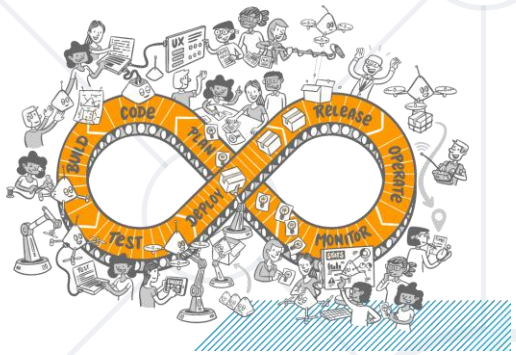
DevOps Overview

What Is DevOps, Practices, Tools, Trends



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#Dev-Ops

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What is DevOps?

Combining Software Development and IT Teams

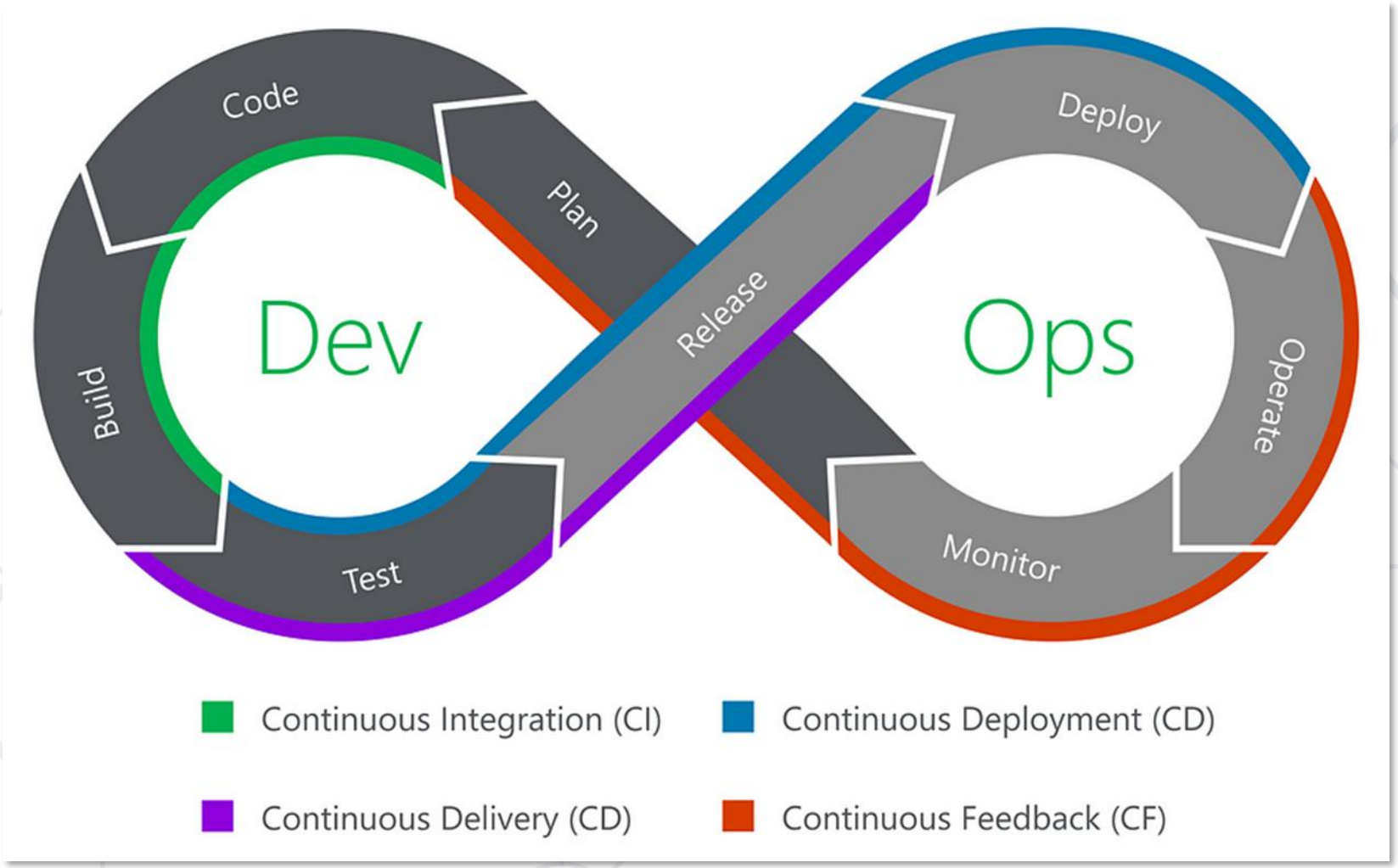
What is DevOps?

