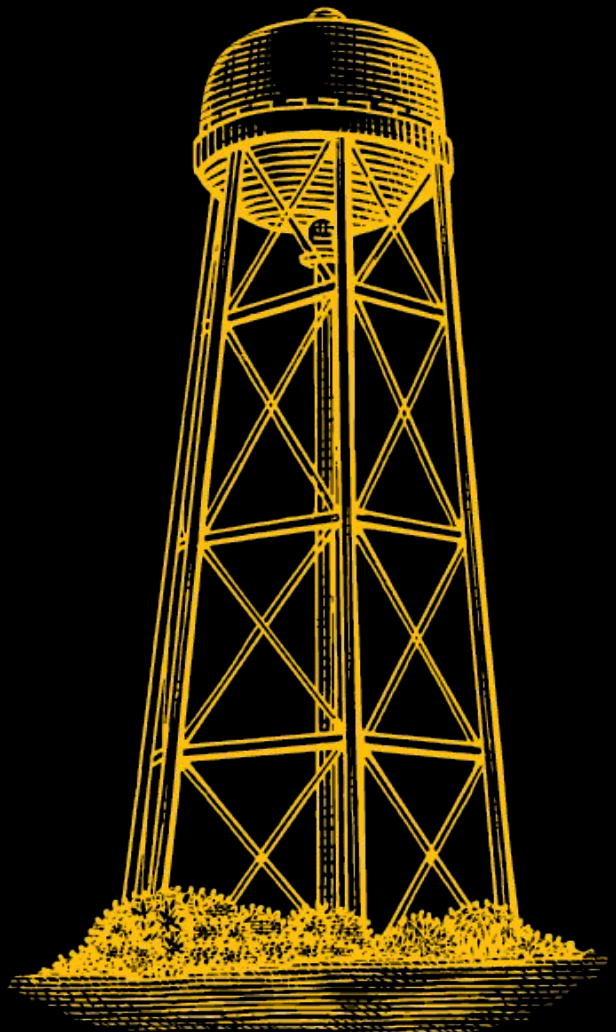

Enhancing Usability and Accessibility in ResilientDB

ResilientDB Ecosystem Development and Support

Apache ResilientDB Incubating

ExpoLab Creativity Unfolded

- Gopal Nambiar -

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Introduction

- Apache ResilientDB (incubating) is a decentralized and secure database designed to ensure transparent, tamper-proof record-keeping.

- High-performance, fault-tolerant blockchain database, now under the Apache incubation umbrella, supporting ongoing development and wider community engagement.

- Our lab’s focus is to make Apache ResilientDB easier to use and accessible, enabling more students and developers to engage with blockchain.

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Project Goals and Impact

- To improve usability, scalability, and development efficiency within the Apache ResilientDB ecosystem.

- **Goals**:
  - Developed Docker images for over 200 users to simplify Apache ResilientDB deployment.
  - Created CLI tools and APIs to facilitate blockchain interactions.
  - Implemented CI/CD to automate deployments and testing.

- **Impact**: Our work has streamlined teaching and research, allowing students and developers to focus more on experiments than setup.

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Docker Images for Apache ResilientDB

- **Problem**: Setting up Apache ResilientDB was complex, often requiring extensive configuration.
- **Solution**: Developed Docker images for Apache ResilientDB to automate and simplify deployment across platforms.
- **Impact**: Around 300 students have used these images, and the download count is still increasing.

