

# Desenvolvimento de Aplicações com Arquitetura Baseada em Microservices

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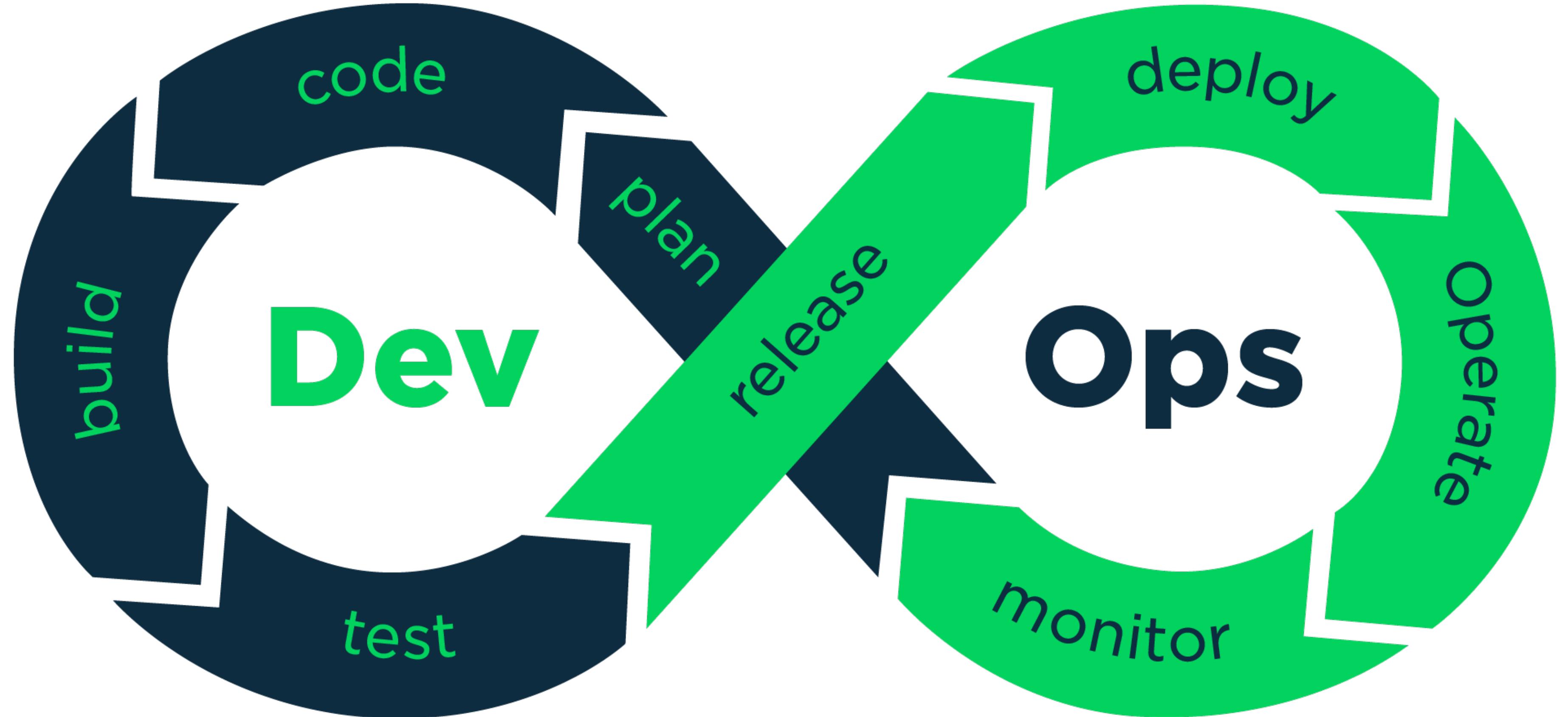


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# Resources

- There is no textbook required. However, the following are some books that may be recommended:
  - [Introduction to Kubernetes - LinuxFoundationX - LFS158x](#)
  - [Kubernetes Ingress: NodePort, Load Balancers, and Ingress Controllers](#)
  - [Deploying Java Applications with Docker and Kubernetes](#)
  - [Deploying Java Applications with Kubernetes and an API Gateway](#)
  - [Kubernetes Documentation](#)
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# The Microservices Development Life Cycle

