The 12-Factor App

Designing DevOps Excellence

by Evren Tan

About Me

DevOps?

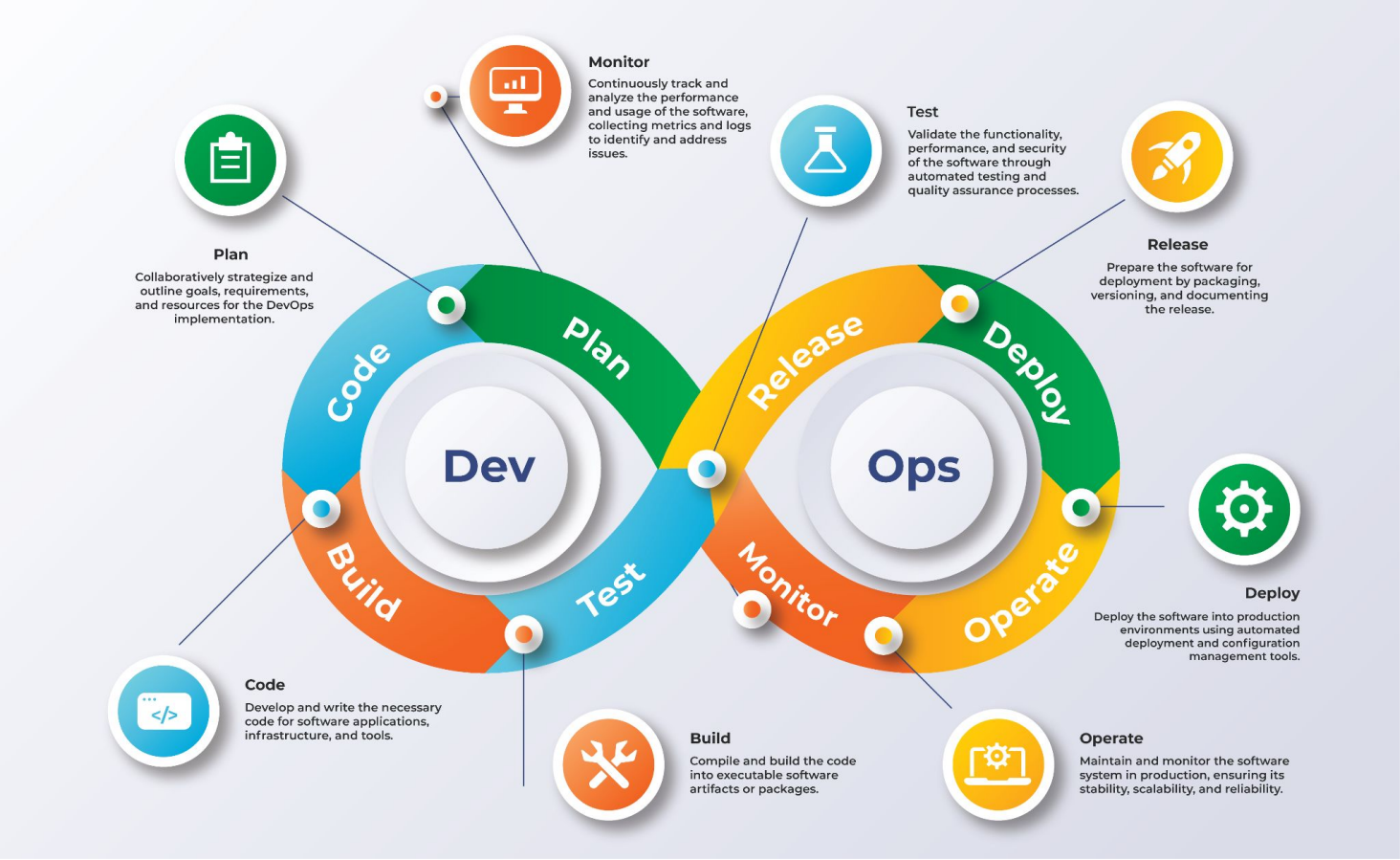


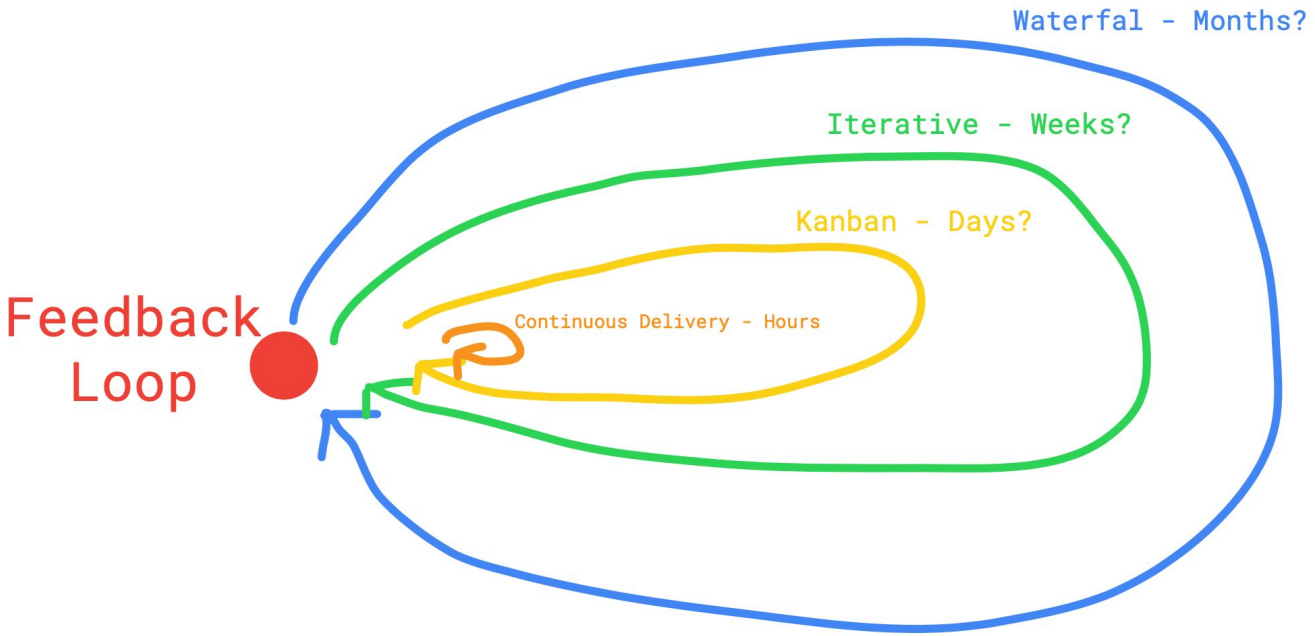
Image Ref: https://www.serole.com/blog/what-are-the-key-benefits-of-devops-for-businesses/

Is DevOps an Approach for Software Crafting Mindset?

Core Principles of DevOps	Software Crafting Manifesto
Collaboration: Encourages open communication and shared responsibilities between development and operations	**A Community of Professionals**: Not only individuals and interactions, but also a community of professionals
Automation: Focuses on automating repetitive tasks, such as testing, deployment, and infrastructure provisioning, to improve efficiency and reduce errors	**Steadily Adding Value**: Not only responding to change, but also steadily adding value
Continuous Integration/Continuous Deployment (CI/CD): Promotes frequent integration of code changes and automated deployments to ensure that software can be reliably released at any time	**Well-Crafted Software:** Not only working software, but also well-crafted software development and operations
Monitoring and Feedback: Involves continuous monitoring of applications in production to gather feedback and make informed improvements	**Productive Partnerships**: Not only customer collaboration, but also productive partnerships

🔗 https://manifesto.softwarecraftsmanship.org/

Feedback Loop?



12-Factor App?

⭐ A methodology for building SaaS apps that:

- Use **declarative** formats for setup automation, to minimize time and cost for new developers joining the project;
- Have a **clean contract** with the underlying operating system, offering **maximum portability** between execution environments;
- Are suitable for **deployment** on modern **cloud platforms**, obviating the need for servers and systems administration;
- **Minimize divergence** between development and production, enabling **continuous deployment** for maximum agility;
- And can **scale up** without significant changes to tooling, architecture, or development practices.

