

System Design

From Code to Business Value

Architectural Insights

The 5 Top Open Source CI/CD Giants

Every Architect Must Know!
(with GitHub Links)

by Esmaeel Moradi
Senior Android Engineer



Seamless Architecture: The 5 Top Open Source CI/CD Giants Every Architect Must Know! (with GitHub Links)

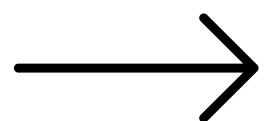
In the world of software delivery, achieving scalability and minimizing Technical Debt is only possible through relentless automation. CI/CD tools are the very cornerstones of this automation.

The selection of a CI/CD tool is not merely a technical choice; it is a strategic architectural decision that will determine your project's technical fate for the next five years.



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The Architectural Divide: Legacy vs. Cloud-Native

The CI/CD market today is fundamentally split between two distinct architectural approaches:

1. Traditional (Legacy/Brownfield):

Centralized systems, built on Java/plugins, optimized for orchestrating diverse, older infrastructure. (Master-Agent Model)

Jenkins, Spinnaker

2. Cloud-Native (GitOps):

Decentralized systems, built on Kubernetes CRDs, optimized for elastic scaling and declarative GitOps principles.

Argo CD, Tekton

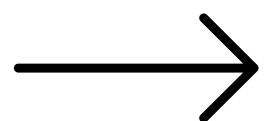
Critical Note:

Large enterprises are often forced to manage both models in parallel during modernization phases.



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1. Jenkins:

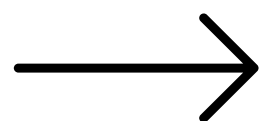
The Godfather of Extensible CI/CD

- **Key Architecture:** Master/Agent automation server defined by its vast plugin ecosystem, enabling integration with virtually any legacy or modern tool.
- **Scale Challenge:** Institutional Inertia — With over 24.7k Stars and its immense maturity, Jenkins is a definitive industry standard. The high cost of migrating critical systems dependent on its plugins is often prohibitive.
- **Modern Strategy:** To achieve modern resilience, organizations increasingly run Jenkins Agents inside Kubernetes Pods to leverage K8s scheduling and mitigate the Master's single point of failure.
- **GitHub Link:**
<https://github.com/jenkinsci/jenkins>



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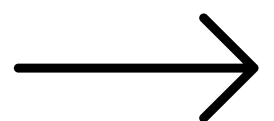
2. GitLab CI/CD: The Integrated DevOps Platform Advantage

- **Key Architecture:** A Pipelines-as-Code (YAML) solution that is deeply integrated with the Source Code Management (SCM) platform.
- **Core Advantage:** Cohesion — This deep integration minimizes developer context switching and enforces standards like DevSecOps seamlessly.
- **Go-based Runners:** The execution engine, the Runner, is written in the efficient Go language, making it highly portable and ideal for running concurrent jobs across any environment (Docker, Kubernetes, VM), enabling elastic scaling.
- **GitHub Link (Runner):**
<https://github.com/gitlabhq/gitlab-runner>



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3. Argo CD:

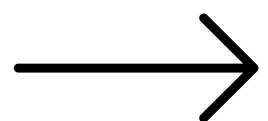
The Leading Standard in GitOps CD

- **Key Architecture:** A specialized Kubernetes Controller that operates based on a constant, relentless Reconciliation Loop.
- **Focus:** Declarative Deployment — The desired state is defined exclusively in Git. Argo CD continuously monitors the cluster state and automatically corrects any deviation (Drift) to enforce synchronization.
- **Security Note:** Decoupling CI from CD; Argo CD performs deployments in a "Pull-based" manner, which is crucial for preventing the exposure of sensitive production credentials during the CI phase.
- **GitHub Link:**
<https://github.com/argoproj/argo-cd>



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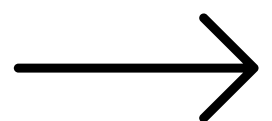
4. Tekton Pipelines: Pure Kubernetes CI/CD Primitives

- **Key Architecture:** A Cloud-Native Framework that abstracts Pipeline concepts (Tasks, Steps) into standard Kubernetes Custom Resources (CRDs).
- **Core Advantage:** Workload Isolation — Every distinct step in the Pipeline runs as a dedicated container within its own Kubernetes Pod, maximizing resilience and resource optimization.
- **Strategy:** Tekton delegates the management of the entire CI infrastructure to the Kubernetes control plane, leading to deep Operational Convergence and true cloud-native efficiency.
- **GitHub Link:**
<https://github.com/tektoncd/pipeline>



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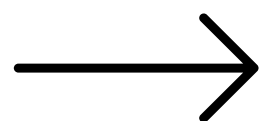
5. Spinnaker: High-Assurance Multi-Cloud Delivery Orchestration

- **Key Architecture:** A Microservices-based Continuous Delivery platform focused on orchestrating advanced deployment strategies (e.g., Canary Rollouts and Blue/Green) across diverse environments.
- **Strategic Point:** The preferred tool for organizations with Heterogeneous Infrastructure (VMs, Multi-Cloud, different K8s clusters).
- **Safety Capabilities:** By inserting automated verification gates and manual checks into the deployment flow, Spinnaker acts as a centralized deployment broker focused on Risk Management and ensuring safe rollbacks.
- **GitHub Link:**
<https://github.com/spinnaker/spinnaker>



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Conclusion:

Specialization, Not Monoliths

Success at massive scale is achieved by shifting control from imperative scripts to declarative state management.

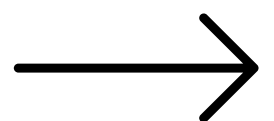
For maximum reliability and fault isolation, the industry is moving away from monolithic CI/CD tools towards modular, specialized components:

- **The Modern Declarative Stack:**
 - **CI (Build & Test):** Tekton (for Kubernetes efficiency)
 - **CD (State Synchronization):** Argo CD (for pure GitOps execution)
- **Key Takeaway:** This separation ensures that CI processes never hold production credentials, and all deployment states are immutably tracked in Git.



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🤖 What is Your Strategic Roadmap?

Strategic investment must prioritize tools that enforce modern engineering principles, viewing Git as the single source of truth.

Which of these approaches (Legacy or Cloud-Native) benefits your organization the most, and why?

Please share your thoughts in the comments:

1. **What is your favorite project?**
2. **If you face CI/CD implementation challenges**, message me privately for a consultation on designing a custom, optimized, and low-TCO pipeline.



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Let's Build a Scalable Future

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