

# Operational Excellence on the Cloud

Operational Excellence on the Cloud. Learn the fundamental design principles of operating on the Cloud.

Operations teams need to understand their business and customer needs so they can effectively and efficiently support business outcomes. They create and use procedures to respond to operational events and validate their effectiveness to support business needs. They also collect metrics that are used to measure the achievement of desired business outcomes.

## Operational Excellence

The operational excellence pillar includes the ability to run and monitor systems to deliver business value and to continually improve supporting processes and procedures.

The operational excellence pillar provides an overview of design principles, best practices, and questions

## Design Principles

There are six design principles for operational excellence in the cloud:

### Perform operations as code:

In the cloud, you can apply the same engineering discipline that you use for application code to your entire environment. You can define your entire workload (applications, infrastructure, etc.) as code and update it with code. You can script your operations procedures and automate their execution by triggering them in response to events. By performing operations as code, you limit human error and enable consistent responses to events.

### Annotate documentation:

In an on-premises environment, documentation is created by hand, used by people, and hard to keep in sync with the pace of change. In the cloud, you can automate the creation of documentation after every build (or automatically annotate hand-crafted documentation). Annotated documentation can be used by people and systems. Use annotations as an input to your operations code.

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Make frequent, small, reversible changes: Design workloads to allow components to be updated regularly. Make changes in small increments that can be reversed if they fail (without affecting customers when possible).

Refine operations procedures frequently:

As you use operations procedures, look for opportunities to improve them. As you evolve your workload, evolve your procedures appropriately. Set up regular game days to review and validate that all procedures are effective and that teams are familiar with them.

Anticipate failure:

Perform “pre-mortem” exercises to identify potential sources of failure so that they can be removed or mitigated.

Test your failure scenarios and validate your understanding of their impact. Test your response procedures to ensure that they are effective and that teams are familiar with their execution. Set up regular game days to test workloads and team responses to simulated events.

Learn from all operational failures:

Drive improvement through lessons learned from all operational events and failures. Share what is learned across teams and through the entire organization.

Definition

There are three best practice areas for operational excellence in the cloud:

1. Prepare
2. Operate
3. Evolve

Operations teams need to understand their business and customer needs so they can effectively and efficiently support business outcomes. Operations creates and uses procedures to respond to operational events and validates their effectiveness to support business needs. Operations collects metrics that are used to measure the achievement of desired business outcomes.

Everything continues to change—your business context, business priorities, customer needs, etc. It's important to design operations to support evolution over time in response to change and to incorporate lessons learned through their performance.

## Best Practices

### Prepare

Effective preparation is required to drive operational excellence. Business success is enabled by shared goals and understanding across the business, development, and operations. Common standards simplify workload design and management, enabling operational success. Design workloads with mechanisms to monitor and gain insight into application, platform, and infrastructure components, as well as customer experience and behavior.

Create mechanisms to validate that workloads, or changes, are ready to be moved into production and supported by operations. Operational readiness is validated through checklists to ensure a workload meets defined standards and that required procedures are adequately captured in runbooks and playbooks. Validate that there are sufficient trained personnel to effectively support the workload. Prior to transition, test responses to operational events and failures. Practice responses in supported environments through failure injection and game day events.

AWS enables operations as code in the cloud and the ability to safely experiment, develop operations procedures, and practice failure. Using AWS CloudFormation enables you to have consistent, templated, sandbox development, test, and production environments with increasing levels of operations control.

AWS enables visibility into your workloads at all layers through various log collection and monitoring features. Data on use of resources, application programming interfaces (APIs), and network flow logs can be collected using Amazon CloudWatch, AWS CloudTrail, and VPC Flow Logs.

You can use the CloudWatch Logs agent, or the collectd plugin, to aggregate information about the operating system into CloudWatch. The following questions focus on preparing considerations for operational excellence :-

OPS 1: What factors drive your operational priorities ?

OPS 2: How do you design your workload to enable operability ?

OPS 3: How do you know that you are ready to support a workload ?

Implement the minimum number of architecture standards for your workloads. Balance the cost to implement a standard against the benefit to the workload and the burden upon operations. Reduce the number of supported standards to reduce the chance that lower-than-acceptable standards will be applied by error.

Operations personnel are often constrained resources. Invest in scripting operations activities to maximize the productivity of operations personnel, minimize error rates, and enable automated responses. Adopt deployment practices that take advantage of the elasticity of the cloud to facilitate pre-deployment of systems for faster implementations.