- **DevOps** is a set of practices, tools, and philosophy that combines **development** (**Dev**) and **operations** (**Ops**) into one, continuous process
- Unites **people**, **process**, and **technology** in application **planning**, **development**, **delivery**, and **operations**
  - Enables coordination and collaboration between isolated roles like development, IT operations, quality engineering, and security

DevOps Lifecycle

- **DevOps lifecycle** (or **pipeline**) is a series of automated development processes or workflows within an **iterative development lifecycle**
- Represents the processes, capabilities, and tools for **development** (left side) and **operations** (right side)
  - Merging both sides into one seamless process
- Follows a continuous approach

Continuous Everything



Source: https://medium.com/taptuit/the-eight-phases-of-a-devops-pipeline-fda53ec9bba

DevOps Lifecycle Stages

- **Plan**
  - Identify business requirements and collect end-user feedback
- **Code**
  - Code development
- **Build**
  - Finished code is committed to a shared repository
- **Test**
  - Build is deployed to a test environment and tests are performed
- **Release**
  - Operations team schedules the releases or deploys multiple releases to production
- **Deploy**
  - The production environment is built and the build is released
- **Operate**
  - Release is live now. Operations team takes care of server configuring and provisioning
- **Monitor**
  - DevOps pipeline is monitored to find problems / bottlenecks

DevOps Pipeline Phases

- Continuous **Development**
  - Plan and code
- Continuous **Integration**
  - Update code and add new features
- Continuous **Testing**
  - Run automated or manual tests
- Continuous **Deployment**
  - Code is automatically deployed on production servers
- Continuous **Feedback**
  - Evaluate user experience to improve future releases
- Continuous **Monitoring**
  - Monitor for system errors or performance issues
- Continuous **Operations**
  - Automate launching the app and its updates

DevOps Tools

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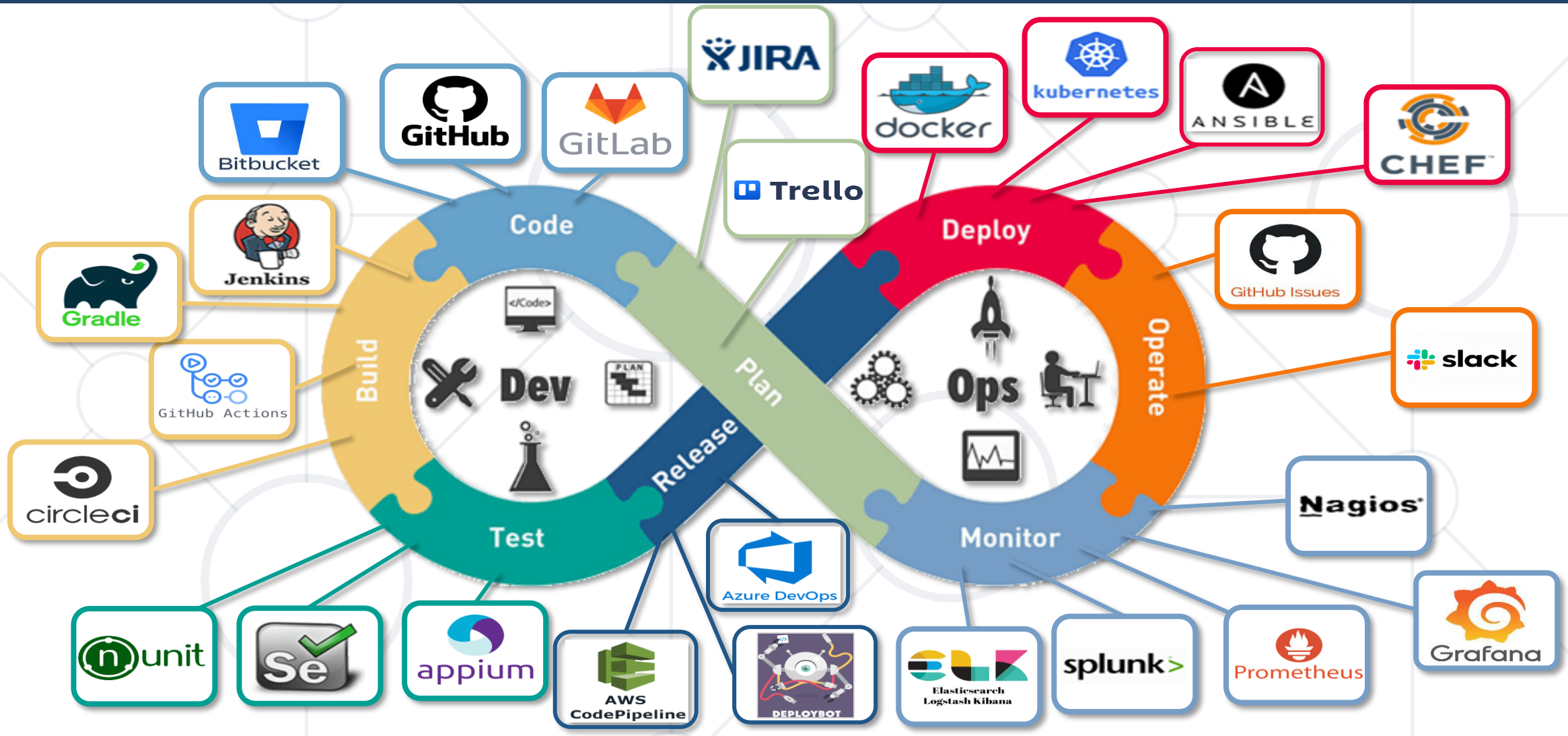


