

Adopting CI/CD Practices to Accelerate Service Provider Business Agility

Introduction

Driven by increasing demands for rapid innovation and adaptation on the one hand, and 5G network design standards on the other, the migration to a cloud native architecture must be part of every service provider's digital transformation path. While there are many essential elements in a cloud native journey, the adoption of Continuous Integration and Continuous Delivery & Deployment (CI/CD) is considered critical for service providers who want to improve their pace of service innovation and market responsiveness.

In place of today's rigid, months long development cycles, CI/CD opens the door to an iterative and continual software release cycle that enables new services and features to be commercialized in a matter of weeks — even days. Zero-touch automation, a capability made possible with cloud native architectures, often becomes an integral element of CI/CD, through the adoption and usage

of open source tools and initiatives. Using CI/CD, service providers can harness the competitive advantages of faster service innovation, reduced time to market, and improved operational efficiency, while reducing the risks and delays associated with traditional service development lifecycles.

Significantly, CI/CD is not just about code. By applying CI/CD principles to cloud native applications, service providers use the packaging of business and configuration rules, along with execution code to market more easily, more quickly and with greater consistency. In this way, unlike other technology-first components essential to a cloud native architecture, CI/CD is a process-oriented principle that allows for seamless and consistent deployment within an environment. As a result, the architecture of the applications themselves are fundamental to maximizing the benefits of CI/CD.

The benefits of CI/CD are tangible and maximizing their potential will require that every vendor in the service provider ecosystem fully embraces the principles of cloud native application development. For both service providers and the vendors that support them, the embrace of CI/CD represents a significant paradigm shift away from traditional telecom software development. In today's hyper-competitive, 5G era, such a shift is no longer optional... it is essential.

CI/CD: An Overview

CI/CD is an application development and deployment methodology that abandons manual, rigid, and fixed approaches in favor of an automated, flexible, and continuous approach to bring new applications to market. At the heart of CI/CD is the use of open source tools to automate processes across application building, testing, deployment, and operation. By leveraging automation, CI/CD enables new features to be brought to market as they become ready rather than being dictated by fixed IT release schedules. Furthermore, automation of code development workflows in CI/CD ensures the quality of each feature by ensuring the same repeated processes, such as building and testing, are followed every time — greatly reducing the risks of human error.

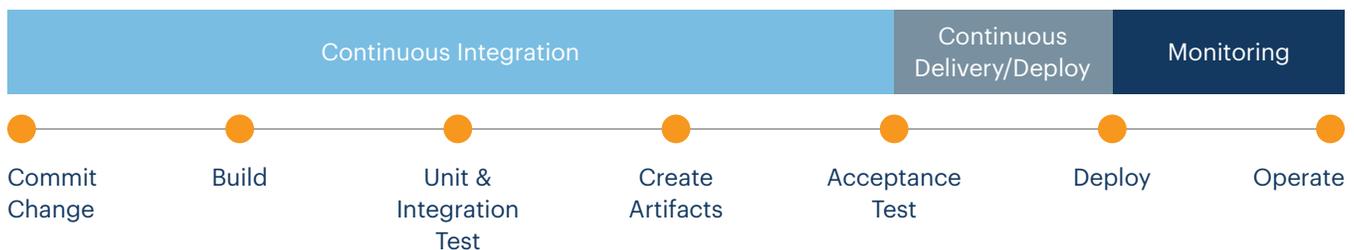
While speed of change combined with product consistency are fundamental to service provider success, absent guarantees for security and reliability once in production, their value is constrained. CI/CD addresses these challenges by creating a common and cohesive set of tools and processes that act to bridge development and operational

organizations and their activities. This joint practice of working together through CI/CD is generally referred to as DevOps, and includes the activities of continuous development, testing, integration, deployment and operation/monitoring of applications throughout the life cycle.

Continuous Integration

With Continuous Integration (CI), teams can better manage and control the entire application development lifecycle. Using open source tools, Continuous Integration establishes automated processes to support team members working on code and configuration updates. Continuous Integration encourages integration of changes to the main branch or repository, early and often. As changes are committed, this triggers automated processes to compile, test, and validate against the main branch. Any errors detected are then immediately addressed, enabling the entire process to be triggered again. Once testing is successful, the unique and immutable artifacts from the successful build are versioned and stored in an artifact repository. The creation and storage of immutable artifacts is a critical consequence of the Continuous Integration process, making it possible to seamlessly deploy the exact and unchanged artifact (business rule, configuration rule, or executable application) to any other environment along the CI/CD pipeline. The benefits of this approach reduce the risk of error introduction and/or delays inherent with rebuilding artifacts for every new environment. The use of immutable artifacts ensures that the exact feature that will ultimately be deployed to production is the same that was utilized along each step of the CI/CD pipeline.