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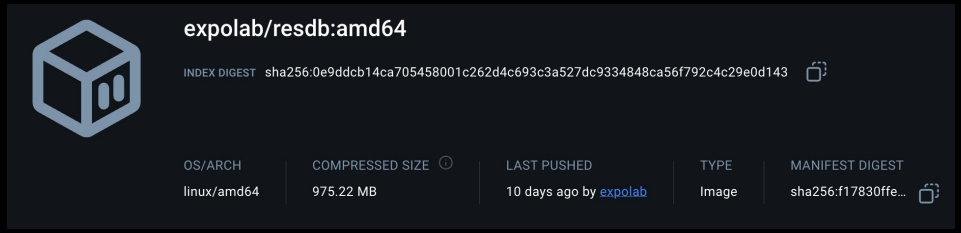
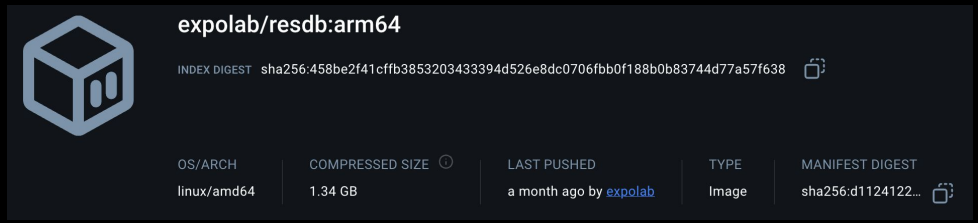
Docker Images





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ResContract (Smart Contracts CLI)

- ResContract is a command-line interface to compile, deploy, and manage smart contracts.
- **Problem**: Interacting with smart contracts on Apache ResilientDB was initially challenging without dedicated tooling.
- **Solution**: ResContract provides an easy-to-use CLI for handling smart contracts, removing technical barriers.
- **Core Features**:
  - Compile: Converts Solidity files into deployable code.
  - Deploy: Allows contract deployment on Apache ResilientDB.
  - Manage: Offers commands to interact with deployed contracts.
- **Impact**: Enhanced developer productivity, greater ease in experimenting with smart contracts.

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ResContract

```
gopuman@node0:~/ResContract$ rescontract
Usage: rescontract [options] [command]

ResContract CLI - Manage smart contracts in ResilientDB

Options:
  -V, --version       output the version number
  -h, --help          display help for command

Commands:
  create [options]    Create a new account
  compile [options]   Compile a .sol file to a .json file
  deploy [options]    Deploy a smart contract
  execute [options]   Execute a smart contract function
  help [command]      display help for command
Usage: rescontract [options] [command]
```

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Smart Contracts GraphQL API

- SmartContractsGraphQL API provides a flexible way to query and manage smart contracts.
- **Problem**: Traditional query methods for Apache ResilientDB were limited in flexibility and accessibility.
- **Solution**: The API enables developers to interact with smart contracts seamlessly, integrating easily with front-end applications.
- **Impact**: Simplified access to blockchain data, increased potential for application integration.

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Smart Contracts GraphQL API

GraphiQL ▶ Prettify Merge Copy History

```
1  mutation {
2    createAccount(config: "../incubator-resilientdb/service/tools/config/interface/service.config")
3  }
```


```
{
  "data": {
    "createAccount": "cmd = create config path = ../incubator-
resilientdb/service/tools/config/interface/service.config\nWARNING: Logging before InitGoogleLogging()
is written to STDERR\nE20241113 15:45:41.758157 31025 contract_tools.cpp:45] create account:\naddress:
\"0x67c6697351ff4aec29cdbaabf2fbe3467cc254f8\""
  }
}
```


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ResDB-ORM Library

- ResDB-ORM is an Object-Relational Mapping (ORM) library to simplify database interactions.
- **Problem**: Interacting directly with Apache ResilientDB's key-value store was time-consuming and error-prone.
- **Solution**: The ORM allows for CRUD operations with minimal code, supporting both version-based and non-version-based functions.
- **Core Features**:
  - Create, Read, Update, Delete (CRUD) operations.
  - Support for both basic and versioned database interactions.
- **Impact**: Streamlined development, easier data management, improved prototyping.

