armed with the expertise to design and deliver high-performance data engineering solutions that are not only robust, efficient, and secure but also future-ready. What you will learn Architect scalable data solutions within a well-architected framework Implement agile software development processes tailored to your organization's needs Design cloud-based data pipelines for analytics, machine learning, and AI-ready data products Optimize data engineering

capabilities to ensure performance and long-term business value Apply best practices for data security, privacy, and compliance Harness serverless computing and microservices to build resilient, scalable, and trustworthy data pipelines Who this book is for If you are a data engineer, ETL developer, or big data engineer who wants to master the principles and techniques of data engineering, this book is for you. A basic understanding of data engineering concepts, ETL processes, and big data technologies is expected. This book is also for professionals who want to explore advanced data engineering practices, including scalable data solutions, agile software development, and cloud-based data processing pipelines.

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