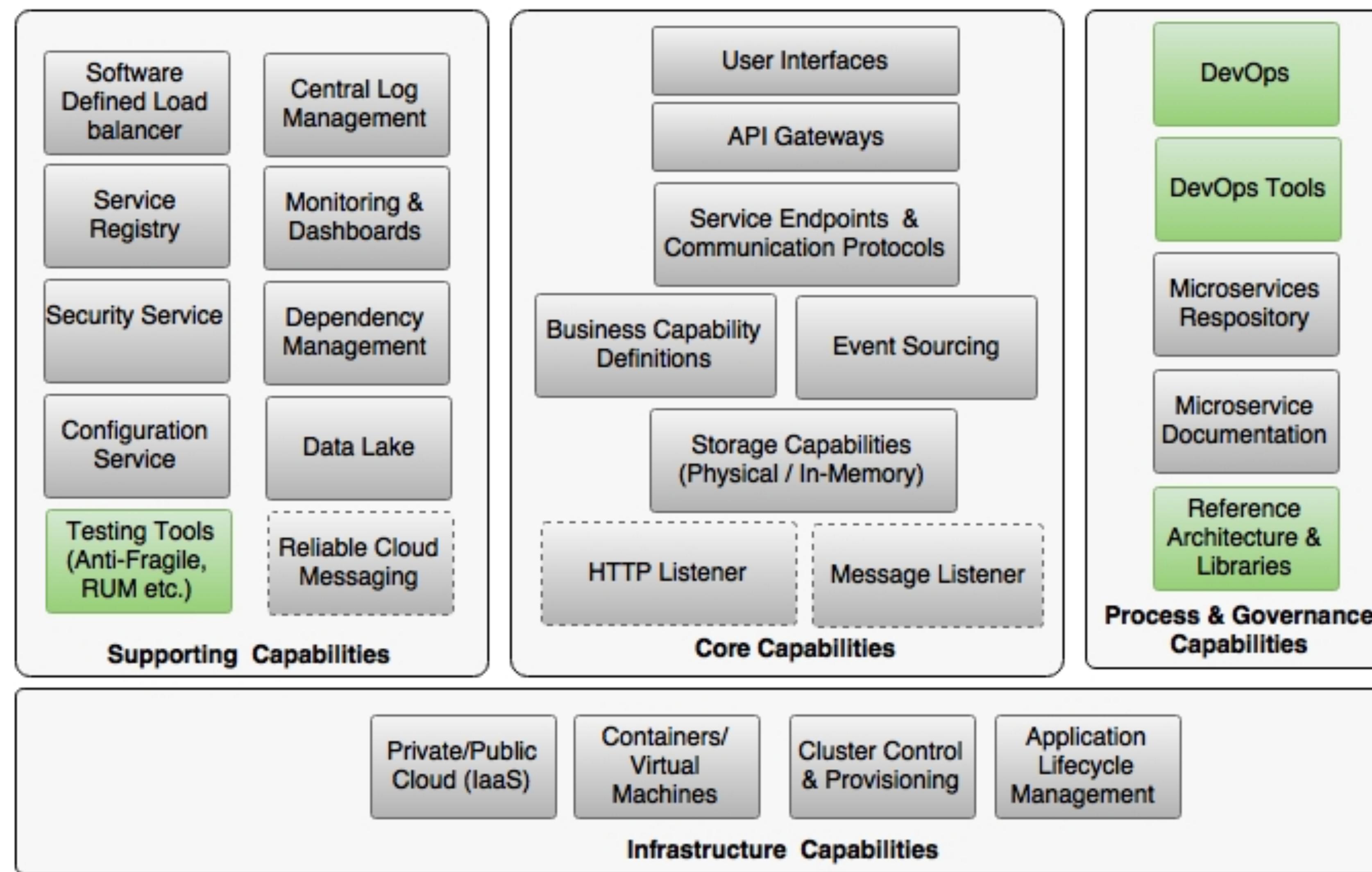
# Overview

- Similar to the software development life cycle (SDLC), it is important to understand the aspects of the microservice development life cycle processes for a successful implementation of the microservices architecture
- What are the best practices in structuring development teams, development methodologies, automated testing, and continuous delivery of microservices in line with DevOps practices?
- What is the importance of the reference architecture in a decentralized governance approach to microservices?

# Topics

- Reviewing DevOps in the context of microservices development
- Defining the microservices life cycle and related processes
- Best practices around the development, testing, and deployment of Internet-scale microservices

# Reviewing the microservice capability model



"DevOps represents a change in IT culture, focusing on rapid IT service delivery through the adoption of agile, lean practices in the context of a system-oriented approach. DevOps emphasizes people (and culture), and seeks to improve collaboration between operations and development teams. DevOps implementations utilize technology — especially automation tools that can leverage an increasingly programmable and dynamic infrastructure from a life cycle perspective."

—Gartner

# The new mantra of lean IT – DevOps

- DevOps and microservices evolved independently
- In this section, we will review the evolution of DevOps and then take a look at how DevOps supports microservices adoption

# The new mantra of lean IT – DevOps

- IT organizations have to master two key areas: speed of delivery and value-driven delivery
- Many IT organizations failed to master this change
  - To overcome this situation, many business departments started their own shadow IT or stealth IT under their control
  - Some smart IT organizations then adopted a lean IT model to respond to these situations

# The new mantra of lean IT – DevOps

- However, many organizations still struggle with this transformation due to the large baggage of legacy systems and processes
- Gartner coined the concept of a **pace-layered application** strategy
  - high speed is required only for certain types of applications or certain business areas
  - Gartner termed this a **system of innovation**
    - A system of innovation requires rapid innovations compared to a **system of records**
- As a system of innovations needs **rapid innovation**, a **lean IT delivery model** is essential for such applications
  - Practitioners evangelized the lean IT model as **DevOps**

# The new mantra of lean IT – DevOps

- There are two key strategies used by organizations to adopt DevOps
  - Some organizations positioned DevOps as a process to fill the gaps in their existing processes
    - An incremental strategy for their DevOps journey
    - Starts with Agile development, then incrementally adopts continuous integration, automated testing, and release to production and then all DevOps practices
    - The challenge is the time to realize the full benefits as well as the mixed culture of people due to legacy processes

# The new mantra of lean IT – DevOps

- There are two key strategies used by organizations to adopt DevOps
  - Many organizations, therefore, take a disruptive approach to adopt DevOps
    - This will be achieved by partitioning IT into two layers or even as two different IT units
      - The high-speed layer of IT uses DevOps-style practices to dramatically change the culture of the organization with no connection to the legacy processes and practices
      - A selective application cluster will be identified and moved to the new IT based on the business value