DevOps Culture

- **DevOps culture** is a collaborative approach to software development and delivery that emphasizes **communication**, **automation**, and **improvement**
- **Collaboration** is crucial
  - All teams should communicate honestly and openly about DevOps processes, priorities, and concerns together
- As teams align, they take **ownership** and **become involved in other lifecycle phases**, not just the ones central to their roles
- DevOps teams remain agile by **releasing software in short cycles**
- Teams strive to **learn** and **continuously improve**

DevOps Engineers

- **DevOps engineers** are responsible for the **deployment**, and **maintenance** of software applications
  - **Collaborate** with development and operations teams
  - Balance a blend of soft skills with their tech knowledge
- They understand **development lifecycles**, **DevOps culture**, **practices** and **tools**

Role of DevOps Engineers

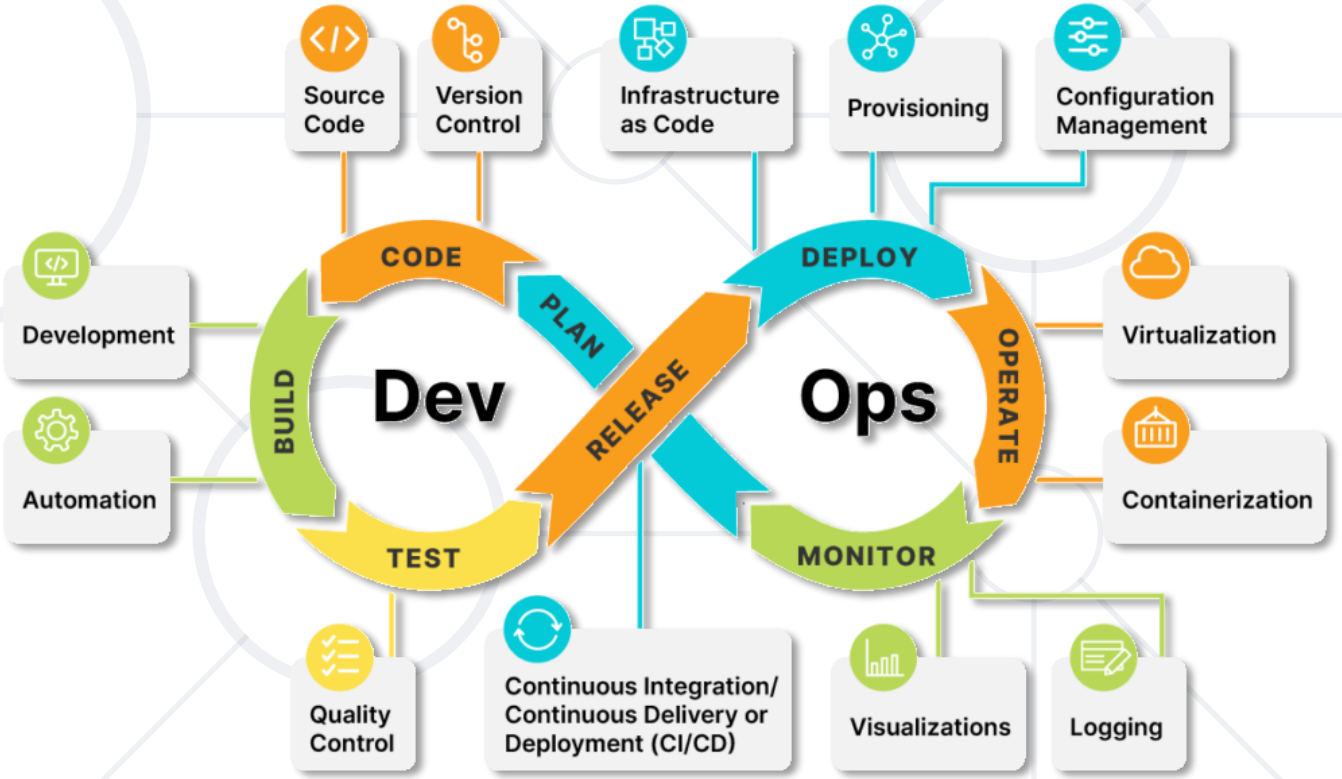
- Their job and responsibilities include
  - Automating processes
  - Managing and maintaining the infrastructure system
  - Monitoring performance
  - Ensuring the security of the software
  - Scale systems and ensure the availability of the services with developers

DevOps Practices

Helpful Throughout the Application Lifecycle

DevOps Practices

- Many **practices**, varying on the specific context and organization
- Some practices are
  - **CI/CD**
  - **Infrastructure as code (IaC)**
  - **Version control**
  - **Monitoring** and **logging**
  - **Automation**
  - **Agile software development**



CI/CD Pipeline

- **CI/CD Pipeline**
  - Cornerstone of DevOps describing the code journey **from a developer's machine to production**
- Consists of multiple **stages**
  - Development
  - Integration
  - Testing
  - Deployment
- **End goal**
  - Deliver features, updates and fixes to users quickly and reliably

CI/CD Pipeline

- **CI/CD** allows organizations to ship software quickly and efficiently
  - **Continuous integration**
    - Developers regularly **merge code changes** into a central repository, which are validated by **automated tests**
  - **Continuous delivery**
    - Code changes are automatically **prepared for a release** to production (and can be manually deployed)
  - **Continuous deployment**
    - Changes that pass all stages of production pipeline are **released automatically** (optional)
- Tools: **GitHub Actions**, Jenkins, CircleCI, etc.