Example CI/CD Pipeline



Continuous Delivery (and Deployment)

Continuous Delivery allows new features to benefit the end customer as quickly as possible, as they do not need to wait for a larger roadmap release based on a specific timeframe. Any changes, inclusive of new feature candidates, configurations, or defect corrections, are seamlessly deployed into production after approval using the versioned artifacts generated from the Continuous Integration process. In the event an issue arises with the newly deployed artifacts, both operations and development teams can quickly revert to the prior version/release simply by re-deploying those artifacts which have been stored in the artifact repository. This helps to minimize customer impact by enabling a faster and repeatable process for handling eventual rollback scenarios.

When high levels of organizational maturity and trust for CI/CD have been established, the last step of deploying to production can be untethered from approval processes. In this Continuous Deployment environment, deployment artifacts are directly deployed to production after success in acceptance testing. By enabling Continuous Deployment, new features and business configurations are further accelerated to the end customer taking full advantages of an end-to-end automated process to reap the benefits of faster time-to-market.

Business Benefits of CI/CD

As service providers look to extract the most value from their migration to cloud native architectures, increasing business agility to better respond to dynamic market conditions is driving increased interest in CI/CD. Additionally, as operators further embrace the distributed networks that cloud native architectures make possible, they will increasingly need the stability and reliability gains that CI/CD makes possible. As a result, with its process-oriented approach to speed, scale and reliability, CI/CD enables greater levels of agility across the entire organization, creating business benefits in the areas of:

- Commercial agility – bring offers to market faster and more accurately
- Customer agility – empower both the customer and the service provider to align service paths and goals
- Operational agility – run the business faster, more efficiently and at lower cost

While every service provider can realize tangible and measurable benefits by adopting CI/CD principles, the core requirements for success in 5G make CI/CD a must-have for any organization looking to maximize their investments in 5G Standalone (SA).

Faster Service Lifecycles

Unlike 4G and older networks, 5G SA delivers a dynamic, highly scalable network environment that offers almost limitless service creativity. For service providers to leverage distributed networks for seamless scalability, service automation for greater operational agility, and virtualization for dynamic service performance and cost flexibility, service providers will require their entire IT ecosystem to be able to perform at similar speed and efficiency or be left behind. The implications for this are clear – by adopting CI/CD principles, applications that rely on traditional, bespoke development processes and monolithic architectures are rendered obsolete.

Take network slicing as an example. Service providers will no longer be able to wait nine to twelve months, or longer, for bespoke, market-specific slices. As a result, traditional development approaches that are iterative and schedule-based will be incapable of supporting the flexible service operations that network slicing will require. Service providers will not just require their fully microservices-based IT infrastructures to enable unique and near real-time 5G service updates and changes, they'll also require minimal to no risk to service integrity as a result of those ongoing updates/upgrades. Only by adopting CI/CD will applications be capable of

evolving and scaling quickly and efficiently enough to reap the benefits of their 5G SA environment's flexibility, velocity and elasticity.

New Functionality, Faster

Eliminating rigidity of the traditional roadmap upgrade timeframe allows service providers to embrace a faster speed of change. Faster development times and automated testing processes allow for more confidently introduced service changes, many of which can be deployed in microsegments for highly differentiated and/or temporal market offerings. Just as quickly as service changes can be rolled out, they can also be rolled back if needed, thanks to automated processes involved with CI/CD. Most importantly, customers waiting for key roadmap candidates and features will see new features more frequently, and likely earlier than expected.

Looking again to 5G SA, take the example of a service provider setting up an enterprise network slice for a stadium. Service providers will need the flexibility to quickly and easily configure and deploy variable charging scenarios based on any parameters that can be quantified and monetized. More importantly, those scenarios will need to be deployed without consuming substantial resources and without risk of disruption. Using CI/CD, dedicated services can be deployed to support any supportable pricing and charging models for any stadium event alongside ongoing code and configuration updates, and then rolled back once the event is complete.

Lower Risk with Greater Consistency

Historically, many service providers have opted for custom solutions tailored to their specific implementation. While the rigidity of this approach may have been an acceptable trade-off for static environments, it results in unsustainable levels of complexity and risk when every customer iteration is different. It's only when service providers choose fully cloud native, product-based applications

capable of seamlessly adopting CI/CD principles that they can standardize and automate their release lifecycle. In this environment, testing of every change in source code will be a consistent and integral part of the configuration process, reducing the risk of defects that may affect service consistency and quality.

CI/CD principles, by emphasizing code consistency and integrity, make it possible for service providers to develop, test and deliver products and services with low risk and high quality.

Cost Effective Testing, Targeting, and Collaborating

With any mission critical IT and network solution, collecting roadmap candidates from customers is essential to future release success and to keep service provider customer satisfaction high. CI/CD brings a new level of flexibility to that process, whereby functional updates can be demonstrated in a testing environment, allowing service providers to collaborate and provide feedback before features go live. More importantly, CI/CD enables service providers to then seamlessly deploy those functional updates in a production environment. The end benefit is faster time to impact functionality and lower costs.