**The Speed Carriage - New IT  
(DevOps)**

**The Legacy Carriage - Classic IT  
(Legacy Processes)**

# Reducing wastage

- DevOps processes and practices essentially speed up deliveries which improves quality
- The speed of delivery is achieved by cutting IT wastage
- This is achieved by avoiding work that adds no value to the business nor to desired business outcomes
- The wastage is reduced by primarily adopting Agile processes, tools, and techniques

# Automating every possible step

- By automating the manually executed tasks, one can dramatically improve the speed of delivery as well as the quality of deliverables
- This also reduces a number of manual gate checks, bureaucratic decision making, and so on
- Automated monitoring mechanisms and feedback go back to the development factory, which gets it fixed and quickly moved to production.

# Value-driven delivery

- DevOps reduces the gap between IT and business through value-driven delivery
- Value-driven delivery closely aligns IT to business by understanding **true business values** and helps the business by **quickly delivering these values**, which can give a competitive advantage
  - This is similar to the shadow IT concept, in which IT is collocated with the business and delivers business needs quickly, rather than waiting for heavy project investment-delivery cycles

# Bridging development and operations

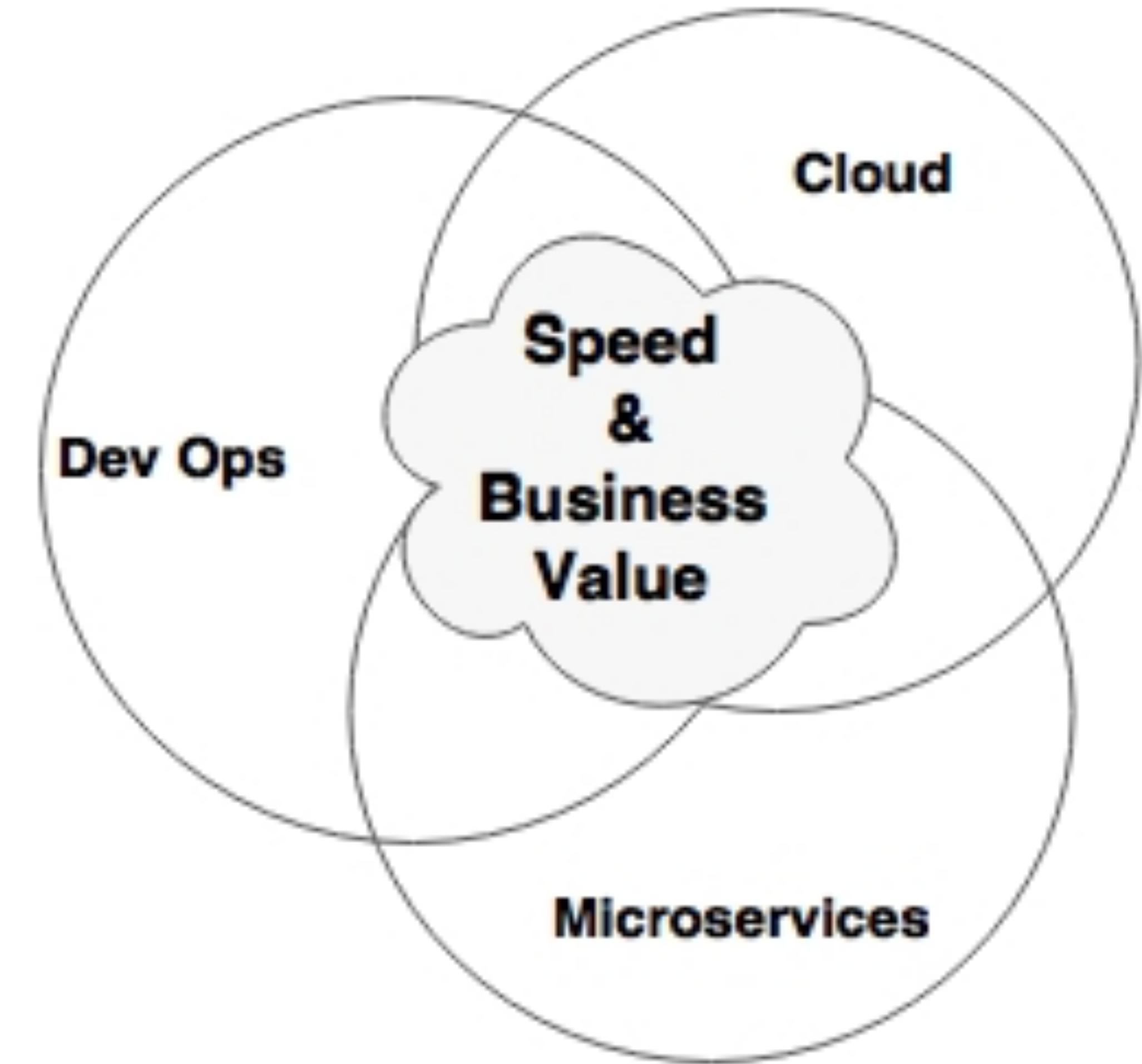
- DevOps reduces the gap between the development and operations teams so that it can potentially reduce wastage and improve quality
  - Multidisciplinary teams work together to address problems at hand rather than throwing mud across the wall
  - Operations teams can make decisions based **exactly on service behaviors** rather than **enforcing standard organizational policies and rules** when designing infrastructure components
  - This would eventually help the IT organization to improve the quality of the product as well as the time to resolve incidents and problem management