Infrastructure as Code (IaC)

- **Infrastructure as Code** (**IaC**)
  - Managing and provisioning of infrastructure through code instead of through manual processes
- Used to **automatically manage infrastructure resources**
  - Servers
  - Operating systems
  - Software platforms
  - Storage
  - Networking
  - Etc.

IaC Tools

- **IaC tools** define **infrastructure resources** using **code / config files**
  - Can be version controlled, tested, and deployed automatically
- Tools: Ansible, Puppet, Chef, Saltstack, Terraform, etc.
- **Approaches** to Iac
  - **Declarative**
    - Defines the desired state of the system, i.e. resources you need and their properties
  - **Imperative**
    - Defines the specific commands for the desired configuration

Version Control

- **Version control** (**source control**)
  - The practice of **managing code in versions** to make code easy to review and recover
  - Includes tracking revisions and change history
    - Saves each individual changes in a special database
  - Necessary for CI/CD and IaC
    - Helps enhance efficiency
    - Allows preserving agility when a team grows larger
- Tools: **Git**, SVN, Mercurial, etc.

Version Control

- **Essential** for software development
  - Serves as a **safety net** to protect code
  - Allows several people to work on a project **simultaneously**
    - Improves collaboration and enhances development speed
  - Manages changes in
    - Code
    - Configurations
    - Infrastructure definitions
    - Documentation

Monitoring and Logging

- **Monitoring** means having **full, real-time visibility** into the health and performance of the entire application stack
  - **App metrics**, **event data**, **logs**, traces, etc. are collected and analyzed
  - Actionable and meaningful **alerts** are set for failures in the entire deployment pipeline
    - Thus, DevOps team can mitigate issues in real time
- Tools: ELK Stack, Splunk, Prometheus, Grafana, Alertmanager, Nagios, etc.

Automation

- DevOps teams aim to **automate** as much of the **software lifecycle** as possible to have more time for writing code and developing features
  - With **automation** the simple act of pushing code changes to a source code repository can trigger a build, test, and deployment process
  - Pros: **software delivery** is **faster**, **processes** are **consistent**, **predictable** and **scalable**, teams don't perform tedious manual tasks
- **Tools** are different for each step of the DevOps process

Agile Software Development

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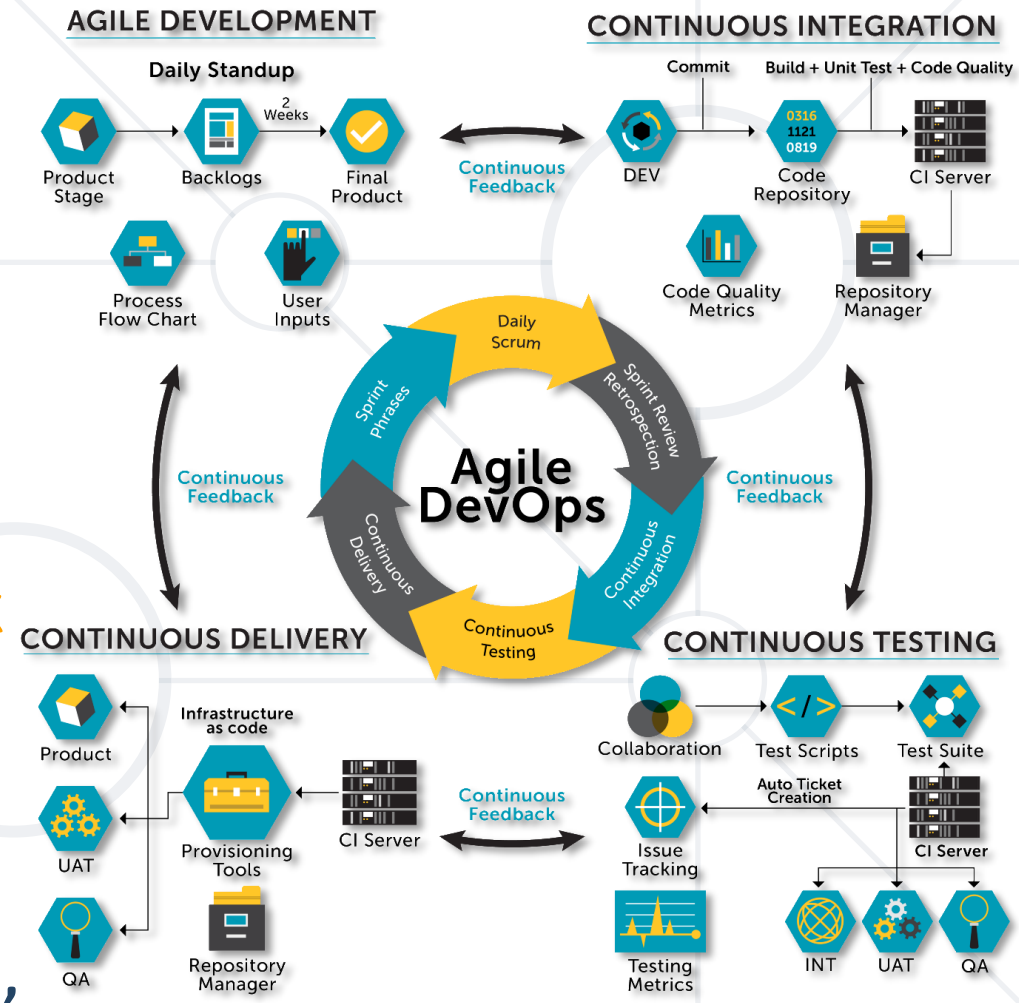
- **Agile** == modern software development approach
- It emphasizes on
  - **High adaptability to change** through **short release cycles**
  - **Customer** and **user feedback**
  - **Team collaboration**
- In **DevOps**, **Agile practices** include increased automation, improved collaboration, etc.