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ResDB-ORM Library

```python
# test.py
import requests
from resdb_orm.orm import ResDBORM

db = ResDBORM()

# Create records
data = {"name": "abc", "age": 123}
create_response = db.create(data)
print("Create Response:", create_response)

# Retrieve records
read_response = db.read(create_response)
print("Read Response:", read_response)
print("Data:", read_response["data"])
```

```python

# Update records
update_response = db.update(create_response, {"name": "def", "age": 456})
print("Update Response:", update_response)
read_response = db.read(create_response)
print("Read Response:", read_response)
print("New Data:", read_response["data"])

# Delete records
delete_response = db.delete(create_response)
print("Delete Response:", delete_response)
read_response = db.read(create_response)

```

```
(venv) gopuman@node0:~/ResDB-ORM$ python tests/test.py
Create Response: c8e738a35294112bef1143193f72c9de346ce11fbee10361f6dda06befe10b13
Read Response: {'id': 'c8e738a35294112bef1143193f72c9de346ce11fbee10361f6dda06befe10b13', 'data': {'name': 'abc', 'age': 123}}
Data: {'name': 'abc', 'age': 123}
Update Response: {'status': 'update successful'}
Read Response: {'id': 'c8e738a35294112bef1143193f72c9de346ce11fbee10361f6dda06befe10b13', 'data': {'name': 'def', 'age': 456}}
New Data: {'name': 'def', 'age': 456}
Delete Response: {'status': 'delete successful'}
```

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CI/CD Support for ResilientEcosystem

- Continuous Integration and Continuous Deployment (CI/CD) automate testing and deployment, improving code quality and efficiency.

- **Problem**: Manual deployment processes made updates slower and more error-prone.

- **Solution**: Implemented CI/CD pipelines for ResilientEcosystem using GitHub Actions automation.

- **Impact**:
  - Faster, more reliable deployments.
  - Improved code quality due to consistent testing.
  - Enabled quicker iterations, fostering a productive development cycle.

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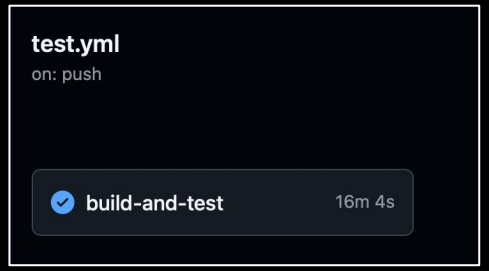
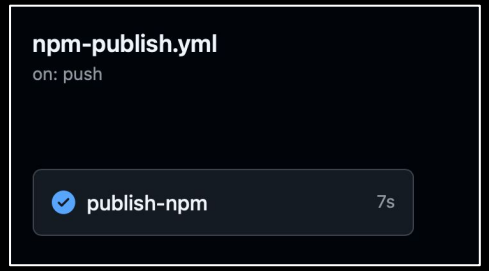
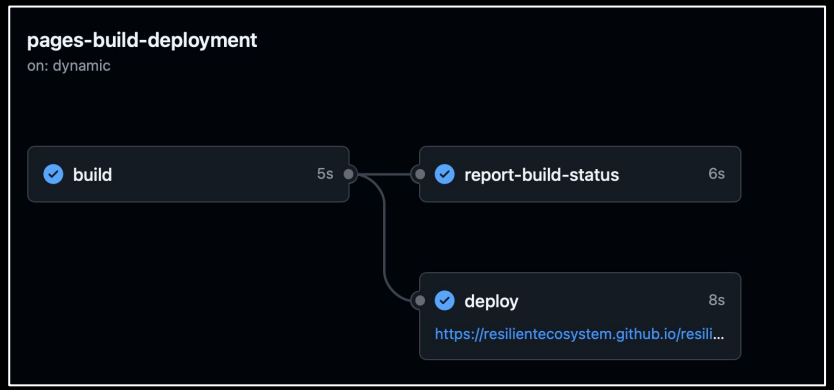
CI/CD Examples







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Quickstart Website

- The Quickstart website provides a user-friendly guide for new users to get started with Apache ResilientDB and its associated tools.

- **Problem**: Setting up Apache ResilientDB and related tools required technical knowledge, often challenging for new users.