# In the DevOps world...

- Speed of delivery is achieved through the automation of high-velocity changes
- Quality is achieved through automation and people
- Business values are achieved through efficiency, speed of delivery, quality, and the ability to innovate
- Cost reduction is achieved through automation, productivity, and reducing wastage

# Meeting the trio – microservices, DevOps, and cloud

- Targets a set of common objectives: speed of delivery, business value, and cost benefit
- All three can stay and evolve independently, but they complement each other to achieve the desired common goals
- Organizations embarking on any of these naturally tend to consider the other two as they are closely linked together



# Cloud as the self-service infrastructure for Microservices

- The main driver for cloud is to improve agility and reduce cost
  - By reducing the time to provision the infrastructure, the speed of delivery can be increased
  - By optimally utilizing the infrastructure, one can bring down the cost
  - Therefore, cloud directly helps achieve both speed of delivery and cost
- Without having a cloud infrastructure with cluster management software, it would be hard to control the infrastructure cost when deploying microservices
  - infrastructure as code or software-defined infrastructure

# DevOps as the practice and process for microservices

- Microservice is an architecture style that enables quick delivery
  - However, microservices cannot provide the desired benefits by themselves
  - Microservices need a set of supporting delivery practices and processes to effectively achieve their goal
- DevOps is the ideal candidate for the underpinning process and practices for microservice delivery
  - DevOps processes and practices gel well with the microservices architecture's philosophies

# Practice points for microservices development

- For a successful microservice delivery, a number of **development-to-delivery practices** need to be considered, including the DevOps philosophy
- In the previous sections, you learned the different architecture capabilities of microservices
- In this section, we will explore the nonarchitectural aspects of microservice developments

# Understanding business motivation and value

- Microservices should not be used for the sake of implementing a niche architecture style
- It is extremely important to understand the business value and business KPIs before selecting microservices as an architectural solution for a given problem
- A good understanding of business motivation and business value will help engineers focus on achieving these goals in a cost-effective way
- Business motivation and value should justify the selection of microservices

# Changing the mindset from project to product development

- Microservices are more aligned to product development
  - Business capabilities that are delivered using microservices should be treated as products
  - This is in line with the DevOps philosophy as well

# Changing the mindset from project to product development

- The product team will always have a sense of ownership and take responsibility for what they produce
- As a result, product teams always try to improve the quality of the product
- The product team is responsible not only for delivering the software but also for production support and maintenance of the product
- Product teams are generally linked directly to a business department for which they are developing the product
- Product thinking is closely aligned with actual business goals

# Changing the mindset from project to product development

- One common pitfall in product development is that IT people represent the business in the product team
- These IT representatives may not fully understand the business vision
- Also, they may not be empowered to take decisions on behalf of the business
- Such cases can result in a misalignment with the business and lead to failure quite rapidly

# Choosing a development philosophy

- Different organizations take different approaches to developing microservices, be it a migration or a new development
- It is important to choose an approach that suits the organization
- There is a wide variety of approaches available

# Design thinking

- DT is an approach primarily used for innovation-centric development
  - Explores the system from an end user point of view: what the customers see and how they experience the solution
  - A story is then built based on observations, patterns, intuition, and interviews
- DT then quickly devises solutions through solution-focused thinking by employing a number of theories, logical reasoning, and assumptions around the problem
  - The concepts are expanded through brainstorming before arriving at a converged solution

# The start-up model

- Many start-ups kick off with a small, focused team—a highly cohesive unit
  - The unit is not worried about how they achieve things; rather, the focus is on what they want to achieve
  - Once they have a product in place, the team thinks about the right way to build and scale it
- This approach addresses quick delivery through production-first thinking
  - The advantage with this approach is that teams are not disturbed by organizational governance and political challenges
  - The team is empowered to think out of the box, be innovative, and deliver things
  - They also follow a fail fast approach and course correct sooner than later

# The Agile practice

- Software is delivered in an incremental, iterative way using the principles put forth in the Agile manifesto
- This type of development uses an Agile method such as Scrum or XP
- The Agile manifesto defines four key points that Agile software development teams should focus on:
  - Individuals and interaction over processes and tools
  - Working software over comprehensive documentation
  - Customer collaboration over contract negotiation
  - Responding to change over following a plan

# Using the concept of Minimum Viable Product

- Irrespective of the development philosophy explained earlier, it is essential to identify a **Minimum Viable Product (MVP)** when developing microservice systems for speed and agility
-

“A Minimum Viable Product is that version of a new product which allows a team to collect the maximum amount of validated learning about customers with the least effort.”