Cost effective testing and faster development cycles are integral to service innovation and creativity. Ask any service provider marketing/pricing executive about launching a new price plan or service capability and the typical responses from IT would be "we can't meet your time frame," "we can't dedicate time to that" or just "no." With its process-oriented approach to flexibility, scalability and automation, CI/CD eliminates the bottlenecks to creativity by streamlining the testing process. With changes to support service creativity done in parallel with more fixed, strategic changes, service providers can better focus on continuous delivery of value across their entire portfolio.

In the case of 5G, delivering on the promise of service creativity will be an essential part of a service provider's financial success. As the industry looks for that monetizable "killer app" just as it did in 3G and 4G/LTE, it may emerge from a collaborative proof of concept, app developer, or even a trial service test scenario. Regardless of its origination point, service providers that use CI/CD principles become an efficient enablers of that creativity.

Roadmap to CI/CD

Adopting CI/CD presents service providers with the business and operational agility needed to support their transformations to 5G. Implementing CI/CD requires a significant organizational shift, acceptance and usage of Agile and DevOps practices, and the broad embrace of CI/CD tools and processes across multiple organization. While the specific adoption paths for service providers will differ based on scale, infrastructure strategy, and organizational structure — all share a common goal... to become more nimble, automated and cost-effective enterprises.

Assess Organizational Readiness

Moving to CI/CD impacts people, process, technology, and organizational ways of working, particularly in how business change is delivered. The shift to a CI/CD environment shifts roles and responsibilities internally, with higher delegation of responsibilities to enable autonomous teams that can independently facilitate change to a discrete set of business functions. This allows changes to be brought to market rapidly without the heavy coordination efforts typical of traditional application development and deployment. While these benefits are highly desirable, it is crucial to assess the organizational readiness in all areas of the business. In particular, CIOs must ensure the cultural readiness across departments to ensure the transformation is efficient and effective.

Create a Coordinated DevOps Approach

Moving to DevOps practices is critical for the success of CI/CD and essential for 5G, as it eliminates the barriers between departments and roles, and brings testing, QA and peer review to the forefront, enabling faster development cycles. As part of the organization change, DevOps ensures that there is constant communications between teams, and that fewer issues occur. Should issues occur, the DevOps approach ensures that both development and operations resources collectively and efficiently can work to resolve by leveraging the tools and processes established through CI/CD. Across the entire technology ecosystem, embracing DevOps reduces the risk associated with control of code versions. Automated testing and peer review create faster and less risky development cycles. Continuous Integration and Delivery processes are subsequently enabled effectively as DevOps becomes the norm.

Define Infrastructure Strategy

Service provider workload deployment strategies (edge, private and public cloud, or hybrid options) will determine the CI/CD tools best suited for the environments. For example, private and public cloud providers offer and maintain their own CI/CD toolsets, while edge infrastructure may include CI/CD toolsets as part of the virtualization platforms. Conversely, there may be instances where the service provider will choose and/or be required to select, procure, and maintain the CI/CD toolsets themselves. Adding to this complexity is the rapidly evolving use of multiple deployment infrastructure to meet customer and business needs. As application deployments increasingly span across multiple infrastructures to facilitate things like ultra-low latency, hyper-scaling or security concerns — service providers will need tools that can support these hybrid approaches.

Start Small and Align with Short Term Objectives (Business and Technology)

Implementation of CI/CD takes time, and nothing fails faster and harder than technology without business alignment. Service providers embarking on CI/CD should start small — and align the implementation of CI/CD with clear business objectives and owners. This could be for a new application or subset of an application together with a small team that will work to implement CI/CD tied to deliver specific business goals. Using this approach will help to prioritize which tooling and processes to implement first. For many, CI/CD will begin with securing automated tests for the application(s). This is typical starting point as increasing the speed of delivery only works if you're able to deploy quality applications. As short-term business and technology objectives are met, the implementation of CI/CD should expand and scale to include additional capabilities and applications that leverage its use.

Innovate and Experiment

Service providers leverage the newfound business and operational benefits by testing new service ideas as a way gain market share and drive revenue. CI/CD not only promotes faster business value but facilitates experimentation by lowering the costs of bringing change to market. As the cost basis has shifted, experimenting with new features becomes the art of the possible.

Conclusion

For service providers looking to extract the most value from their migration to cloud native architectures, while maximizing the benefits of their 5G network investments, they will require infrastructure capable of adapting, expanding and evolving at web speed. To keep up, the configuration and deployment of new services will require operations and business support functions that can operate just as fast. By adopting CI/CD principles, service providers will be able to standardize the speed and flexibility they need to effectively compete.