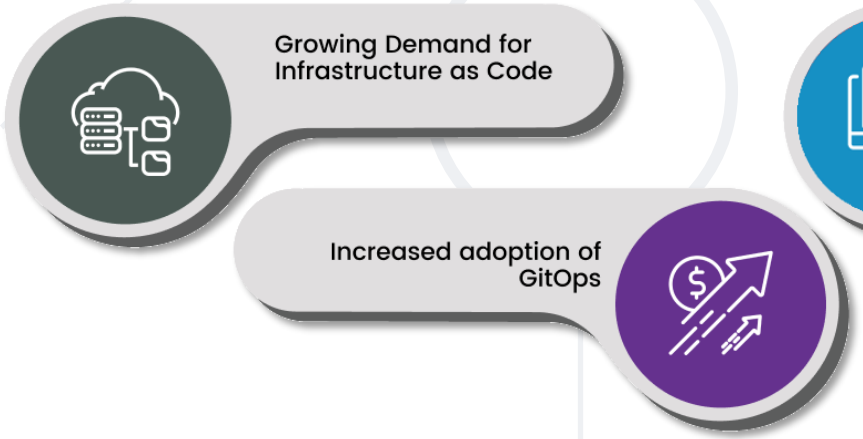


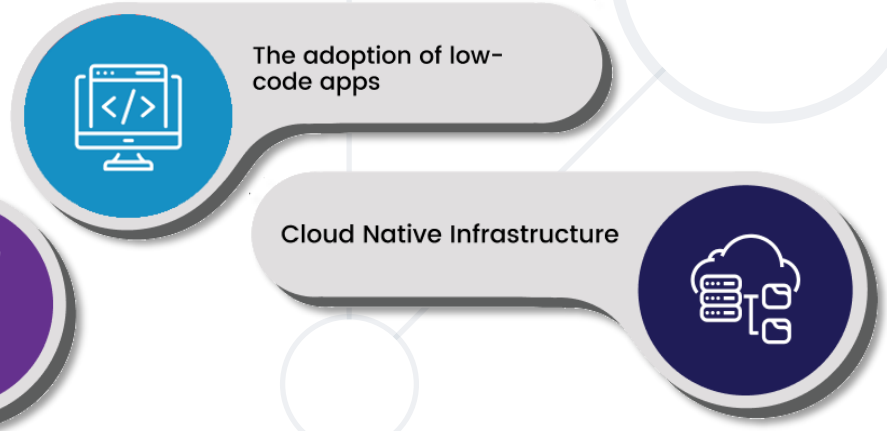
DevOps Trends

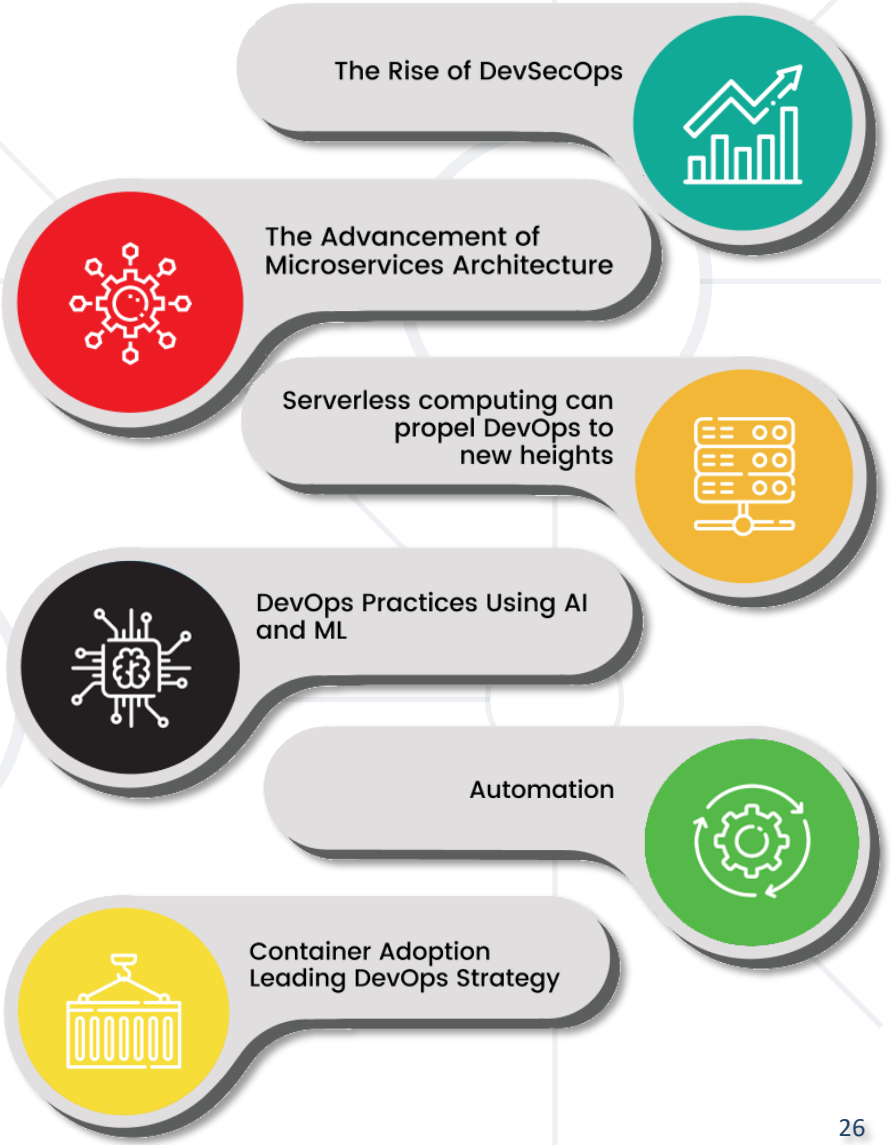
Additional DevOps Practices for Improved Lifecycle

DevOps Trends

- **DevOps movement trends** include
  - Increased focus on **security** and **compliance**
  - Adoption of **microservices architecture**
  - Evolution of **automation** and **AI**
  - And many more…
- They improve overall job productivity







DevSecOps

- **DevSecOps** = **development** + **security** + **operations**
- Includes **DevOps framework** with **security** as a shared responsibility
- Its mindset is to **integrate security practices** into applications and infrastructure from the start