–Eric Ries

# Using the concept of Minimum Viable Product

- The objective of the MVP approach is to **quickly** build a piece of software that **showcases the most important aspects** of the software
- The MVP approach realizes the **core concept** of an idea and perhaps chooses those features that **add maximum value** to the business
  - It helps get early feedback and then course corrects as necessary before building a heavy product

# Overcoming the legacy hotspot

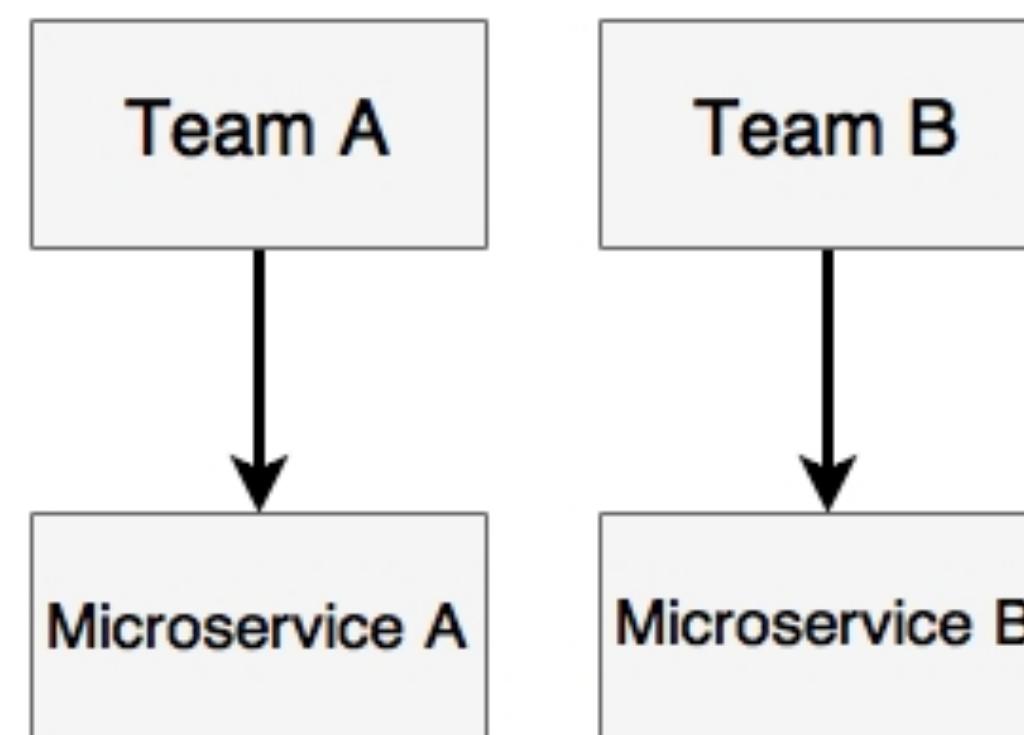
- It is important to understand the environmental and political challenges in an organization before embarking on microservices development
- It is common in microservices to have dependencies on other legacy applications, directly or indirectly
- A common issue with direct legacy integration is the slow development cycle of the legacy application
- This is especially common when migrating legacy monolithic applications to microservices
  - In many cases, legacy systems continue to undergo development in a non-Agile way with larger release cycles

# Addressing challenges around databases

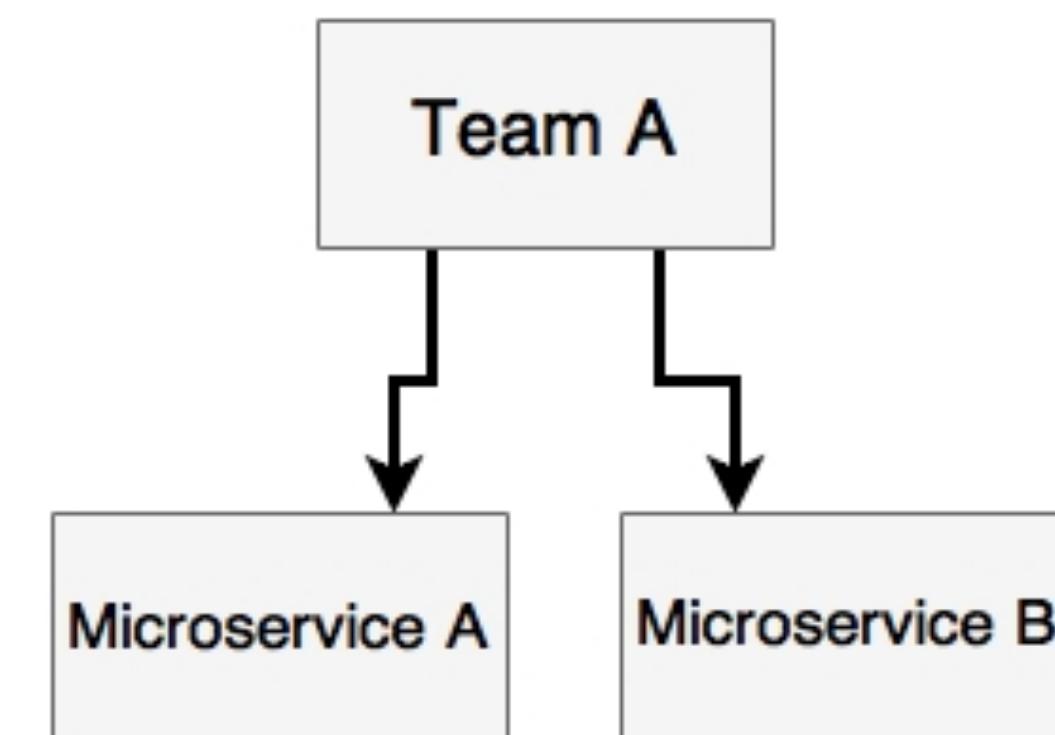
- Automation is key in microservices development
  - Automating databases is one of the key challenges in many microservice developments
- Many automation tools focus on the application logic
  - As a result, many development teams completely ignore database automation
  - Ignoring database automation can severely impact the overall benefits and can derail microservices development
- The database has to be treated in the same way as applications with appropriate source controls and change management
  - When selecting a database, it is also important to consider automation as one of the key aspects
- **Database automation** is much easier in the case of NoSQL databases but is hard to manage with traditional RDBMs
  - **Database Lifecycle Management (DLM)** as a concept is popular in the DevOps world, particularly to handle database automation
  - Tools such as DBmaestro, Redgate DLM, Datical DB, and Delphix support database automation