The twelve-factor methodology can be applied to apps written in any programming language, and which use any combination of backing services (database, queue, memory cache, etc).

HEROKU

🔗 https://12factor.net/

And these factors are;

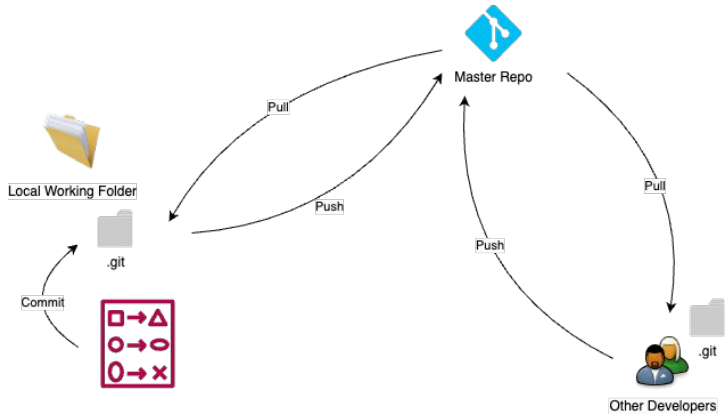
1. Codebase
2. Dependencies
3. Config
4. Backing Services
5. Build, Release & Run
6. Processes
7. Port Binding
8. Concurrency
9. Disposability
10. Dev/Prod Parity
11. Logs
12. Admin Processes

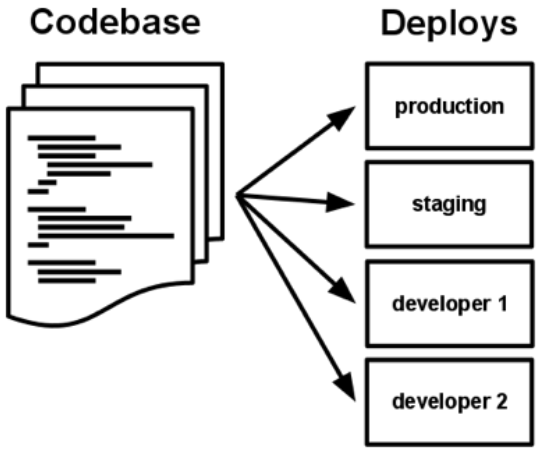
Codebase

❌ Multiple Codebases ≠ One App ➡️ A Distributed System

❌ Multiple Apps Sharing the Same Codebase

✅ One Codebase per App with Many Deploys





https://12factor.net/codebase

Dependencies

❗ A 12-factor app never relies on implicit existence of system-wide packages.

✅ It declares all dependencies, completely and exactly, via a dependency declaration manifest.

🧰 A dependency isolation tool

```
repositories {
    mavenCentral()
    maven { url "https://repo.spring.io/snapshot" }
    maven { url "https://repo.spring.io/milestone" }
    maven { url "https://repo.spring.io/release" }
}

ext {
    set('springCloudVersion', "2022.0.0")
}

dependencies {
    implementation 'org.springframework.boot:spring-boot-starter-actuator'
    implementation 'org.springframework.cloud:spring-cloud-config-client'
    implementation 'org.springframework.cloud:spring-cloud-starter-bootstrap'
    implementation group: 'javax.validation', name: 'validation-api', version: '2.0.1.Final'
    implementation 'org.springframework.boot:spring-boot-starter-data-jpa'
    implementation 'org.hibernate.validator:hibernate-validator'
    implementation 'org.springframework.boot:spring-boot-starter-web'
    implementation 'org.springframework.cloud:spring-cloud-starter-netflix-eureka-client'
    implementation 'org.springframework.cloud:spring-cloud-starter-openfeign'
    implementation group: 'org.springdoc', name: 'springdoc-openapi-ui', version: '1.6.4'
    compileOnly 'org.springframework.boot:spring-boot-starter-jdbc'
    compileOnly 'org.projectlombok:lombok'
    implementation 'org.flywaydb:flyway-core'
    runtimeOnly 'org.postgresql:postgresql'
    annotationProcessor 'org.projectlombok:lombok'
    testImplementation 'org.springframework.boot:spring-boot-starter-test'
    compileOnly group: 'javax.xml.bind', name: 'jaxb-api', version: '2.3.0'
}

dependencyManagement {
    imports {
        mavenBom "org.springframework.cloud:spring-cloud-dependencies:${springCloudVersion}"
    }
}
```