- Identifying security vulnerabilities via analysis
- Tools
  - Static analysis
    - SonarCube, Fortify , Veracode, Chekmarx
  - Dynamic analysis
    - OWASP Zed Attack Proxy, Burp Suite, Acunetix, WebInspect

DevOps vs DevSecOps

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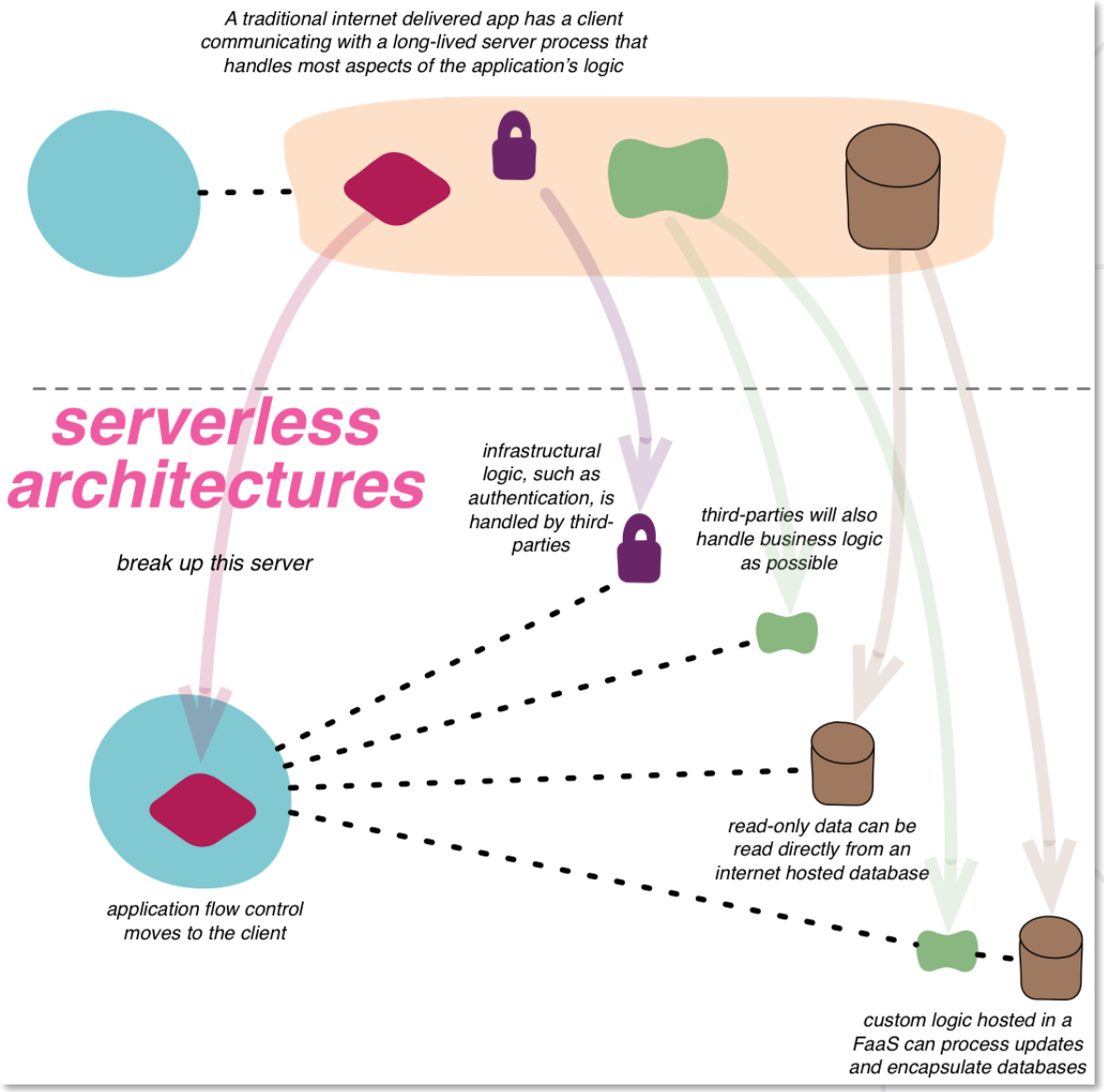
	DevOps	DevSecOps
Focus	Increasing quality and speed of software development and delivery	Secure software development processes by integrating security
Process	CI/CD	CI/CD + additional security-related processes
Activities	Continuous testing, development and monitoring QA tasks	Pre-commit, commit-time, build-time, test-time, deploy time checks of code