- **Solution**: The Quickstart website offers a streamlined, guided experience for installation and configuration.

- **Core Features**:
  - Step-by-Step Installation Guides.
  - Code Samples and Usage Examples.
  - Integration Guides.
  - Link to Blog posts.
  - Interactive installation script download

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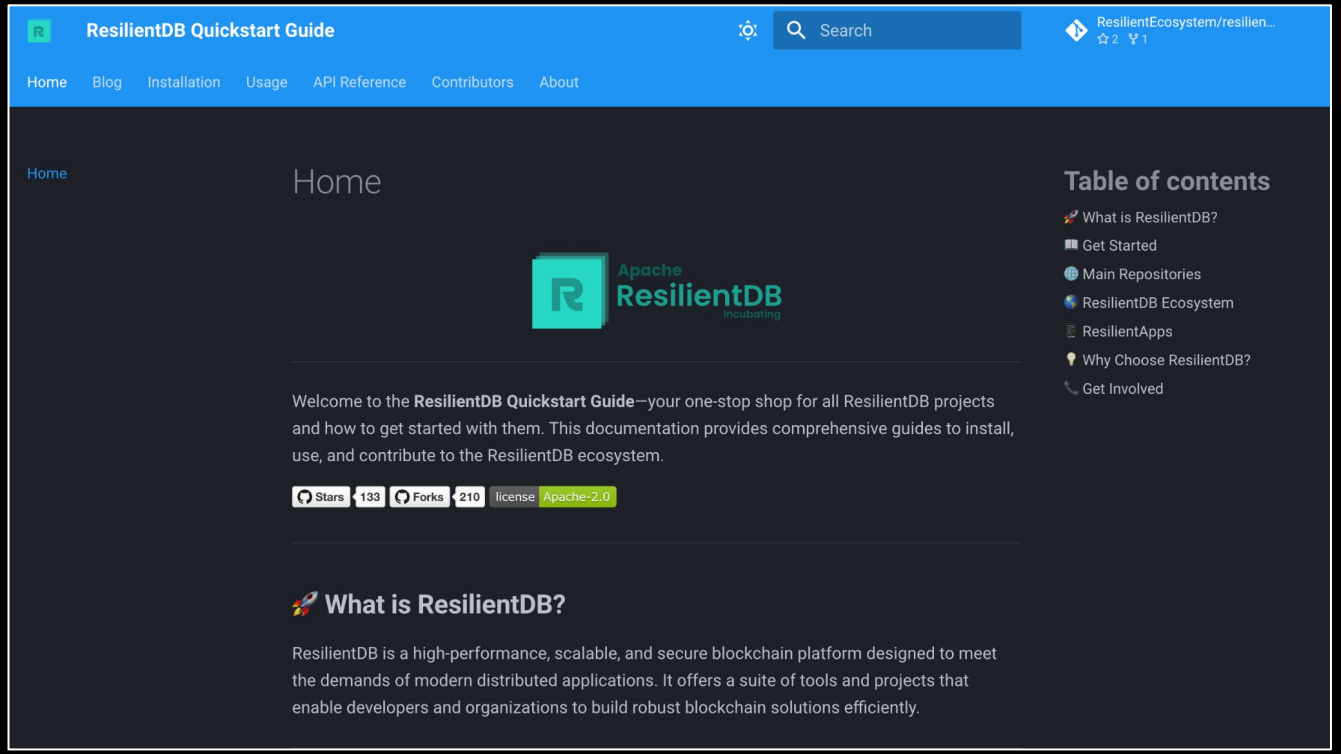
Quickstart Website



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Cumulative Impact and Future Directions

- Docker images, CLI tools, API, ORM library, and CI/CD support collectively make Apache ResilientDB accessible and usable for developers and students.

- Over 300 students using Docker, increasing downloads, feedback from the academic community.

- Future Plans:
  - Expand CLI capabilities.
  - Enhance API features.
  - Continue developing CI/CD for scalability.

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DEMO