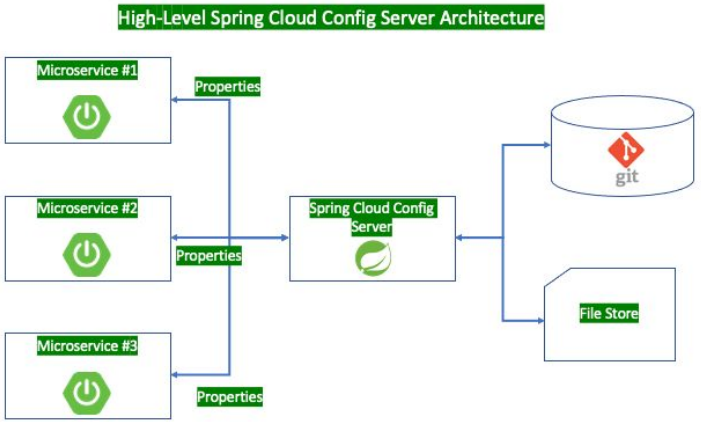
Config

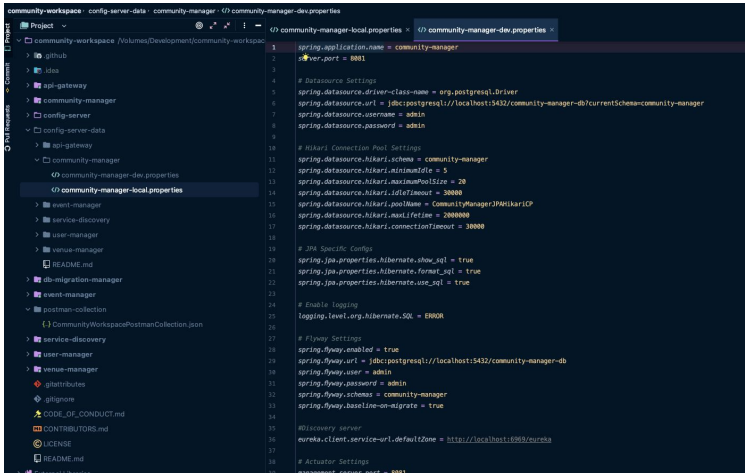
❓Store configs static in the codebase ❌

✅ Strict Separation Config from the Codebase

✅ The twelve-factor app stores config in environment variables

♻️ Group configs in the same batch, i.e., dev, test, staging, production





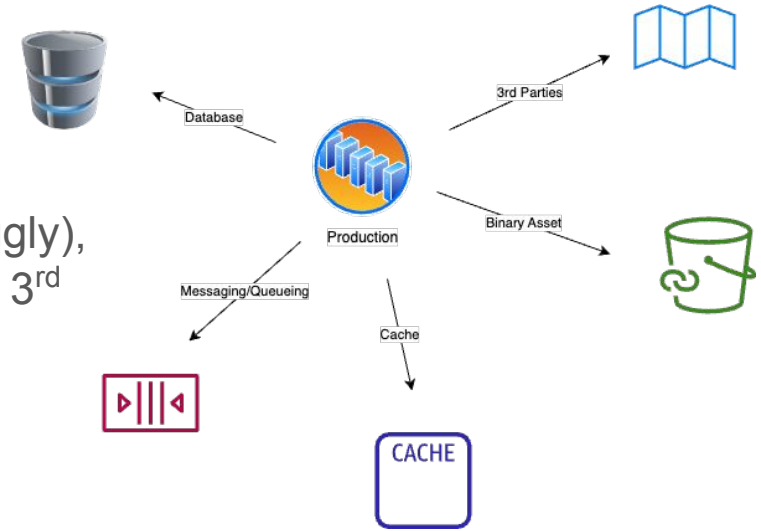
Backing Services

ℹ️ A backing service is any service the app consumes over the network as part of its normal operation.