# Establishing self-organizing teams

- One of the most important activities in microservices development is to establish the right teams for development
- As recommended in many DevOps processes, a small, focused team always delivers the best results



A) One team per microservice



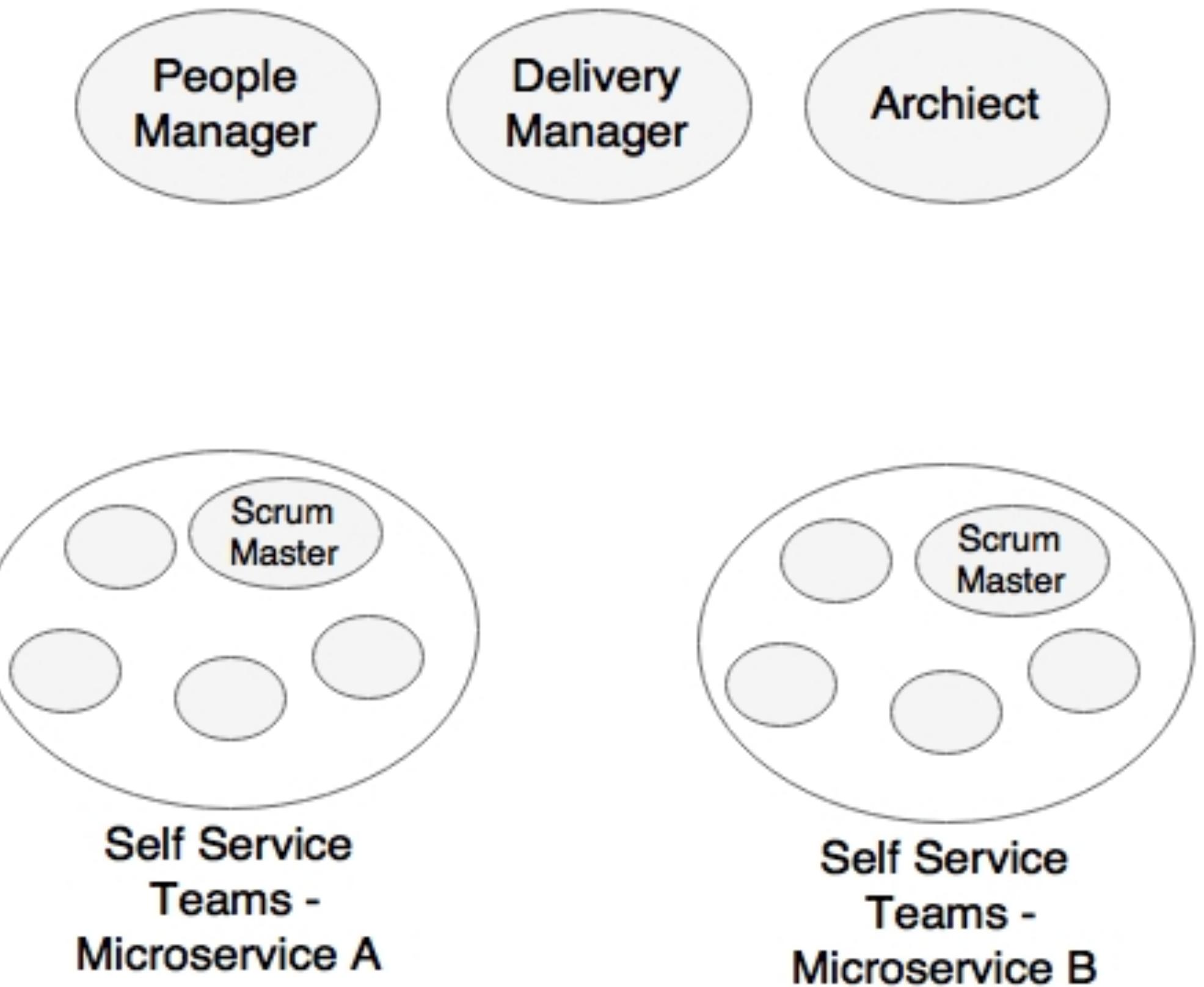
A) One team per group of microservice representing related business capabilities

# Establishing self-organizing teams

- Teams are expected to take full ownership in ideating for, analyzing, developing, and supporting services
  - Werner Vogels from Amazon.com calls this you build it and you run it
  - As per Werner's theory, developers pay more attention to develop quality code to avoid unexpected support calls
- Teams should have multidisciplinary skills to satisfy all the capabilities required to deliver a service
- One common solution to this problem is to use the concept of consultants
  - Consultants are SMEs and are engaged to gain expertise on specific problems faced by the team
  - Some organizations also use shared or platform teams to deliver some common capabilities

# Establishing self-organizing teams

- Agile software development also encourages having self-organizing teams
- Self-organizing teams act as a cohesive unit and find ways to achieve their goals as a team
- The team automatically align themselves and distribute the responsibilities
- The members in the team are self-managed and empowered to make decisions in their day-to-day work
- The team's communication and transparency are extremely important in such teams
  - This emphasizes the need for collocation and collaboration, with a high bandwidth for communication