Static vs Dynamic Analysis in DevSecOps

- Static Analysis
  - Used for identifying **security vulnerabilities**
  - Analysis of the code **without executing** it
  - Catch potential security issues **early** in the development stage
- Dynamic Analysis
  - Used for identifying **security weaknesses**
  - Analysis of the code by **executing the app** in real or simulated environment
  - Detect security issues **at runtime**

Serverless Computing

- **Serverless computing** refers to **outsourcing back-end cloud** infrastructure and operations tasks to a **cloud provider**
  - Developers **focus on writing code**
  - Cloud provider manages the **infrastructure**, ensuring agility and scalability



Serverless Computing

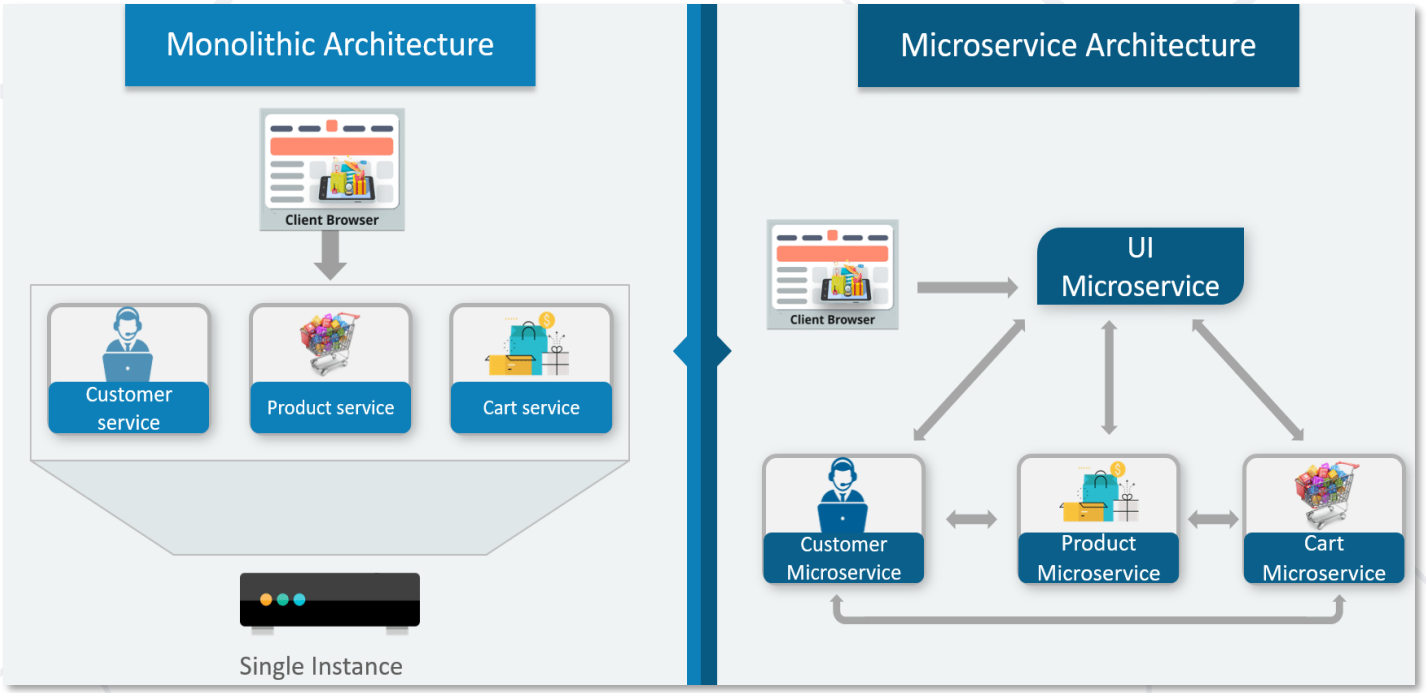
- **Serverless computing** == **Function-as-a-Service** (**Faas**)
- Based on **event-driven execution**
  - Allows functions to be triggered in response to specific events (changes in data or user requests, etc.)
- **Stateless nature**
  - Serverless functions are designed to be stateless
- Wide range of tools
  - Frameworks, SDKs, CLIs