➡️ Databases (PostgreSQL, MongoDB), Messaging/Queueing Services (Kafka, RabbitMQ), Caching (Redis), Metrics Gathering (New Relic, Loggly), Binary Asset Services (Amazon S3), API accessible 3rd Parties (Twitter, Google Maps, etc)

⭐ Treat backing services as attached resources

🌟 Resources must be designed according to loose coupling pattern

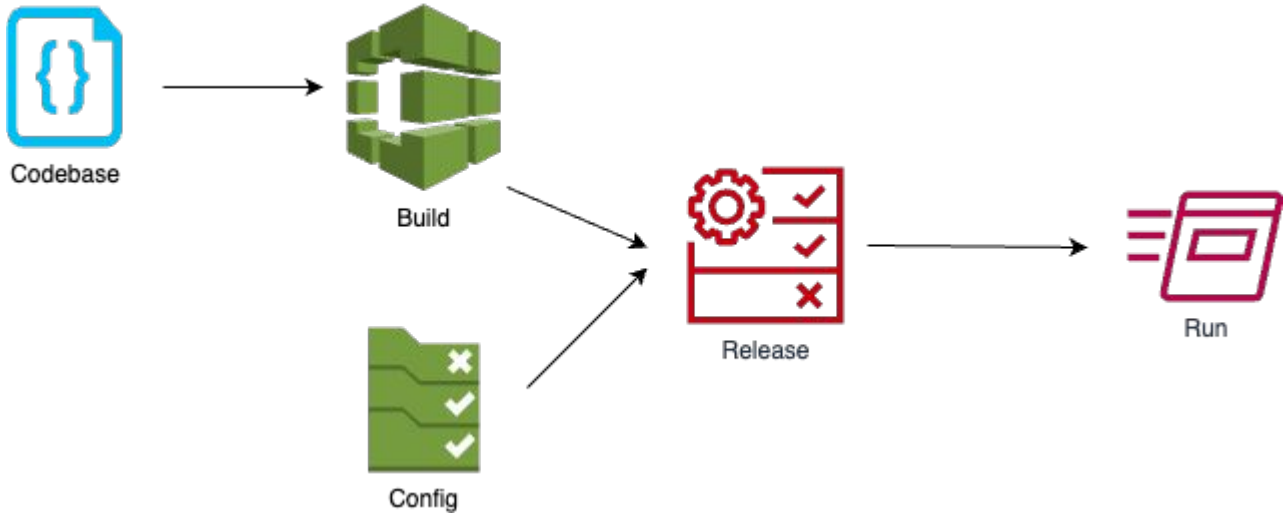


Build, Release & Run

❗ Strictly separate build, release and run stages

ℹ️ Three stages;

1. Build Stage
2. Release Stage
3. Run Stage



Processes

⭐ Twelve-factor processes are stateless and share-nothing.

⭐ Any data that needs to persist must be stored in a stateful backing service, typically a database.

✅ Execute the app as one or more stateless processes

Port Binding

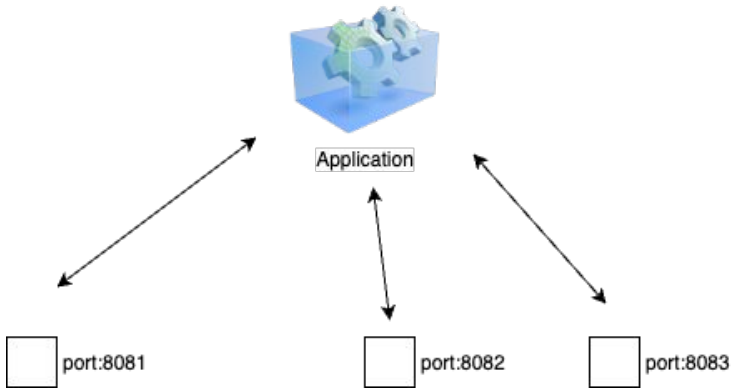
⭐ Export services via port binding

ℹ️ Improves an application’s portability and security

🧐 An App has three services and all binds to different ports ❓

Scalability, portability, security, routing, load balancing (container native load balancing)

