

1. Introduction to Apache Airflow
  - Overview of workflow management systems
  - Introduction to Apache Airflow
  - Key features and benefits
  - Use cases
2. Installation and Setup
  - System requirements
  - Installation methods (pip, Docker, etc.)
  - Configuration options
  - Initializing Airflow database
  - Setting up Airflow web server and scheduler
3. Core Concepts
  - Directed Acyclic Graphs (DAGs)
  - Operators and Tasks
  - Sensors
  - Executors
  - Hooks and Connections
  - XComs
  - Variables

#### Hands-On Lab: Installation and Basic Setup

- Install Airflow
  - Configure Airflow
  - Initialize Airflow database
  - Start Airflow web server and scheduler
  - Create a simple DAG and run it
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4. Writing and Managing Workflows
    - Creating a DAG
    - Defining tasks with operators
    - Setting task dependencies
    - Templating with Jinja
    - Scheduling and triggering workflows
  5. Advanced Airflow Features
    - SubDAGs and TaskGroups
    - Branching and Conditional Logic
    - Trigger Rules
    - Managing Dependencies Dynamically

- Cross-DAG Dependencies

#### Hands-On Lab: Workflow Development

- Create complex DAGs with multiple tasks
- Implement branching and conditional logic
- Manage dynamic task dependencies
- Explore cross-DAG dependencies

#### 6. Monitoring and Troubleshooting

- Logging and Alerts
- Monitoring DAG runs and task instances
- Retries and Failures
- Scaling Airflow for Production
- Performance optimization

#### 7. Deployment and Integration

- High Availability and Fault Tolerance
- Security Best Practices
- Integration with External Systems (Databases, Cloud Services, etc.)
- Managing Airflow deployments in different environments

#### Hands-On Lab: Monitoring, Troubleshooting, and Deployment

- Configure logging and alerts
- Monitor DAG runs and task instances
- Handle retries and failures
- Deploy Airflow in a production-like environment
- Integrate Airflow with external systems

#### 8. Airflow Ecosystem

- Introduction to Apache Airflow Providers
- Overview of Airflow-related tools and projects
- Comparison with other workflow orchestration tools