## Operate

Successful operation of a workload is measured by the achievement of business and customer outcomes. Define expected outcomes, determine how success will be measured and identify the workload and operations metrics that will be used in those calculations to determine if operations are successful. Consider that operational health includes both the health of the workload and the health and success of the operations acting upon the workload (for example, deployment and incident response). Establish baselines from which improvement or degradation of operations will be identified, collect and analyze your metrics, and then validate your understanding of operations success and how it changes over time.

Use collected metrics to determine if you are satisfy customer and business needs, and identify areas for improvement. Efficient and effective management of operational events is required to achieve operational excellence. This applies to both planned and unplanned operational events. Use established runbooks for well-understood events, and use playbooks to aid in the resolution of other events. Prioritize responses to events based on their business and customer impact. Ensure that if an alert is raised in response to an event, there is an associated process to be executed, with a specifically identified owner.

Define in advance the personnel required to resolve an event and include

escalation triggers to engage additional personnel, as it becomes necessary, based on impact (that is, duration, scale, and scope). Identify and engage individuals with the authority to decide on courses of action where there will be a business impact from an event response not previously addressed. Communicate the operational status of workloads through dashboards and notifications that are tailored to the target audience (for example, customer, business, developers, operations) so that they may take appropriate action, so that their expectations are managed, and so that they are informed when normal operations resume.

Determine the root cause of unplanned events and unexpected impacts from planned events. This information will be used to update your procedures to mitigate future occurrence of events. Communicate root cause with affected communities as appropriate. In AWS, you can generate dashboard views of your metrics collected from workloads and natively from AWS. You can leverage CloudWatch or third-party applications to aggregate and present business, workload, and operations level views of operations activities. AWS provides workload insights through logging capabilities including AWS X-Ray, CloudWatch, CloudTrail, and VPC Flow Logs enabling the identification of workload issues in support of root cause analysis and remediation.

The following questions focus on operate considerations for operational excellence.

OPS 4: What factors drive your understanding of operational health? OPS 5: How do you manage operational events?

Routine operations, as well as responses to unplanned events, should be automated. Manual processes for deployments, release management, changes, and rollbacks should be avoided. Releases should not be large batches that are done infrequently. Rollbacks are more difficult in large changes. Failing to have a rollback plan, or the ability to mitigate failure impacts, will prevent continuity of operations. Align metrics to business needs so that responses are effective at maintaining business continuity. One-time, decentralized metrics with manual responses will result in greater disruption to operations during unplanned events.

## Evolve

Evolution of operations is required to sustain operational excellence. Dedicate

work cycles to making continuous incremental improvements. Regularly evaluate and prioritize opportunities for improvement (for example, feature requests, issue remediation, and compliance requirements), including both the workload and operations procedures.

Include feedback loops within your procedures to rapidly identify areas for improvement and capture learnings from the execution of operations. Share lessons learned across teams to share the benefits of those lessons. Analyze trends within lessons learned and perform cross-team retrospective analysis of operations metrics to identify opportunities and methods for improvement.

Implement changes intended to bring about improvement and evaluate the results to determine success. With AWS Developer Tools you can implement continuous delivery build, test, and deployment activities that work with a variety of source code, build, testing, and deployment tools from AWS and third parties. The results of deployment activities can be used to identify opportunities for improvement for both deployment and development. You can perform analytics on your metrics data integrating data from your operations and deployment activities, to enable analysis of the impact of those activities against business and customer outcomes. This data can be leveraged in cross-team retrospective analysis to identify opportunities and methods for improvement. The following question focuses on evolve considerations for operational excellence.

**OPS 6: How do you evolve operations?**

Successful evolution of operations is founded in: frequent small improvements; providing safe environments and time to experiment, develop, and test improvements; and environments in which learning from failures is encouraged. Operations support for sandbox, development, test, and production environments, with increasing level of operational controls, facilitates development and increases the predictability of successful results from changes deployed into production.

**Key AWS Services**

The AWS service that is essential to operational excellence is AWS CloudFormation, which you can use to create templates based on best practices. This enables you to provision resources in an orderly and consistent fashion from your development through production environments.

The following services and features support the three areas of operational excellence:

**Prepare:**

AWS Config and AWS Config rules can be used to create standards for workloads and to determine if environments are compliant with those standards before being put into production.

**Operate:**

Amazon CloudWatch allows you to monitor the operational health of a workload.

**Evolve:**

Amazon Elasticsearch Service (Amazon ES) allows you to analyze your log data to gain actionable insights quickly and securely