**Pillar five: Operational Excellence**

**What it’s about:**

* It includes operational practices and procedures used to manage production workloads.
* This includes how planned changes are executed, as well as responses to unexpected operational events.
* Change execution and responses should be automated. All processes and procedures of operational excellence should be documented, tested, and regularly reviewed.

**Design Principles:**

* Perform operations with code.
* Align operations processes to business objectives.
* Make regular, small, incremental changes.
* Test for responses to unexpected events.
* Learn from operational events and failures.
* Keep operations procedures current.

**Definition:**

* There are three best practice areas for Operational Excellence in the cloud:
  + Preparation:
    - Effective preparation is required to drive operational excellence.
    - Operations checklists will ensure that workloads are ready for production operation, and prevent unintentional production promotion without effective preparation.
    - Workloads should have;
      * Runbooks – operations guidance that operations teams can refer to so they can perform normal daily tasks.
      * Playbooks – guidance for responding to unexpected operational events. They should include response plans, as well as escalation paths and stakeholder notifications.
    - In AWS there are several methods, services and features that can be used so support operational readiness, and the ability to prepare for normal day-to-day operations as well as unexpected operational events.
    - CloudFormation can be used to ensure that environments contain all required resources when deployed in production, and that the configuration of the environment is based on tested best practices, which reduces the opportunity for human error.
    - Implementing auto scaling, or other automated scaling mechanisms, will allow workloads to automatically respond when business-related events affect operational needs.
    - Services like AWS Config with the AWS Config rules feature create mechanisms to automatically track and respond to changes in your AWS workloads and environments.
    - It is also important to use features like tagging to make sure all resources in a workload can be easily identified when needed during operations and responses.
    - Be sure that documentation does not become stale or out of date as procedures change. Also make sure that it is thorough. Without application designs, environment configurations, resource configurations, response plans, and mitigation plans, documentation is not complete. If documentation is not updated and tested regularly, it will not be useful when unexpected operational events occur. If workloads are not reviewed before production, operations will be affected when undetected issues occur. If resources are not documented, when operational events occur, determining how to respond will be more difficult while the correct resources are identified.
    - Preparation – Questions:
      * What best practices for cloud operations are you using?
      * How are you doing configuration management for your workload?
  + Operation:
    - Operations should be standardized and manageable on a routine basis. The focus should be on automation, small frequent changes, regular quality assurance testing, and defined mechanisms to track, audit, roll back, and review changes. Changes should not be large and infrequent, they should not require scheduled downtime, and they should not require manual execution. A wide range of logs and metrics that are based on key operational indicators for a workload should be collected and reviewed to ensure continuous operations.
    - In AWS you can set up a continuous integration / continuous deployment (CI/CD) pipeline (e.g. source code repository, build systems, deployment and testing automation). Release management processes, whether manual or automated, should be tested and be based on small incremental changes that introduce operational issues without causing operational impact.
    - 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, and failing to have a rollback plan, or the ability to mitigate failure impacts, will prevent continuity of operations. Align monitoring to business needs, so that the responses are effective at maintaining business continuity. Monitoring that is ad hoc and not centralized, with responses that are manual, will cause more impact to operations during unexpected events.
    - Operation – Questions:
      * How are you evolving your workload while minimizing the impact of change?
      * How do you monitor your workload to ensure it is operating as expected?
  + Response:
    - Responses to unexpected operational events should be automated. This is not just for alerting, but also for mitigation, remediation, rollback, and recovery. Alerts should be timely, and should invoke escalations when responses are not adequate to mitigate the impact of operational events. Quality assurance mechanisms should be in place to automatically roll back failed deployments. Responses should follow a pre-defined playbook that includes stakeholders, the escalation process, and procedures. Escalation paths should be defined and include both functional and hierarchical escalation capabilities. Hierarchical escalation should be automated, and escalated priority should result in stakeholder notifications.
    - In AWS, there are several mechanisms to ensure both appropriate alerting and notification in response to unplanned operational events, as well as automated responses.
    - Response – Questions:
      * How do you response to unplanned operational events?
      * How is escalation managed when responding to unplanned operational events?

**Key AWS Services:**

* Preparation: AWS Config provides a detailed inventory of your AWS resources and configuration, and continuously records configuration changes. AWS Service Catalog helps to create a standardized set of service offerings that are aligned to best practices. Designing workloads that use automation with services like Auto Scaling, and Amazon SQS, are good methods to ensure continuous operations in the event of unexpected operational events.
* Operation: AWS CodeCommit, in AWS CodeDeploy, and AWS CodePipeline can be used to manage and automate code changes to AWS workloads, Use AWS SDKs or third-party libraries to automate operational changes. Use AWS CloudTrail to audit and track changes made to AWS environments.
* Response: take advantage of all of the Amazon CloudWatch service features for effective and automated responses. Amazon CloudWatch alarms can be used to set thresholds for alerting and notification, and Amazon CloudWatch events can trigger notifications and automated responses.

**Exam Tips – Operational Excellence:**

* Operational excellence in the cloud consists of 3 areas;
  + Preparation.
  + Operation.
  + Responses.

**Exam Tips – Operational Excellence Questions:**

* Preparation:
  + What best practices for cloud operations are you using?
  + How are you doing configuration management for your workload?
* Operations:
  + How are you evolving your workload while minimizing the impact of change?
  + How do you monitor your workload to ensure it is operating as expected?
* Responses:
  + How do you response to unplanned operational events?
  + How is escalation managed when responding to unplanned operational events?