# Building a self-service cloud

- What microservice developers need is more than just an IaaS cloud platform
  - Neither the developers nor the operations engineers in the team should worry about where the application is deployed and how optimally it is deployed
  - They also should not worry about how the capacity is managed
- This level of sophistication requires a cloud platform with self-service capabilities (as we discussed earlier)
  - Mesos and Marathon and Kubernetes cluster management solutions
  - Containerized deployment is also important in managing and end-to-end-automation
  - Building this self-service cloud ecosystem is a prerequisite for microservice development

# Building a microservices ecosystem

- Microservices require a number of capabilities
  - All these capabilities should be in place before implementing microservices at scale
- These capabilities include service registration, discovery, API gateways, and an externalized configuration service
  - All are provided by the Spring Cloud project
  - Capabilities such as centralized logging, monitoring, and so on are also required as a prerequisite for microservices development

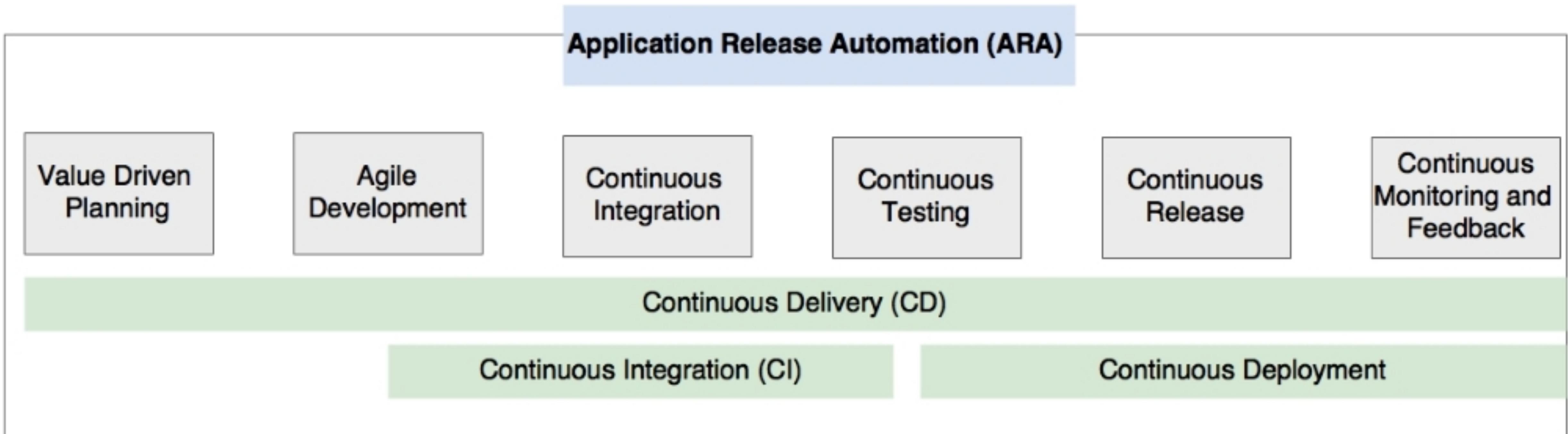
# Defining a DevOps-style microservice life cycle process

- Organizations already practicing DevOps do not need another practice for microservices development
- Rather than reinventing a process for microservices, we will explore DevOps processes and practices from the microservice perspective

# Common terminologies used in the DevOps world

- **Continuous integration (CI)**: This automates the application build and quality checks continuously in a designated environment, either in a time-triggered manner or on developer commits
- **Continuous delivery (CD)**: This automates the end-to-end software delivery practice from idea to production
  - In a non-DevOps model, this used to be known as **Application Lifecycle Management (ALM)**
- **Continuous deployment**: This is an approach to automating the deployment of application binaries to one or more environments by managing binary movement and associated configuration parameters
- **Application Release Automation (ARA)**: ARA tools help monitor and manage end-to-end delivery pipelines. ARA tools use CI and CD tools and manage the additional steps of release management approvals

# DevOps process for microservices development



# Value-driven planning

- Value-driven planning is a term used in Agile development practices
  - Identify which microservices to develop
- The most important aspect is to identify those requirements that have the highest value to business and those that have the lowest risks
- The MVP philosophy is used when developing microservices from the ground up
- The selected microservices are expected to precisely deliver the expected value to the business
- Business KPIs to measure this value have to be identified as part of value-driven planning

# Agile development

- Once the microservices are identified, development must be carried out in an Agile approach following the Agile manifesto principles, for instance
- The scrum methodology is used by most of the organizations for microservices development

# Continuous integration

- The continuous integration steps should be in place to automatically build the source code produced by various team members and generate binaries
- Continuous integration also executes various QAs as part of the build pipeline, such as code coverage, security checks, design guidelines, and unit test cases

# Continuous testing

- Once continuous integration generates the binaries, they are moved to the testing phase
- A fully automated testing cycle is kicked off in this phase
- This could range from the integration test environment to the production environment to test in production

# Continuous release

- Continuous release to production takes care of actual deployment, infrastructure provisioning, and rollout
- The binaries are automatically shipped and deployed to production by applying certain rules
- Many organizations stop automation with the staging environment and make use of manual approval steps to move to production

# Continuous monitoring and feedback

- The continuous monitoring and feedback phase is the most important phase in Agile microservices development
- Based on the feedback, the services are adjusted and the same cycle is then repeated