❓Treats like a backing service. Think about a Java app behind a Nginx web server



Concurrency

⭐ Scale out via the process model

🏅 Processes are a first class citizen for a 12-Factor App

🏗️ The developer can architect their app to handle diverse workloads by assigning each type of work to a process type.

- HTTP requests may be handled by a web process, and long-running background tasks handled by a worker process.

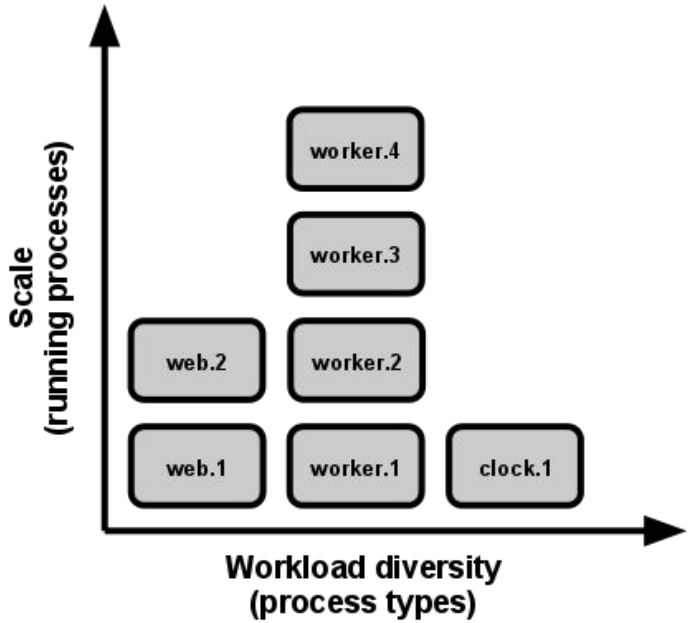


Image Ref: https://12factor.net/concurrency

Disposability

⭐ Maximize robustness with fast startup and graceful shutdown

ℹ️ Processes are disposable, meaning they can be started or stopped at a moment's notice.

- ⚖️ Fast elastic scaling
- 💻 Rapid deployment of code or config changes
- 💪 Robustness of production deploys

💥 A 12-Factor app is architected to handle unexpected, non-graceful terminations
➡️ Crash-only Software ➡️ A software that crashes safely and recovers quickly

Dev/Prod Parity

⭐ Keep development, staging, and production as similar as possible

ℹ️ The 12-factor app is designed for continuous deployment by keeping the gap between development and production small ➡️ Smaller Feedback Loop

	Traditional app	Twelve-factor app
Time between deploys	Weeks	Hours
Code authors vs code deployers	Different people	Same people
Dev vs production environments	Divergent	As similar as possible

❗ The twelve-factor developer resists the urge to use different backing services between development and production

🐳 Containerization tools like Docker

Logs

⭐ Treat logs as event streams

ℹ️ Logs are the stream of aggregated, time-ordered events collected from the output streams of all running processes and backing services

❗ A 12-factor app never concerns itself with routing or storage of its output stream

❌ Write to or manage log files in the local file system

✅ Write to STDOUT as unbuffered data

Admin Processes

ℹ️ What are Admin Processes;

- Running DB migrations
- Running reports
- Running one-time scripts committed into the app’s repo

⭐ Run admin/management tasks as one-off processes

✅ Each one of those processes should be run against a new instance having identical configs with the app

❗ Ensures that those background tasks do NOT have impact on the standard process

Q&A