Microservices Architecture

- **Microservices** == architectural approach to development that **breaks the application** into different **loosely coupled services**
  - Each service focuses on a specific business capability
    - Can be independently developed, deployed and scaled
- As everything is broken down into separate services, **development teams** can also be **divided** to **tackle each service**
  - Makes the development process more flexible

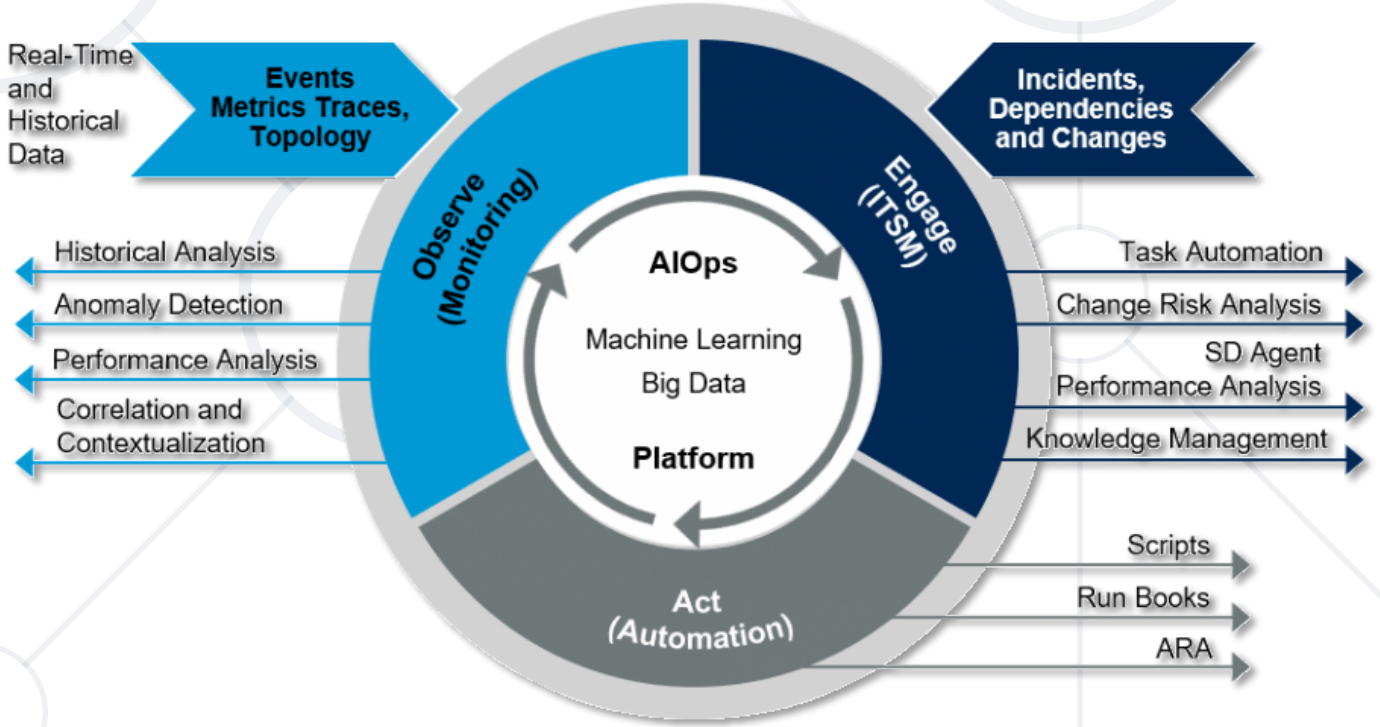
Microservices Architecture

- **Communication** between services is typically achieved through **lightweight protocols**, e.g., HTTP/REST
- Each microservice can have its own technology stack, programming language and database
  - These depend on the specific business requirements



AIOps and MLOps

- **AIOps** (Artificial Intelligence for IT Operations) refers to the use of artificial intelligence (**AI**) and machine learning (**ML**) technologies to automate and enhance various IT operations and processes
- **AIOps** helps with identifying the main cause of the problems that hamper operational productivity
- **MLOps** helps with optimizing operations and enhancing productivity



Summary

- **DevOps** == a set of **practices**, **tools** and a **cultural philosophy** that automate and integrate the processes between **software development** and **IT operations teams**
- 8 **DevOps lifecycle stages** and 7 **pipeline phases**
- **DevOps practices** include **CI/CD**, **Infrastructure as Code**, **Version Control**, **Monitoring** and **Logging**, **Automation**, **Agile Software Development**, etc.
- DevOps trends include **DevSecOps**, **Microservices**, **Serverless Computing** and **AIOps**

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