# Automating the continuous delivery pipeline

- The life cycle stages can be altered by organizations based on their organizational needs but also based on the nature of the application
- There are many tools available to build end-to-end pipelines, both in the open source and commercial space
- Organizations can select the products of their choice to connect pipeline tasks

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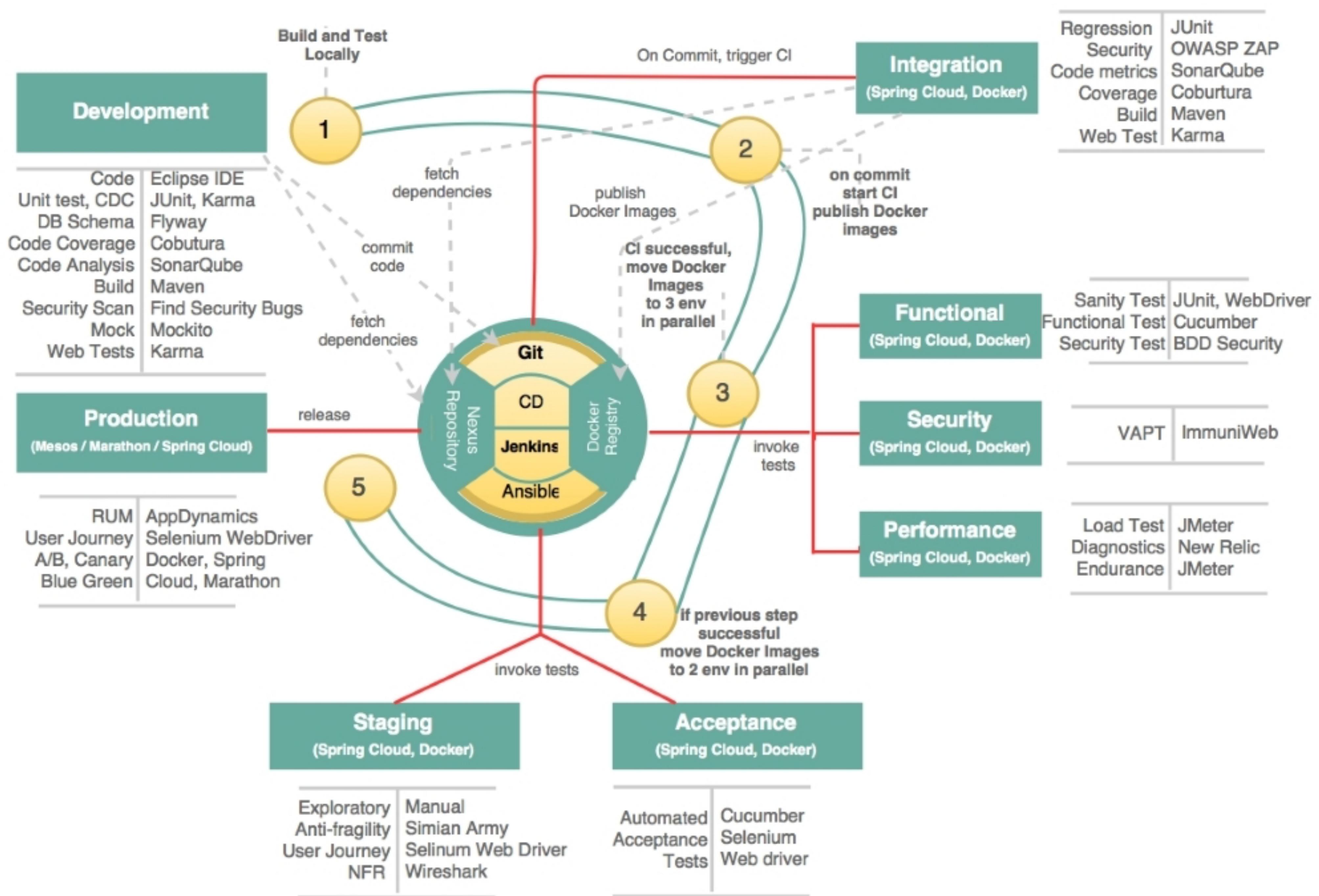
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# Automating the continuous delivery pipeline

- The pipelines may initially be expensive to set up as they require many toolsets and environments
- Organizations may not realize an immediate cost benefit in implementing the delivery pipeline
- Also, building a pipeline needs high-power resources
- Large build pipelines may involve hundreds of machines
  - It also takes hours to move changes through the pipeline from one end to the other
  - Hence, it is important to have different pipelines for different microservices

# Automating the continuous delivery pipeline

- The key focus in the pipeline is on end-to-end automation, from development to production, and on failing fast if something goes wrong



# Automated configuration management

- Use new methods for configuration management rather than using a traditional statically configured CMDB
  - The manual maintenance of CMDB is no longer an option
- The new styles of CMDB automatically create CI configurations based on an operational topology
  - These should be discovery based to get up-to-date information
  - The new CMDB should be capable of managing bare metals, virtual machines, and containers

# Microservices development governance, reference architectures, and libraries

- It is important to have an overall enterprise reference architecture and a standard set of tools for microservices development to ensure that development is done in a consistent manner
- For quick wins and to take advantage of timelines, microservices development teams may deviate from these practices in some cases

# Desenvolvimento de Aplicações com Arquitetura Baseada em Microservices

Muito obrigado a todos!

Próximos passos?

